SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – RESEARCH METHODOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

COMMON SYLLABUS OF RESEARCH METHODOLOGY

1. Meaning of research; objectives of research; basic steps of research; criteria of good research; types of research.
2. Meaning of research problem; selection of research problem.
3. Review of related literature- Meaning, necessity and sources.
4. Hypothesis- Meaning, function and types of hypothesis; Null/Alternative hypothesis
5. Variables- Meaning and types.
6. Research design: Types of research design- exploratory, descriptive, diagnostic and experimental.
7. Sampling- Meaning and types of sampling; Probability and Non-Probability.
8. Tools and techniques of data collection- questionnaire, schedule, interview, observation, case study, survey etc.
9. Statistics and its significance in research.
10. Research reports: Writing preliminaries, main body of research, references and bibliography; Meaning and importance of workshop, seminar, conference, symposium etc. in research.
11. Plagiarism- Concept and significance of plagiarism.

1. शोध का अर्थ; शोध के उद्देश्य; शोध के आधारभूत चरण; अच्छे शोध के मापदंड; शोध के प्रकार।
2. शोध समस्या का अर्थ; शोध समस्या का चयन।
3. सम्बन्धित साहित्य का सिंहावलोकन– अर्थ, आवश्यकता एवं स्रोत।
4. परिकल्पना– परिकल्पना का अर्थ, कार्य एवं प्रकार; शून्य/वैकल्पिक परिकल्पना।
5. चर– अर्थ एवं प्रकार।
6. शोध प्ररचनाः शोध प्ररचना के प्रकार– अन्वेषणात्मक, विवरणात्मक, निदानात्मक, प्रयोगात्मक।
7. निदर्शन– निदर्शन के अर्थ एवं प्रकार; प्रायिकता एवं अप्रायिकता।
8. आंकड़े संकलन के उपकरण एवं तकनीकियाँ– प्रश्नावली, अनुसूची, साक्षात्कार, अवलोकन, एकल अध्ययन पद्धति, सर्वेक्षण इत्यादि।
9. सांख्यिकी एवं शोध में इसका महत्व।
10. शोध आख्या– प्रारंभिक लेखन, शोध का मुख्य भाग, सन्दर्भ, ग्रन्थ सूची; कार्यशाला, सेमिनार, सम्मेलन, संगोष्ठी इत्यादि का अर्थ एवं शोध में महत्व।
11. प्लैजरिज्म– अवधारणा एवं महत्व।

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – ANTHROPOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Syllabus for Ph.D. Entrance Examination

Unit 1: Fundamentals of Anthropology

History, development, aim and scope of Anthropology, relationship with other sciences, different branches of Anthropology (including Linguistic Anthropology) and their interrelationship.

Research methodology and methods: Concepts of epistemology, ontology and theoretical perspectives. Types of research (qualitative and quantitative), research design, hypothesis.

Fieldwork and fieldwork tradition, Ethnography, Observation, Interview, Case Study, Life History, Focus group, PRA, RRA, Genealogical Method, Schedules and Questionnaires, Grounded Theory, Exploration and Excavation, GIS.

Statistics: concept of variables, sampling, measures of central tendency and dispersion, parametric and nonparametric bivariate and multivariate (linear regression and logistic regression) statistical tests.

Techniques of Analysis: Content analysis, Discourse analysis and Narratives.

Unit 2: Evolution

Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism, Synthetic theory, neutral theory of molecular evolution, concept of cladogenesis and anagenesis, punctuated equilibrium, selection.

Trends in Primate radiation: Primate classification and distribution of extinct and extant species.

Characteristics of primates: morphological (hair), skeletal (cranial, post cranial, dental, brain), physical (opposability of thumb), locomotion (quadrupedalism, brachiation and bipedalism) and posture, Primate social behaviour.

Extant Primates: Distribution, characteristics and classification. Prosimii (Tarsiioidea, Lorisoidea, Lemuroidea), Anthropoidea (Ceboidea, Cercopithecoidea, Hominoidea). Morphological and anatomical characteristics of Human, Chimpanzee, Gorilla, Orangutan and Gibbon

Fossils of extinct Primates: Oligocene-Miocene fossils – Parapithecus, Gigantopithecus, Aegyptopithecus, Dryopithecus, Ramapithecus and Sivapithecus.

Pre-hominid groups: Sahelanthropus tchadensis (Toumai), Orrorin tugenensis, Ardipithecus ramidus.

Early Hominids: Australopithecus afarensis, Australopithecus ramidus, Australopithecus africanus, Australopithecus (Paranthropous) boisei, Australopithecus (Paranthropous) robustus, Australopithecus bahrelghazali.

Early Transitional Human: Homo habilis.

Hominid Evolution: Characteristics and distribution of Homo erectus in general, Special reference to the fossil evidence discovered from Africa (Turkana boy), Asia (Java man and Peking man), Europe (Dmanisi), Homo floresiensis (Dwarf variety)

Characteristics of Archaic sapiens with special reference to Europe (Homo heidelbergensis), Africa (Rhodesian Man), Asia (China, Jinniushan, India, Narmada Man).

Neandertal man: Distribution, salient features and phylogenetic position.

Characteristics of anatomically Modern Homo sapiens with special reference to Africa (Omo), Europe (Cro-magnon, Chancelade, Grimaldi), Asia (Jinniushan) and Australia (Lake Mungo).

Dispersal of modern humans: Out of Africa hypothesis, Multiregional hypothesis, Partial Replacement hypothesis.

Unit 3: Modern Human Variation

Typological Model, Populational Model and Clinal Model, an overview of Classification proposed by Blumenbach, Deniker, Hooton, Coon, Garn and Birdsell.

Ethnic Classification and distribution of Indian Populations: H.H. Risley, B. S. Guha, S. S.Sarkar.

Linguistic distribution of ethnic groups.

Methods of studying Human Genetics: Cytogenetics, Mendelian Genetics, Twin Genetics, Sib Pair methods, Population Genetics, Molecular Genetics.

Cytogenetics: cell cycle, standard karyotyping and banding techniques (G, C and Q), chromosomal abnormalities, fluorescent in situ hybridization, Lyon's hypothesis, importance of telomere and centromere.

Linkage and chromosome mapping, genetic imprinting.

Modes of inheritance: Autosomal (dominant, recessive, codominance), sex linked, sex influenced, sex limited, modifying genes, suppressor genes, selfish gene, multiple allelic inheritance, multifactorial inheritance (stature and skin colour), polygeneic (dermatoglyphicsFinger-ball Pattern types, Dankmeijer's Index, Furuhata's Index and Pattern Intensity Index, Total Finger Ridge Count, Absolute Finger Ridge Count, Palmar formula and mainline index, transversality, atd angle and flexion creases.

Population genetics: Hardy-Weinberg equilibrium, definition and application, mating patterns (random, assortative and consanguineous), inbreeding coefficient, genetic load, genetic isolate, genetic drift, genetic distance), genetic polymorphisim (balanced and transient).

Molecular genetics: DNA, RNA, genetic code, protein structure and synthesis, concepts of RFLPs, VNTRs, STRs, and SNPs, Mitrochondrial DNA, genic and genomic mutations.

Unit 4: Human Growth, Development and Maturation

Definition, concepts. Basic principles of growth, phases of growth: Prenatal and postnatal (growth and development of different body parts, subcutaneous tissues and physiological variables). Growth curves: Velocity, Distance, Acceleration and Scammon's Growth curve. Catch up and Catch down growth.

Aging and senescence with special reference to somatic, skeletal and dental maturation, Factors affecting growth: Genetic and Environmental. Secular trends in growth.

Methods of studying human growth: Longitudinal, Cross-sectional, Mixed longitudinal, Linked longitudinal.

Body composition: Bone mass, body mass, percentage of body fat, segmental fat, body age.

Human Adaptation: Allen's and Bergmann's rule, Human Adaptability Programme, human adaptation to heat, cold, high altitude.

Somatotyping: Concept, Development (Kretschmer, Sheldon, Parnoll, Health-Carter) and its application.

Demography: Multidisciplinary nature of demography and its relation with other disciplines.

Relationship between demography and anthropological demography. Fertility (concept and determinants), Morbidity and mortality (concept and determinants), Migration (concept and determinants), Selection intensity.

Unit 5: Concept of Prehistoric Archaeology

Ethno-archaeology, experimental archaeology, environmental archaeology, settlement archaeology, cognitive archaeology, geo-archaeology, action archaeology. Theoretical paradigms – descriptive to scientific period to interpretative period.

Dating: Typology, seriation, geo-archaeological, obsidian, hydration, chemical dating of bones, oxygen isotope, fluorine estimation, dendrochronology, radio-carbon, fission track, thermo- luminescence, potassium-argon, varve clay, cross-dating, amino acid racemization, palaeomagnetic.

Paleoenvironment: Major geological stages (Tertiary, Quaternary, Pleistocene, Holocene). Major climatic changes during the Pleistocene and post-Pleistocene periods, glacial and interglacial periods, ice age, and pluvial and inter-pluvial climatic phases. Evidence of quarternary climatic changes (moraines, varve, river terraces, loess, sea level changes, beach sequences, sea core, fluviatile deposits, palynology, palaeontology). Site formation.

Lithic tool typology and technology: Lower Palaeolithic (pebble tools, chopper and chopping tools, bifaces, handaxes and cleavers), Middle Palaeolithic (Clactonean, Levalloisian and Mousterian flakes, discoid cores, tortoise core, fluted core, scrapers,

point), Upper Palaeolithic (blade, knife, blunted back, borer, burin, points), Mesolithic (microliths), Neolithic (ring stone, grindstone, celt, adze).

Overview of Lithic Cultures of Europe:

Lower Palaeolithic: Acheulian culture.

Middle Palaeolithic: Mousterian culture.

Upper Palaeolithic: Perigordian, Chatelperronian, Gravettian, Aurignacian, Solutrian, Magdalenian.

Mesolithic: Azilian, Tardenoisean, Maglamosean, Kitchen Midden, Natufian.

Early Farming Cultures and Neolithic of the Near East: Sites like Jericho, Jarmo, Çatal Huyuk, Shanidar.

Unit 6: Lower Palaeolithic Period in India

Pebble tool culture: Soan Acheulian culture: Madrasian (Kortalayar Valley), Attirmpakkam, Didwana, Belan Valley, Bhimbetka, Chirki-Nevasa, Hunsgi, Krishna Valley. Importance of Hathnora, Narmada valley.

Middle Palaeolithic period in India: Belan valley, Bhimbetka, Nevasa, Narmada valley.

Upper Palaeolithic period in India: Renigunta, Billa Surgam, Patne, Bhimbetka, Son and Belan Valleys, Visadi, Pushkar, Gunjan Valley.

Mesolithic period in India: Mesolithic economy and society. Post Pleistocene environmental changes. Development in microlithic technology, composite tools and bows and arrows. Sites include Bagor, Tilwara, Langhnaj, Adamgarh, Bagor, Chopani Mando, Bhimbetka, Sarai Nahar Rai, Birbhanpur.

Neolithic Period in India: Economic and social consequences of food production. Settlements, population growth, craft specializations, class formation and political institutions. Sites like Burzahom, Gufkral, Ahar, Gilund, Nagada, Kayatha, Navdatoli, Eran, Nevasa, Chandoli, Daimabad, Inamgaon, Prakash, Maski, Brahmagiri, Sangankallu, Tekkalkota, Piklihal, Nagarjunakonda, Daojali Hading, Kuchai, Sarutadu.

Prehistoric Cave art from India: Bhimbetka, Adamgarh.

Indus Civilization: Expansion of village sites. Development of metal technology, art and writing. Architecture and city planning. Stages and theories of decline. Sites like Amri, Kot Diji, Kalibangan, Mohenjodaro, Harappa, Lothal, Dholavira, Rakhigarhi.

Pottery and Traditions: Ochre Coloured Pottery (OCP), Black and Red ware, Painted Grey Ware (PGW), Northern Black Polished Ware (NBP). Distribution of the pottery types and period.

Bronze/Copper Age: General characteristics, distribution, people.

Iron Age and Urban Revolution: General characteristics, distribution, people.

Megaliths: concept and types (menhir, dolmen, topical, cist, cairn circle, sarcophagi)

Unit 7: Conceptual Understanding of Social Anthropology

Culture: Attributes, Holism, Universals, Acculturation, Enculturation, Transculturation, Culture Change, Culture Shock, Cultural Relativism, Civilization, Folk-Urban Continuum, Great and Little Tradition, Cultural Pluralism and World-View.

Society: Groups, Institutions, Associations, Community, Status and Role. Incest. Endogamy and Exogamy. Rites of passage.

Social Institutions:

Family: Definitions, universality of the family. Typological and Processual methods of studying the family. Types of family – conjugal-natal, consanguineal, nuclear, joint, extended. Rules of residence – Patrilocal, Matrilocal, Ambilocal, Bilocal, Neolocal, Avunculocal, Virilocal, Amitalocal, Uxorilocal. Functions of family, Trends of change – urbanization, globalization, industrialization, feminist movements.

Marriage: Definition, universality, types and functions (monogamy, polygamy – polyandry, polygyny, hypogamy, hypergamy, levirate, sororate). Preferential and Prescriptive types. Types and forms of marital transactions – bride price and dowry. Marriage as exchange.

Kinship: Definition, Descent, kinship terminology, matrilineal puzzle. Joking and avoidance. Moiety, phratry, clan and lineage. Types of kinship systems.

Economic Anthropology: Definition and relationship with Anthropology and Economy. Theories (Malinowski, Formal, Substantivist, Marxist). Livelihoods, Subsistence, Principles of production, distribution, consumption, division of labour in hunting-gathering, pastoral, swidden and agricultural communities. Exchange, reciprocity, gifts and barter systems. Kula, Potlatch and Jajmani – Anthropological explanations.

Legal Anthropology: Anthropology of Law, Social Sanctions.

Political Organization: Definitions, political processes in band, tribe, chiefdom and state systems. Conflicts and social control. Nations and Nation-state, democracy.

Religion and Belief Systems: Definitions, animism, animatism, manaism, bongaism, totemism, taboo. Religious specialists – witch, shaman, priest, medicine-man, sorcerer. Magic – definitions, types, approaches. Rituals.

Social Change: Basic ideas and concepts (Assimilation, Integration, Syncretism, Dominance and Subjugation), Approaches.

Unit 8: Theories in Social Anthropology

Evolutionism – Tylor, Morgan, Fraser, Maine, McLennan.

Diffusionism – Three schools (Austro-German, British, American).

Historical Particularism – Boas.

Functionalism – Malinowski.

Structural-Functionalism – Radcliffe-Brown, Firth, Fortes, Eggan, Parsons.

Structuralism – Levi-Strauss.

Culture and Personality/Psychological Anthropology – Mead, Benedict, DuBois, Linton, Kardiner, Whiting and Child.

Cultural Ecology, Environmental Anthropology, Neo-evolutionism (Leslie White, Julian Steward, Marshall Sahlins).

Cultural Materialism – Marvin Harris.

Symbolic Anthropology – Victor Turner, Raymond Firth, Mary Douglas.

Cognitive Anthropology – Roy D'Andrade, Stephen Tyler, Ward Goodenough.

Deep Ethnography, Interpretive Anthropology – Clifford Geertz.

Anthropology and Gender – Leela Dube, Renato Rosaldo, Marilyn Strathern, Zora Neale Hutson.

Postmodernism, Poststructuralism, Postcolonialism – Foucault, Derrida, Bourdieu.

Ethnicity – Barth, Jeffery, Weber.

Unit 9: Stages in the Development of Indian Anthropology

Concepts: Social Stratification (eg. Caste), Scheduled Caste (SC), Dalit, OBC, Nomadic Groups. Revivalist/Nativist movements, Peasant movements (Malabar and Telengana movements).

Tribe, Scheduled Tribe (ST), Particularly Vulnerable Groups (PVTGs), Tribal movements (Birsa and Naga movements), Tribal Development, Distribution.

Indian Village and Village Studies in India (S.C. Dube, McKim Marriott, Weiser, Scarlett Epstein, M.N. Srinivas, F.G. Bailey)

Constitutional Safeguards for SC and ST, Inclusion and Exclusion. Panchayati Raj Institutions and other traditional community political organizations, Self-Help Groups (SHGs).

Theoretical ideas: Sanskritization, Westernization, Modernization, Globalization, Sacred Complex, Nature-Man-Spirit Complex.

Early Indian Anthropologists and their contributions: G.S. Ghurye, B.S. Guha, S.C. Roy, Iravati Karve, L.P. Vidyarthi, S.C. Dube, M.N. Srinivas, N.K. Bose, Surajit Sinha, D.N. Majumdar, S.R.K. Chopra, Verrier Elwin, S.S. Sarkar, Dharani Sen, T.C. Das, P.C. Biswas.

Unit 10: Concepts and Theories

Applied Anthropology, Action Anthropology, Engaged Anthropology, Experimental Anthropology, Urban Anthropology, Public Anthropology, Public Archaeology, Anthropology of Development, Medical Anthropology, Visual Anthropology, Genomic Studies, Genetic Screening and Counseling, Forensic Anthropology, Food and Nutritional Anthropology, Ergonomics, Kinanthropometry, Business Anthropology.

Community Development Projects (Rural, Urban and Tribal), Revisits, Re-studies, Reinterpretations, Intervention, Research Process and Social Impact Assessment (SIA).

Anthropological approaches in community studies: public health, education, nutrition, land alienation, bonded labour, housing, alternative economy, livelihood, gender issues, relief, rehabilitation and relocation, identity crisis, communication, training and management, aging and the aged.

Development Strategies (Plan/Sub Plan).

Role of NGOs in Development. Anthropology and NGOs.

Empowerment of Women, LGBT groups.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT –ARCHAEOLGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
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SRINAGAR (GARHWAL)
UTTARAKHAND

Department of History and Archaeology
HNB Garhwal University, Srinagar (Garhwal)

Proposed M.A. Courses in Ancient Indian History, Culture and Archaeology

First Semester

Core/Compulsory Courses:

Course-I	**Principles and Methods in Archaeology**	(3 Credits)
Course-II	**Environmental Archaeology**	(3 Credits)
Course-III	**Paleolithic Culture in Indian sub-continent**	(3 Credits)
Course-IV	**Copper Bronze Age In Indian Sub-Continent**	(3 credits)
Course-V	**Political History of India (C 600BCE to 650CE)**	(3 credits)
Course-VI	**Society of India from Vedic times to 1200 CE**	(3 credits)

Second Semester

Core/Compulsory Courses:

Course-VII	**Documentation and Dating methods in archaeology**	(3 credits)
Course-VIII	**Scientific and Analytical Archaeology**	(3 Credits)
Course-IX	**Early Farming communities -Mesolithic and Neolithic Culture in India**	(3 Credits)
Course-X	**Iron Age in India**	(3 Credits)
Course-XI	**Economic History (From earliest time to C1200CE)**	(3 Credits)
Course-XII	**Ancient Indian Art**	(3 Credits)

Third Semester

Core/Compulsory Courses:

Course-XIII	**History of India (C650CE to 1200CE)**	(3 credits)
Course-XIV	**Paleography and Epigraphy**	(3 Credits)
Course-XV	**Beginning of Indian Coinage**	(3 Credits)

Elective/Optional Courses:

The candidates are required to opt any three courses/papers from the following groups of courses.

Course-XVI (Group-A): The candidates are required to opt any one of the following courses/papers:

1. **Bioarchaeology** (3 credits)
2. **History of South India (650 CE to 1200 CE**) (3 credits)

Course-XVII (Group-B): The candidates are required to opt any one of the following courses:

1. **Ethnoarchaeology** (3 credits)
2. **History of Ancient Indian Religion** (3 credits)

Course-XVIII (Group-C): The candidates are required to opt any one of the following courses:

1. **Geoarchaeology** (3 Credits)
2. **Sources of Ancient Indian History** (3 credits)

Fourth Semester

Core/Compulsory Courses:

Course-XIX Indian Iconography (3 Credits)

Course-XX Early Indian coinage (3 Credits)

Course-XXIAncient Indian Architecture (3 Credits)

Elective/Optional Courses:

The candidates are required to opt any three courses/papers from the following groups of courses:

Course-XXII (Group-A): The candidates are required to opt any one course of the following courses:

1. **Conservation and Preservation of Archaeological artifacts** (3 credits)
2. **Historical Geography of Ancient India** (3 credits)

Course-XXIII (Group-B): The candidates are required to opt any one of the following courses

1. **Archaeological Computing** (3 Credits)
2. **Post- Gupta coinage** (3 credits)

Course XXIV (Group-C): The candidates are required to opt any one of the following courses:

1. **Protohistoric and Early historical sites and Their significance** (3 credits)
2. **World Prehistory** (3 credits)

Proposed M.A. Courses in Ancient Indian History, Culture and Archaeology

NOTE

1. All courses in **First** semester and **Second** semester are compulsory. In **Third** semester course **XIII, XIV**, **XV** and in **Forth Semester** course **XIX, XX, XI** are compulsory, while course **XVI, XVII, XVIII, XXII, XIII and XXIV** are elective/optional and these course are divided into 'A' 'B' and 'C' three groups. The candidates can opt any three courses out of these three groups in Third and **Fourth** Semester
2. Each course shall carry **3 credits**/100 marks. The Theory Paper will be of 60 marks and the Sessional tests shall be of 40 marks (i.e. 60+40=100).

First Semester

Core/Compulsory Courses

Course-I Principles and Methods in Archaeology

Unit –I: Nature and History of Archaeology

1. Definition and scope of Archaeology
2. History of Indian Archaeology from the 19th Century till the present
3. Relationship of Archaeology with History, Anthropology and Natural sciences.

Unit –II: Methods of data retrieval

1. Field discoveries: Aims, objectives and methods of Exploration of archaeological sits; Chance discoveries; Village to village survey. Field survey of prehistoric and historical sites.

2. Unearthing the sites: Selection of Site for excavations; Layout technique and Excavation methods.
3. Methods of recording the contexts of excavated remains.
4. Retrieval of biological and other degradable material: methods and Floatation technique,

Unit –III: Conservation and preservation of Archaeological Remains

1. Chemical treatment of organic and inorganic objects
2. Museum and the storage, display of antiquities.
3. Architectural conservation: Preservation and conservation of excavated structures and monuments.

Recommended Readings

1. Wheeler, Mortimer-Archaeology from the Earth, Oxford University press, London, 1955.
2. Wheeler, Mortimer- Prithvi Se Puratattva (Hindi Translation).
3. Atkinson, R.J.C.- Field Archaeology, II edition, 1958.
4. Kenyon, K.N. - Beginning in Archaeology, 1961.
5. Delaet, S.J.-Archaeology and its problems, London, 1957.
6. Crowford, O.G.S. - Archaeology in the Field, III impression, London, 1954.
7. Webester, Graham - Practical Archaeology.
8. Puri, Baijnath- Puratattva Vigyan (Hindi)
9. Ojha, R.P. - Kshetriya Prutattva (Hindi)
10. Singh, M.M.- Puratattva ki Ruprekha Patna, 1971 (Hindi)
11. Gairola, T.R.- Hand Book of Chemical Conservation of Museum Objects, National Museum.
12. Mohammad. Sanaullah- "Notes on the Preservation of Antiquities in the field", Ancient India, No. 1 pp. 82.
13. Lal, B.B.- "Chemical Preservation of Objects", Ancient India No. 18-19.
14. Plenderlieth H.J.-The conservation of Antiquities and works of Art, London, 1957.
15. Zeuner, F.E. - Dating the Past. 1958.
16. Piggot, S. - Approach to Archaeology.
17. Hemond, P.C.-Archaeological Techniques for Amateurs.
18. Michels. J.W.-Dating Methods in Archaeological Techniques for Amateurs.
19. Hester, J.J.-Introduction to Archaeology.
20. Shrma, Y.D.- Remains of Early Historical Cities (Archaeological Remains Monuments and Museums : Part, I-1964)
21. Sharma. Y.D. -"Exploration of Historical Sites" Ancient India, No. 9, pp. 166-169.
22. Lal, B.B. - "Excavation at Hastinapur and other Exploration, 1950-52 Ancient India, No.-10-11 : pp. 4-151.
23. Sharma, G.R.- Excavations at Kausambhi, 1957-59.
24. Wheeler, M., Gosh,-"Arikamedu-An Indo Roman Trading station on the East A and Deva, Krishana coast of India, Ancient India, No. 2, pp. 17- 124.
25. Wheelar, R.E.M. - "Brahmagiri and Chandravali, Megalith and other cultures in Mysore State". Ancient India No. 4, 1948, p. 180-310.
26. Lal. B.B.- "Sisupalgarh 1948 and Early Historical fort in Eastrn India. Ancient India No. 5, 1949, pp. 62-105.
27. Pande, J.N.-Puratattva Vimarsh, Allahabad.
28. Plender lieth, H.J. -The conservation of Antiquities and works of art
29. Gairola, T. D.-Hand Book of Chemical conservation of Museum.
30. Agrawal, D. P.-An Introduction to the Preservation of Paintings.
31. Bhowmic, S. K.-Protection and Conservation of Museum collection (Hindi Trans by P. K. Trivedi and Y. S. Rawat)

32. Singh, A. P.-Conservation and Museum Techniques.

Course-II Environmental Archaeology

Unit-I: Concept of Environmental Archaeology

1. Definition and Elements of Environmental Archaeology. Environment and Ecology.
2. Palaeo-environmental indicators and varieties of evidences

Unit-II: Palaeoclimatic Changes

1. Basic knowledge of quaternary geology.
2. Human Evolution. Quaternary period and geological records associated with Prehistory.
3. Palaeoclimatic indicators and methods of study. Quaternary deposits in India and its relevance in Palaeoclimatic reconstruction.
4. Palaeoclimatic and Palaeoenvironment in Archaeology.

Unit-III: Branches of Environmental archaeology

1. Bioarchaeology: Archaeozoology and Palaeobotany
2. Anthropological Archaeology
3. Marine archaeology.

Unit-IV: Study of Floral and Faunal Remains

1. Types of Faunal and Floral Remains and general methods of their study, sample collection and processing
2. Human Osteology in reconstruction of palaeohistory and biocultural remains and its archaeological significance
3. Case studies in and India, with special reference to Uttarakhand Himalaya.

Recommended Reading

1. Dena Ferran Dincauze: Environmental archaeology: Principles and Practice, Cambridge university Press, 2000.
2. Butyer, K.: Environment & Archaeology.
3. De Terra H. & Paterson T.T. Studies in the Ice-Age and Associated Human Cultures. 193
4. Relevant articles of Puratattva and Man & Environment.
5. Charles L. Redman: Human Impact on Ancient Environment, University of Arizona Press 1999.
6. Clive Orton: Sampling in Archaeology (Cambridge Manuals in Archaeology), Cambridg University Press, 2000.
7. Shackley, Myra: Environmental Archaeology, 1981.
8. Laporte, Leo, F.: Ancient environment, 1968.
9. Wing and brown: Palaeonutrition,
10. Binford, L. R.: An Archaeological Perspective. London. 1972.
11. Brill, Robert H. (Eds.): Science and Archaeology. Cambridge 1971.
12. Brothwell, D. R. & S. E. Higgs (Eds.). Science in Archaeology. London. 1969.
13. Bintliff, John Devidson, D. A. and Grant E.G.: Conceptual Issues in Environmer Archaeology, Edinbargh University Press, 1988.
14. Sharma, G.R. & J.D. Clark, Encyclopedia of Environmental Science, Mc Crow Hill.
15. Mellars, P and Stringer, C.: The Human Evolution: Behavioural and Biologi Perspectives on the Origins of the Modern Humans, Edinbargh University Press, 1989.
16. Mercer, R.: Farming Practice in British Prehistory, Edinbargh University Press, 1981.

17. Lambert, J. B. and Grupe, Gisela: Prehistoric Human Bone: archaeology at the Molicu Level, Psringer-Verlag, New York, 1993.
18. Krechmer, N. and Robertson, W.V.B.: Human Evolution, Readings fron Scientific Ameri San Fracisco, 1978.
19. Price, T.D.: The Prehistoric human Bone, Cambridge University Press, Nrw York, 1989.
20. Studies in Indian Archaeology and Palaeontology, Dharwad, India, 1990.
21. Singh, R. P.: Agriculture in Protohistoric India, Pratibha Prakashan, Delhi, 1990.
22. Evans, J. C.: An Introduction to Environmental Archaeology, Ithaca, New York, Corr University, Press, 1978.
23. Yellen, J.E.: Archaeological approaches to the Present: Models for the Reconstructing Pasr, Academic Press, New York, 1977a

Course-III: Paleolithic Culture in Indian Sub-Continent

Unit-I: Prehistoric Archaeology and scope of prehistory

1. An introduction to prehistory: features and scope.
2. Salient features of world Prehistory
3. Methods of Study of Prehistoric rocks: Micro-wear studies, experimental archaeology.
4. Tool technology: Important methods of making tools.

Unit-II: Paleolithic Culture: Lower, Middle and Upper Paleolithic Cultures

1. Pebble tool culture in India, problems and issues, regional distribution of palaeolithic culture, geological context and Palaeoclimatic stratigraphy.
2. Palaeolithic culture in Himalayas, Himachal Shivaliks and Nepal; central India (Soan valley).l
3. Distribution of lower and middle palaeolithic cultures: Geoarchaeological context and tool types.
4. The Central India and Peninsular Context: Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Tamil Nadu and other regions.
5. Distribution of upper palaeolithic cultures

Recommended Reading

1. Zeumer, F.E. Plaistocene Period.
2. Rendell D., & Hobin, Pleistocene and Palaeolithic Investigations in Sohan Valley, N. Pakistan.
3. Pant, P.C. Prehistoric Uttar Pradesh. Delhi.
1. Relevant articles of Puratattva and Man & Environment.
2. Allchin B. & Allchin F.R.: The Rise of Civilization in India & Pakistan, New Delhi, 1983.
3. Ghosh, A. (Ed.).: An Encyclopedia of Indian Archaeology, Vols. I & II. (Relevant Portions). New Delhi, 1989.
4. Jarrige, Catherine et.al [Ed.]: Mehargarh, Field Reports 1974-1985 from Neolithic Times to the Indus civilization. Karachi, Pakistan. 1995.
5. Jayaswal, V.: "Stone Age Technologies in India": History of Technology in India, Vol. I, New Delhi, 1997.
6. Leakey, L.S.B.: Olduvia Gorge 1959-1961, VolumesI, Cambridge, 1965.
7. Leakey, M.D.: Olduvia Gorge: Excavations in Beds I & II. 1960–1963, Cambridge, 1971.
8. Paddaya, K.: The Acheulian Culture of The Hunsgi Valley (Peninusular India) – A Settlement System Perspective, Poona, 1982.
9. Pant, P.C. & Vidula Jayaswal. Paisra: A Stone Age Settlement in Bihar, New Delhi, 1999.
10. Relevant articles of Purattatva, Pragdhara, Man & Environment, Ancient India.
11. Rendell, Dennell & Halim: Pleistocene & Palaeolithic Investigations in the san valley, North Pakistan.
12. H.D. Sankali: *Stone Age Tools: Their Techniques, Names and Probable Functions*, Deccan College, Pune, 1982.
13. H.D. Sankalia- *Prehistory and Protohistory of India and Pakistan*, Deccan college, Pune, 1974
14. Poona, 1982.
15. Sharma, G.R. & J.D. Clark (ed.): Palaeo environments and Prehistory in the Middle Son Valley, Allahabad, 1983.
16. Sharma, G.R. et.al: From Hunting and Food Gathering to Domestication of Plants and Animals, Beginnings of Agriculture, Allahabad, 1980.
17. Singh., Birendra Pratap: Early Farming Communities of the Kaimur, Jaipur, 2004.
18. B. Subbarao- *Personality of India*, Baroda, 1958
19. Terra H. De & T.T. Paterson: The Studies on the Ice-Age in India & Associated Human Cultures, Washington, 1939.
20. Thapar, B.K.: Recent Archaeological Discoveries in India, UNESCO, 1985.
21. Wymer, J.J.: The Paleolithic Age, London, 1982.
22. B.K.Thapar- *Recent Archaeological Discoveries in India*, UNESCO Publication, 1985.

23. B.R.Allchin , D.K.Chakrabarti- *A Source Book on Indian Archaeology*, M.M Publishers Pvt. limited, New Delhi , 1979.
24. D.P Agrawal, D.K.Chakrabarti- *Essays in Indian Protohistory*, B.R. Publishing Co, Delhi, 1979
25. D.P.Agrawal- *The Archaeology of India*, Curzon Press, London. 1982.
26. R.E.M.Wheeler- *The Indus Civilization*, University Press, London, 1968.
27. R.E.M Wheeler- *Early India and Pakistan*, Thames and Hudson, London,, 1959.
28. W.A.Fairservis Jr- *The Roots of Ancient India*, The University if Chicago press, Chicago, 1975.
29. B.B.Lal- *The Earliest Civilization of South Asia*, Aryan Books International, New Delhi, 1979.
30. Erwin Newmayer- *Lines on Stone: Prehistoric Rock Art of India*, Manohar, New Delhi, 1993.

Course-IV Copper Bronze Age in Indian Sub-Continent

Unit-I: Early Chalcolithic and Preharappan cultures

1. Early Chalcolithic Cultures of Afghanistan and Pakistan
2. Pre and Early Harappan Culture of Afghanistan, Pakistan and India

Unit-II: Indus–Sarswati Civilization

1. Its Origin, Extent, Chronology, main characteristics and Settlement system
2. Decline of Harappan Culture in Gujarat & Saurastra

Unit-III: Late Survival of Bronze Age Culture

1. Late Harappan Culture in Punjab & Haryana
2. Chalcolithic village communities in Rajasthan and central India.
3. Chalcolithic Cultures of Maharashtra and eastern India

Unit –IV: Copper using communities of Gangetic Plain

1. Copper hoard and OCP Cultures and their co-relationship
2. Copper using Communities in Middle and Lower Ganga Plain, with special reference to Chirand, Senuar and Narhan
3. Growth of Urban settlements in Ganga valley.

Recommended Readings

1. Agrawal, D. P. & Chakrabarti, D. K. (eds.) Essays in Indian Protohistory. Delhi. 1979.
2. Agrawal, D. P. Archaeology of India. New Delhi, 1982.
3. Agrawal, D.P.& J.S. Kharakwal. Bronze Age and Iron Age in South Asia. New Delhi, 2003.
4. Allchin, B. & Allchin F. R.: The Rise of Civilization in India and Pakistan. London. 1982.
5. Allchin, F.R. The Archaeology of Early Historic South Asia : Emergence of City and States. Cambridge. 1995.
6. Also Relevant articles/communications in Puratattva, Man and Environment, Praghadhara, Ancient India and Indian Archaeology-A Review.
7. Asthana, Shashi, Pre-Harappan Cultures of India and the Borderlands, New Delhi, 1985.
8. Chakrabarty, D. K. The Early use of Iron in India, Oxford University Press. 1992.
9. Dhavalikar, M. K. , H. D. Sankalia and Z. D. Ansari, Excavations at Inamgaon, Pune. 1988.
10. Dhavalikar, M.K. Indian Proto-history. New Delhi. 1997.
11. Gaur, R. C. : (ed.) : Painted Grey Ware, Jaipur. 1994.
12. Gaur, R.C. Excavations at Atranjikhera. Delhi. 1983.

13. Ghosh, A. (ed). An Encyclopedia of Indian Archaeology. Gaur, R. C. : (ed.) : Painted Grey Ware, Publication Scheme, Jaipur, 1994.Vols. I & 2. ICHR. New Delhi. 1989.
14. Ghosh, A. The City in Early Historical India. Shimla. 1973.
15. Jarrige, Catherine et.al [ed.]. Mehrgarh, Field Reports 1974-1985. From Neolithic Times to the Indus civilization. Karachi. 1995.
16. Lal, B. B. : Excavation at Shringverapura, 1977-86; Archaeological Survey of India. New Delhi. 1993.
17. Lal, B. B. and S. P. Gupta (eds.) : Frontiers of Indus Civilisation, New Delhi. 1984.
18. Lal, B.B. : The Earliest Civilization of South Asia. New Delhi, 1997.
19. Marshall, J. : Mohenjo-daro and the Indus Civilisation, Delhi-Varanasi. 1983.
20. Narain, A. K. et al. Excavations at Rajghat, B. H. U. , 1976 & 1977.
21. Possehl, Gregory (ed.) Ancient Cities of the Indus. Delhi. 1979.
22. Possehl, Gregory (ed.) Harappan Civilization. Delhi. 1982.
23. Rao, S. R. : Lothal: A Harappan Port Town-1955-62, A. S. I., New Delhi. 1985.
24. Sali, S. R.: Daimabad, 1976-79, A.S.I., New Delhi, 1986.
25. Sankalia, H.D., et.al. Chalcolithic Navdatoli, Pune, 1971.
26. Sharma, G.R. The Excavations at Kausamli (1949-50). Delhi. 1969.
27. Singh, B.P. Early Forming Communities of the Kaimur (Excavations at Senuwar 1986-87, 89-90). Jaipur. 2004.
28. Sinha, B.P. & S.R. Roy. Vaisali Excavations 1958-62. Patna 1969.
29. Sinha, K.K. Excavations at Sravasti 1959. Varanasi.

Course-V Political History of India from c. 600 BCE to c. 650CE

Unit –I: Janapadas and Mahajanapadas

1. Political formations: monarchical and republican.
2. Rise of Magadha empire

Unit –II: Towards empire: Nandas and Mauryas

1. Alexander's invasion
2. Growth of Nandas and Mauryas
3. Polity; nature and extent of centralization; and foreign relations.
4. Kautilya's Arthashastra and Megasthenes' Indica

Unit-III: Post Mauryan Dynasties and Polity

1. Sungas and Kanvas: Indo-Greeks, Saka-Pahallava, Satavahanas and Western Kshatrapas.
2. The Kushanas: Political consolidation
3. Sangam age: chiefdoms.

Unit-IV: Guptas, Hunas and Vakatakas

1. Dynastic history of the Guptas; Huna invasion; Vakatakas and contemporary dynasties in the peninsular India.
2. Administrative organization: provincial and feudatory states.

Unit-V Vardhanas, Chalukya and Pallavas

1. Harsha-Polity and administration
2. Chalukyas and Pallavas: Extent of kingdoms and administration.

Recommended Readings

1. Chattopadhyaya, D.P., Indian Philosophy (New Delhi, Popular Publishing House, 1986).
2. Comprehensive History of India, Vols II (1957), III (Orient longman,1952), IV (Delhi, PPH, 1992).

3. Jha, D.N. and Shrimali K.M., Prachin Bharat Ka Ithihas (Delhi, Hindi Directorate, 1990).
4. Kulke, H, and D. Rothermund, History of India (london, Routledge,1998).
5. Majumdar, R.C. et al., History and Culture of the Indian People, Vols II, III,IV (Mumbai, Bhartiya Vidya Bhavan Series, 1970, 1979, 1980).
6. Munshi, V.K.M. and R.R. Diwakar, Bharatiya Vidya Bhavan Series -Indian Inheritance, 3 vols (Bombay, Bhartiya Vidya Bhavan, 1965, 1970).
7. Nilkanta Sastri, K.A., A History of South India from pre-historic times to the fall of Vijaynagar (Chennai, OUP, 1983).
8. ------ Nand Mauryan Yugeen Bharat.
9. ----------(edited) Comprehensive History of Ancient India, Vol. II, The Mauryas and Satvahanas,1957.
10. Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India (Delhi, Motilal Banarsidass, 1991) (Revised edition).
11. Sharma, R.S., Ancient Indian History.
12. Thapar, Romila, Early India(from origin to AD.1300)penguin Book-2002.
13. ----- Ashoka and the Decline of Mauryas.
14. ----------From Lineage to State, oxford,1984, seventh ed.2002.
15. ---Interpreting Early india, oxford press,1992, ninth ed.2005.
16. Raychaudhary, H.C., Political History of Ancient India, 1950.
17. Mookerjee, R.K., Ancient India, 1956.
18. Smith, V.A., Early History of India, 1924.
19. Puri, B.N. India as described by early greek writers,1939.
20. Chattopadyay Bhaskar, The Age of the Kushanas, a Numismatic Study,1967.
21. ----------Kushana State and Indian Society: A study in Post-Mauryan Polity and Society,1975.
22. Chattopadyay Sudhakar, The Sakas in India,1955.
23. Narain,A.K. The Indo-Greeks,1957.
24. Mazumdar, R.C. The Vakataka-Gupta.
25. Gupta, P.L. Gupta Samrajya.
26. Upadhyay, Vasudev. Gupta Samrajya Ka Itihas.
27. Rai, U.N., Gupta Samrat aur Unka Kal.
28. Sharma, B.N. Harsha and his Times.
29. Majumdar, R.C. Ancient India.
30. Sen, S.N., Ancient Indian History and Civilization, willey Eastern limited, Delhi.
31. Mookerjee, R.K., The Gupta Empire, 1969.
32. ---------- Harsha.
33. Pannikar, K.M., Shri Harsha of Kannauj, 1922.
34. Tripathi, R.S., History of Kannauj, 1927.
35. Goyal, S.R., A History of Imperial Guptas, 1967.
36. Devahuti, D., Harsha, A political Study,1970.
37. -------A History of South India, 1966.
38. Gopalan, R., History of Pallavas of Kanchi, 1928.
39. Venkataramanayya, N., The eastern Chalukyas of Vengi, 1950.
40. Chattopadhyaya, S. Early History of Northern India. Delhi. 1976.
41. Mukherjee, B.N. The Kushana Geneology, Calcutta. 1957.
42. Narain, A.K. From Alexander to Kanishka. Varanasi. 1967.
43. Pathak, V. Uttar Bharat Ka Rajnitik Ithas (Hindi). Lucknow. 1973.
44. Puri, B.N. India Under the Kushanas. Bombay. 1965.
45. Rapson, E.J. Cambridge History of India, Vol. I. Cambridge. 1922.
46. Sharma, R.S. Material Culture and Social Formations in Ancient India. Delhi, 1985.
47. Thapar, Romila, Early India(from origin to AD.1300)penguin Book-2002.

Course-VI Society of India from Vedic times to 1200 CE

Unit I: Social stratification, beginnings of varnashram system and other social aspects

Unit II: Post Vedic Society up to pre Gupta times- caste system, condition of women, Sangam age; society.

Unit III: Gupta society (Till 650 CE)

Unit IV: Post Gupta (from 650- 1200A.D. Society: Social stratification, proliferation of castes, inheritance, everyday life and conditions of women.

Recommended Readings

1. Hiriyanna, M., Essentials of Indian Philosophy (Delhi, Motilal Banarsidass, 1995).
2. Jha, D.N. and Shrimali K.M., Prachin Bharat Ka Ithihas (Delhi, Hindi Directorate, 1990).
3. Majumdar, R.C. et al., History and Culture of the Indian People, Vols 4. III, IV and V (Mumbai, Bhartiya Vidya Bhavan Series, 1970, 1979, 1980).
5. Munshi, V.K.M. and R.R. Diwakar, Bharatiya Vidya Bhavan Series -Indian Inheritance, 3 vols (Bombay, Bhartiya Vidya Bhavan, 1965, 1970).
6. Nilkanta Sastri, K.A., A History of South India from pre-historic times to the fall of Vijaynagar (Chennai, OUP, 1983).
7. Stein, Burton, Peasant State and Society in Medieval South India.(Delhi, OUP, 1980).
8. Thapar, Romila, A History of India, Vol. 1 (Pelican, 1966, Penguin, Harmondsworth).
9. Thapar, Romila, Ancient Indian Social History
10. Jain, K.C., Prachin Bharat ki samajik evam arthik sansthain
11. Om Prakash, Prachin Bharat ka samajik evam arthik itihas.

Second Semester
Core/compulsory Paper

Course-VII Documentation and Dating methods in archaeology

Unit-I: Photography in Archaeology

1. History of the application of camera in archaeology, its significance in archaeological photography. Indoor and Digital photography.
2. Application of new software in photography. Videographer in archaeology.

Unit-II: Reconstruction of Chronological sequence:

1. Stratigraphy: causes of the formation of layers, their nature, order, identification and recording the strata.

Unit-III: Dating methods:

1. Relative dating: Typology and Dendrochronology
2. Absolute dating: Radiocarbon Dating, Thermo luminescence Dating, Potassium Argon Dating, Obsidian hydration and Amino Acid Racemization

Recommended Readings

1. Atkinson, R.J.C. Field Archaeology. London. 1952.
2. Brill, Robert H. (ed.) : Science and Archaeology. Cambridge 1971.
3. Brothwell, D. R. & S. E. Higgs (eds.). Science in Archaeology. London. 1969.
4. Cookson, M. B. Photography Archaeologist. London. 1954.
5. Crawford, O.G.S. Archaeology in the Field. London. 1953.
6. Cronyn, J. M. The Elements of Archaeological Conservation. New York. 1990.
7. Plenderlieth, H. J. Conservation of Antiquities and Works of Art. London. 1957.
8. Webster, G. Practical Archaeology: An Introduction to Archaeological Excavation. London. 1974.

Course-VIII: Scientific and Analytical Archaeology

Unit-I: History of Science and its application in archaeology

1. Brief history of scientific Techniques. Development and application of Scientific Techniques in Archaeology.
2. Importance, relevance, utility and scope of analytical techniques in archaeological study.

Unit-II: Scientific methods and instruments used in archaeological study

1. Dendrochronology
2. X-ray diffraction (XRD) and X-ray fluorescence (XRF)
3. Metallography, microscopy and Scanning electron microscopy
4. Radiocarbon dating and Thermo luminescence dating
5. Spectroscopy, mass spectroscopy (MS), Atomic absorption spectroscopy (AAS) and inductively couple plasma emission spectroscopy (ICPES).
6. Neutron activation analysis (NAA) and Amino acid racemization.

UNIT-III: Analytical techniques

1. Phosphate and trace element analysis in archaeological soils and reconstruction of intensity of occupation in ancient settlements.
2. Estimation of isotopic ratios of carbon, nitrogen, oxygen and strontium in archaeological faunal remains to infer the palaeodiet, palaeoenvironment and residential mobility of ancient settlement.

3. Study of trace element analysis in archaeological faunal remains for reconstructing the palaeodiet and palaeo-environmental conditions of ancient settlement.

Recommended Readings

1. Ingersoll, D., Yellen, J.E. and MacDonald, W.: Experimental archaeology, New York, 1977.
2. Binford, L. R. : An Archaeological Perspective. London. 1972.
3. Atkinson, R.J.C. Field Archaeology. London. 1952.
4. Brill, Robert H. (ed.) : Science and Archaeology. Cambridge, 1971.
5. Brothwell, D. R. & S. E. Higgs (eds.): Science in Archaeology, London, 1969.
6. Chang, K. C.: Settlement Archaeology, Palo Alto, Caligo, 1968.
7. Clark, D. L.: Models in Archaeology, London, 1972.
8. Clark, David : Analytical Archaeology, London, 1968.
9. Daniel, G. A.: Hundred Years of Archaeology, London. 1950.
10. Daniel, G.: The Origin and Growth of Archaeology, London 1967.
11. Piggott, S.: Approach to Archaeology, New-York. 1965.
12. Sankalia, H. D.: New Archaeology Its Scope and application in India, Lucknow. 1977.
13. Srivastava, K. M.: New Era of Indian Archaeology, New Delhi, 1982.
14. Wheeler, M.: Archaeology from Earth,
15. Yellen, John: Archaeological Approaches to the present, New York, 1977.
16. Whitehead, A. N.: Science and the Modern world, New York, 1957.
17. Limbrey, Susa: Soil science and Archaeology, Academic Press, New York, 1975.
18. Smith, Keith A.: Soil Analysis Modern Instrumental techniques), new York, 1990.
19. Council on Soil Testing and Plant analysis, Georgia University, Athens, USA: Hand Book of Reference Methods fro soil Analysis, 1992.
20. Bag, A.K. (ed.) History of Technology in India, Vol. I. New Delhi. 1997.
21. Bose, D.M. et. al. Concise History of Science in India . INSA. New Delhi. 1971.
22. Forbes, R. J. Studies in Ancient Technology, Vol. I to IX. Leiden. 1976.
23. Hodges, H. Technology in the Ancient World . London. Pelican. 1970.
24. Jaggi, O. P. Dawn of Indian Technology. Delhi. 1969.
25. Sankalia, H. D. Some aspects of Prehistoric Technology in India. New Delhi. 1970.
26. Singer, C. et. al. A History of technology .Vol. I & II. (relevant chapters).
27. Singh, R.N. : Ancient Indian Glass. Delhi. 1989.
28. Sinha, B.P. Sinha, Potteries in Ancient India.

Course-IX: Early Farming Communities-Mesolithic and Neolithic Culture in India

Unit-I: Early Holocene Hunting-Gathering Strategies:

1. Mesolithic stage: Climatic changes and technological adaptation: concepts and archaeological remains.
2. Microlithic succession: Geo-chronology and cultural sequence of microliths in India.
3. Ecological zones and associated Mesolithic sites of India: Alluvial plain adaptation; Baghor; Chopani-Mando, Birbhanpur; Horse-shoe-lake sites; Sarai-nahar-rai; Mahdaha; Rock shelter sites; Langhnaj; Bagor; rock-shelter sites; Adamgarh, Bhimbetka; Lahariadih; Morhana-pahar.

Unit-II: Beginnings of food production: A world perspective

1. Interpretative models for the Origins of food production economy**.**
2. Origin and expansion of Neolithism: Archaeological remains of Neolithic in West Asia and India.
3. Early farming communities of Central India: Neolithic remains of Belan valley, Vindhyan foot-hills and Ganga plains.

4. Neolithic remains of eastern India: Neolithic sites of Chhota Nagpur plateau; Orissa and Assam.
5. Pastoral communities of Deccan: Ash mound and village sites of Karnataka and Tamilnadu.

Recommended Readings

1. Wendrof, fred & Angela E. Close: Advances in World archaeology, 1983.
2. Clarke, Grahame: World Prehistory, 1977.
3. Bhattacharya, D.K.: Emergence of Cultures in Europe, Delhi, 1978.
4. Bhattacharya, D.K.: Old Stone Age Tools, Calcutta, 1979.
5. Bordes, F.: The Old Stone Age, London, 1968.
6. Clark, J.D.: The Prehistory of Africa, Cambridge History of Africa, Volume-I, London, 1970.
7. Gamble, C.: Paleolithic Settlement of Europe, Cambridge, 1986.
8. Jarrige, Catherine et.al [Ed.]: Mehargarh, Field Reports 1974-1985 from Neolithic Times to the Indus civilization. Karachi, Pakistan. 1995.
9. Jayaswal, V.: "Stone Age Technologies in India": History of Technology in India, Vol. I, New Delhi, 1997.
10. Zeumer, F.E. Plaistocene Period.
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12. Sharma, G.R. et.al: From Hunting and Food Gathering to Domestication of Plants and Animals, Beginnings of Agriculture, Allahabad, 1980.
13. Singh., Birendra Pratap: Early Farming Communities of the Kaimur (Excavations at Seminar 1986-87, 89-90), Jaipur, 2004.
14. Leakey, L.S.B.: Olduvia Gorge 1959-1961, VolumesI, Cambridge, 1965.
15. Leakey, M.D.: Olduvia Gorge: Excavations in Beds I & II. 1960–1963, Cambridge, 1971.
16. Zeumer, F.E. Plaistocene Period.
17. Burzer, Karl W.: Archaeology as Human Ecology, 1982.
18. Mercer, R.: Farming Practice in British Prehistory, Edinbargh University Press, 1981.

Course-X Iron Age in India

Unit-I :

1. Beginning of Iron Age in India and its role in second urbanization in India
2. Development of iron technology and associated metallurgy, Iron Ores sites in India and Uttarakhand,
3. Painted Grey ware (PGW) culture: Authorship, Extent, Chronology, Settlement and pattern.
4. Northern Black Polished ware Culture: Authorship, Extent, Chronology and Settlement Pattern.

Unit-II: Painted Grey Ware and Northern Black Polished Ware with special reference to Ganga valley and Uttarakhand

Unit-III: Megalithic Cultures

1. Megalithic Cultures of North-India
2. Megalithic Cultures of South India
3. Megalithic cave burial Culture of high altitude Himalaya, Nepal and Tibet.

Recommended Reading

1. Agrawal, D.P & J.S. Kharkwal, Bronze Age and Iron Age In South Asia, N. Delhi, 2003.

2. Banarji, N.R, Iron Age in India.
3. Lal, B.B, The Earliest Civilization of South Asia, 1997.
4. Allchin, F.R, Archaeology of Early Historic South Asia Emergence of City and States.
5. Sinha, K.K. Excavation at Sravasti, 1959 Varansi
6. Tripathi, Vibha, Painted Grey Ware- An Iron age culture of North India, 1976 Delhi.
7. Wheeler, REM, Bhrahmagiri & Chandravally, 1947, Also relevant articles /communications in Man & Environment , Puratattva, Pragdhara, Indan Archaeology : A Review and Ancient India.

Course-XI Economic History (Vedic Times to c. 1200CE)

Unit-I: Stages in ancient Indian economy

1. Meaning & Significance of varta.
2. Vedic agriculture.
3. Economy in the 6th century B.C.:

Unit-II: Money economy and trade

1. Maritime trade and trade route with east & west and Roman trade c. 200 B. C. – 300 A. D.
2. Origin & development of banking system, exchange and currency.
3. Imperial control over economy and economic progress in the Gupta period.

Unit-III: Early Medieval economic life

1. Feudalism and it's control over economy and Early medieval economic life.
2. Slavery, Labour, Taxation, land ownership, Guilds.
3. South Indian economy: Maritime trade and temple economy.

Recommended Readings

1. Achche, Lal Prachin Bharat Mein Krisi, (Hindi), 1980.
2. Adhya, G. L. Early Indian Economics, Bombay. 1966.
3. Aiyanger, C. V. R. Ancient Indian Economic Thought, Varanasi. 1965.
4. Bajpeyi, K. D. Bharatiya Vyapar Ka Itihas. (Hindi). Mathura. 1951.
5. Bandopadhyaya, N. C. Economic Life and Progress in Ancient India, Calcutta.
6. Bandopadhyaya, N. C. Kautilya or An Exposition of his social Ideas and Political Theory Vol. I, Calcutta. 1972.
7. Bose, A. N. Social & Rural Economics of Northern India. Vol. I, Calcutta, 1966.
8. Das, Dipakranjan. Economic History of Deccan from Ist Cen. A.D. to 6th cen. A.D., Delhi. 1971.
9. Ghoshal, U. N. Contribution to the History of Hindu Revenue System,Calcutta, 1929.
10. Gopal, L. Aspects of History of Agriculture in Ancient India, Varanasi, 1980.
11. Gopal, L. Economic Life of Northern India (700-1200 A. D.). Delhi. 1965.
12. Jain, Beena. Guilds in Ancient India. Delhi. 1990.
13. Maity, S. K. Economic Life in Northern India in the Gupta Period. Varanasi, 1970.
14. Motichand Trade and trade Route in Ancient India. New Delhi. 1977.
15. Om Prakash. Early Land Grants and State Economy. Allahabad, 1988.
16. Pandey, B. K. Temple Economy Under the Cholas, New Delhi, 1984.
17. Rai, J. The Rural-Urban Economy and Social Change in Ancient India (300 B. C.-600 A.D.), Varanasi, 1974.
18. Singh, A. K. Indo-Roman Trade. Patna. 1988.
19. Srivastava, Balram. Trade & Commerce in Ancient India. Varanasi. 1968.

Course-XII Ancient Indian Art

Unit-I: Harppan Art: Stone, Terracotta and Metal Figurines.

Unit-II : **Mauryan Art:** Pillars and Capitals; Early Yaksha Figures.

Unit-III: Sunga and Satvahana Art: Bharhut, Sanchi and Amravati.

Unit-IV: Art of Kushana: Mathura and Gandhara School.

Unit-V: Art of Gupta Period.

Unit-VI: Paintings: 1. Ajanta 2. Bagh

Recommended Readings

1. Agarwal, V. S.- Indian Art
2. --do-- - Studies in Indian Art
3. --do-- - Bhartiya, Kala (Hindi)
4. Bhattacharya, B. C. -Indian Images (Part 1)
5. Bachhofer, L. -Early Indian Sculpture
6. Ray, Niharranjan -Maurya and Post Mauryan Art
7. Coomaraswamy A. K.-Introduction to Indian Art
8. Coomaraswamy, A. K.-History of Indian and Indonesian Art
9. --do-- - Yakshas
10. Rowson, P. - Indian Art
11. Havell, E. B. - Hand book of Indian Art.
12. Saraswati, S. K. -A Survey of Indian Sculpture
13. Kramrisch, Stellia -Indian Sculpture
14. Harle, J. C. - Gupta Sculpture
15. Swarup, S. - 5000 years of Art and Crafts in India and Pakistan
18. Chandra, Moti -Studies in Early Indian Paintings
19. Khandelvala, K. J. -The Development of Style in Indian Paintings.
20. Khandelvala, K. J. -Indian Sculptures and Paintings
21. Gairola, V. - Bhartiya Chitrakala
22. Sivaramamurti, C. -South Indian Paintings.
28. Sivaramamurti, C. Art of India.
32. Agarwal, V. S. -Gupta Art
33. Harle, J. C. - Art and Architecture of Indian Subcontinent
34. Mishra, R. N. - Bhartiya Murtikala
36. Yajdani, G. - Ajanta
37. Marshall, J. - The Buddhist Art of Gandhar.

Third Semester

Core/Compulsory Course

Course-XIII History of India (C650CE to 1200CE)

Unit- I: Early Medieval India

1. Early medieval Period, its historical significance.
2. Changing Pattern of society, Polity and Economy

Unit-II: Early Medieval historiography

1. Tradition of History writing
2. Role of royal courts

Unit-III: Sources of Pre-Medieval history

1. Literature : Sanskrit, Prakrit, Apbhransh and Hindi
2. Archaeological Evidences.

Unit IV: Dynastic India

1. North & Eastern India: Pratihar, Pala & Senas
2. Western & Central India: Chauhan, Parmar, Gahadwal & Chandelas.

Recommended Readings

1. Bose, N.S., History of Chandelas
2. Gangully, D.C., History of Parmar Dynasty
3. Niyogi, Roma, History of Gahadwal Dynasty 1959
4. Pathak, Vishudhanand, Uttar Bharat Ka Rajnitik Itihas, (Hindi) 2006 (Ed)Luknow
5. Puri, B.N., Gurjar – Pratihar
6. Raichaudhury, H.C. Dynastic History of Northen India Vol. I & II
7. Tripathi, R.S., History of Kannauj
8. Vaidya, C.V., History of Medieval Hindu India 3 Vol. 1921-26- Pune
9. Winternitz, M, History of Indian Litrature, Vol. I & II 1933, Culcatta

Course-XIV Paleography and Epigraphy

Unit-I: Antiquity of writing in India

1. Value of inscriptions for historical reconstruction.
2. Origin of antiquity and art of writing in India.
3. Writing materials.

Unit-II: Origin and development of Script: 1. Brahmi 2. Kharosthi

Unit-III: Indian Eras: Vikram, Saka and Gupta Era

Unit-IV: Antiquity of Writing in India

1. Rock Edict XIII of Ashoka
2. Pillar Edict VII of Ashoka
3. Sarnath minor Pillar Edict of Ashoka
4. Rummandei Pillar inscription of Ashoka
5. Second Rock Edict of Ashoka
6. Basenagar Garuda pillar Inscription of Heliodorus
7. Hathigumpha Inscription of Kanishka-I
8. Nanaghat Inscription of Queen Naganika
9. Junagarh Rock inscription of Rudradaman
10. Allahabad Pillar Inscription of Samudragupta
11. Mathura Pillar Inscription of Chandragupta-II
12. Mehrauli iron pillar Inscription of Chandra

13. Mandsaur iron pillar Inscription Yashodharman Vishnuvardhan
14. Banskhera copper plate Inscription of Harsha
15. Pandukeshwar copper plates of Lalitsurdeva.

Recommended Reading

1. C.J. Brown, Coins of India, 1973, Indological Book House, Delhi
2. D.C. Sircar, Indian Epigraphy, 1984, Motilal Banarasida, Delhi
3. Rajbali Pandey, Indian Palaeography, 1984, Motilal Banarasidas, Delhi
4. K.V. Ramesh Indian Epigpaphy, Vol-1 and 2, 1984, Sandeep Prakashan, Delhi.
5. D.C. Sircar, Selected Inscriptions, Vol.1, 1942, University of Calcutta
6. R.K. MookerjiAshokan Inscriptions, 1959, Calcutta Progressive Publishers. Calcutta.
7. F. Hultzch Corpus Incriptionsum Indicarum, Vol. I, 1969.
8. J. Fleet Corpus Inscriptionum Indicarum, Vol. III, 1971.
9. V.V. Mirashi Corpus Innscriptionum Indicarum, Vol. IV, 1955.
10. D.C. Sircar Studies in Indian Coins,1968, Motilal Banarasidas Delhi.
11. A. Cunningham Inscriptions of Ashoka,1961, Indological Book House, Delhi.
12. J. Allen Catalogue of the Coins of Ancient India, Munshiram Manoharlal, Delhi.
13. G.H. Oza Bharatiya Prachina Lipimala(Hindi)1959, Munshiram Manoharlal, Delhi.

Course-XV Beginning of Indian Coinage

Unit–I: Introduction

1. Antiquity of coinage in India : Origin and evolution, literary evidence, archaeological and epigraphical evidences
2. Techniques and methods of manufacturing of Indian coins

Unit–II: Early Indian Coins

1. Punch marked coins
2. Cast coins

Unit – III: Local and Tribal Coins

1. Local Coins – Taxila, Kaushambi
2. Tribal Coins – Yaudheyas, Kunindas, Audumbaras, Arjunayanas

Recommended Reading

1. "A Comparative Study of the Patraha (Purnea) Hoard of Silver Punch-marked Coins". JNSI - IV.
2. "Punch-marked Coins from Taxila". MASI. 59.
3. A.M. Shastri; Catalogue of the coins of the Maghas.
4. Allan, J. Catalogue of the Indian Coins in the British Museum. London. 1936.
5. Altekar, A. S. "Origin and Early History of Coinage in Ancient India" JNSI, XV. pp. 1-26.
6. Bela Lahiri, Indigenous States of Northern India.
7. Bhandarkar, D. R. Carmichael Lectures on Ancient Indian Numismatics. Calcutta. 1921.
8. Bhattacharya, P. N. "A Hoard of Silver Punch-markrd coins from Purnea". MASI-62. Delhi. 1940.
9. Chakraborty, S. K. A Study of Ancient Indian Numismatics. Calcutta. 1973.
10. Cunningham, A. Coins of Ancient India. Varanasi. 1974.
11. Dasgupta, K. K . A Tribal History of Ancient India , A Numismatic Approach. Calcutta. 1974.
12. Goel, S.R. Ancient Indian Coinage.

13. Gupta, P. L. and Hardaker, T.R. Ancient Indian Silver Punch-marked Coins of the Magadh – Maurya Karshapana Series. Nasik. 1985.
14. Gupta, P. L. The Amaravati Hoard of Silver Punch-marked coins. Hyderabad. 1963.
15. Gupta, P.L. Coins – The Source of Indian History. Delhi. 1969.
16. Gupta, P.L. Pracheena Bharteeya Mudrayen. Varanasi.
17. Kosambi, D. D. Indian Numismatics, Delhi. Orient Longman. 1981.
18. Narain A. K. & Gopal, L. (eds.) Seminar papers on the Chronology of Punch-marked Coins. Varanasi. 1966.
19. Narain, A. K. Seminar Papers on the Local Coins of Northern India, Varanasi. 1968.
20. Prasad, D. "Classification and Significance of the symbols on the silver Punch-marked coins of Ancient India". JNSI. XIV and XLVII.
21. Shastri, A.M. The Catalogue of Coins of Nagas.
22. Singh, J. P. and N. Ahmad. Seminar Papers on the Tribal Coins of Ancient India. Varanasi. 1977.
23. Trivedi, H.V., Catalogue of the Coins of the Naga Kings of Padmavati.
24. Walsh, E. H. C. "Punch-marked Silver Coins, Their Standard of Weight. Age and Minting". JRAS, 1937.
25. Walsh, E. H. C. "Paila Hoard of Punch-marked coins". JNSI - II.

Elective/Optional Courses

The candidates are required to select any three courses/papers from the following groups of courses.

Course-XVI (Group-A): The candidates are required to select any one of the following course/paper:

Course-1: Bioarchaeology

Unit-I: Concept and Scope of Bioarchaeology

1. Meaning and scope of Bioarchaeology, methods of Collection of Faunal and Floral remains from archaeological sites.
2. Processing and methods for morphological analysis of faunal and floral remains.
3. Study of plant and animal fossils from archaeological sites of India and their relationship with past occupation.

Unit-II: Archaeozoology

1. Definition and application of Archaeozoology in reconstructing the history of past occupation.
2. Study of Faunal and Human Remains and their Significance in Archaeological Context.
3. Case Study of Faunal Analysis in Some of the Important Archaeological Sites of India

Unit-III: Palaeobotany

1. Definition and application of Floral Remains in reconstructing the history of past occupation.
2. Study of Floral Remains, Micro-Organisms, Ferns & Mosses, Pollen Grains, Wood Remains and their Significance in Archaeological Context.
3. Case Study of Floral Analysis in Some of the Important Archaeological Sites of India

Recommended Readings

1. Angela Von den Driesch: A Guide to the Measurement of animal bones from archaeological Sites, Peabody Museum Bulletin No.1, 1976.
2. Angela Von den Driesch: Approaches to the faunal analysis in the Middle East, Peabody Museum Bulletin No.2, 1978.

3. Krechmer, N. and Robertson, W.V.B.: Human Evolution, Readings from Scientific America, San Fracisco, 1978.
4. Price, T.D.: The Prehistoric human Bone, Cambridge University Press, Nrw York, 1989.
5. Studies in Indian Archaeology and Palaeontology, Dharwad, India, 1990.
6. Binford, L. R.: An Archaeological Perspective. London. 1972.
7. Brill, Robert H. (Eds.): Science and Archaeology. Cambridge 1971.
8. Brothwell, D. R. & S. E. Higgs (Eds.). Science in Archaeology. London. 1969.
9. Kennedy, K.A.R. Lukacs, J.R. and Misra, V.N.: The Biological anthropology of Human Skeletal remains from Bhimbetka, Central India, ISPQS, Monograph series-2, 2002.
10. Corwall, I.W.: Bones for the archaeologist, London, 1994.
11. Binford, L.R.: Bones: ancient Men and Modern myths (Studies in archaeology), Academic Press, New York, 1981.
12. Kurten, B.: Pleistocene Mammals of Europe, Chicago, Aldine, 1968.
13. Kurten, B.: The Cave Bear story: Life and death of a Vanished Animal, New York, 1976.
14. Schiffer, M.B. Behavioural Archaeology, Academic Press, New York, 1976.
15. Price, T.D.: The Prehistoric human Bone, Cambridge University Press, Nrw York, 1989.
16. Alur, K.R.: Studies in Indian Archaeology and Palaeontology, Dharwad, India, 1990.
17. Relevant Articles from Journal of archaeological science, Archaeometry, Man and Environment and American Anthropology

Course-2: History of South India (650 CE to 1200 CE)

Unit–I: Interpreting the period: Its Historical importance and literary sources.

Unit–II Dynasties of the Deccan:

Rastrakutas, Chalukyas of Badami and Kalyani,and Yadavas.

Unit–III: Dynasties of south India: Cholas, Pallavas and Pandyas

Unit–V: Polity and Administration:

1. Political structure-Central, Provincial and Local administration
2. Emergence of Feudalism in Southern India and struggle for Supremacy

Recommended Reading

1. Altekar A. S., Rashtrakutas and their times.
2. Majumdar, R. C. & Pusalkar, A. D., Imperial Kannauj
3. Shastri, K. A., Nilkantha, History of South India (also Hindi trans)
4. Srivastava, Balarama, Dakshin Bharat Ka Itihas (Hindi)
5. Tripathi, R. S., History of Kannauj
6. Yazdari G., History of Deccan (Hindi)
7. Sharma, R.S., Indian Feudalism (Hindi)
8. Subramaniam, T.N., South Indian Temple Inscriptions, Vol. I,II,III, 1953-54-55, Madras
9. Aiyenger, Ancient India.

Courses-XVII (Group-B): The candidates are required to opt any one of the following

Course-1: Ethnoarchaeology

Unit-I: Nature and interrelationship of archaeological and ethnographic records

1. Role of analogy, definition, scope and methods of ethno archaeology.
2. Review of the history of ethno archaeological research in India and abroad

Unit-II: Ethno archaeology of the South Indian Neolithic culture

1. Present-day shifting cultivation practices and their relevance to the study of Mesolithic, Neolithic and Chalcolithic cultures of India
2. Relevance of ethno archaeological research for reconstructing the life ways of the early agro-pastoral chalcolithic communities of Central and Western India

Unit-III: Ethno archaeology of technology

1. Ethno archaeological Study of Bead manufacturer of Khambat, India
2. Ethno archaeological View of Indian Terracotta
3. Ethno archaeology of Iron and Copper technology of Uttarakhand Himalaya.

Unit-IV: Living tradition of Uttarakhand tribes

1. Agricultural Practices and Khark-Chhans tradition
2. Fishing-hunting tradition and Medicinal practices
3. Ceramic practices and Pastoralism

Recommended Readings

1. Charlton, T, H., 1981: Archaeology, Ethnohistory, and Ethnology: Interpretive Interfaces, in *Advances in Archaeological Methods and Theory*, vol. 4 (ed.) M. B. Schiffer, pp. 129-159. Academic Press.
2. Gould, R., (ed.) 1978: *Exploration in Ethnoarchaeology*. Introduction and pp. 241-293 Albuquerque: University of New Mexico.
3. Allchin, B. 1994: South Asia's Living Past**,** in *Living Tradition: Studies in Ethnoarchaeology of South Asia,* pp. 1-11. Oxford and IHB, New Delhi
4. Kramer, C., 1982: *Village Ethnoarchaeology: Rural Iran in Archaeological Perspective***.** Introduction, pp. 1-5. Academic Press: New York.
5. Coles, J., 1979: *Experimental Archaeology*, *Introduction*, pp. 1-48. Academic Press: New York.
6. Helms, M. W., 1993: *Craft and the Kingly Idea: Art, Trade and Power*. Chaps. 1-5. University of Texas Press, Austin.
7. Costin, L. C., 1991: Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production**,** in *Advances in Archaeological Methods and Theory*Vol. 3 (ed.) M. B. Schiffer, pp. 1-56. University of Arizona Press: Tucson.
8. Kenoyer, J. M., M. Vidale and K. K. Bhan 1991: Contemporary Stone Bead making in Khambhat India: patterns of craft specialization and organization of production as reflected in archaeological record. *World Archaeology* 23(1): 44-63.
9. Kenoyer, J. M. M. Vidale and K. K. Bhan 1994: Carnelian Bead Production in Khambhat India: An Ethnoarchaeological Study, in *Living Tradition: Studies in Ethnoarchaeology of South Asia,* (ed.) B. Allchin, pp. 281-306. Oxford and IBH, New Delhi.
10. Hodges H., 1971: *Artifacts*. Chapter Sixteen, pp. 175-187. Academic Press: John Baker.
11. Hodges. H., 1971: *Artifacts***.** Chapters seven and seventeen pp. 98-111 and 188-193 Academic Press. John Baker.
12. Inizan M. -L. H. Roche and J, Tixier 1992: *Technology of Knapped Stone***.** Meudon: CREP.
13. Kenoyer, J. M and M. Vidale 1993: A New Look at Stone Drills of the Indus Valley Tradition**,** in *Material and Issues in Art and Archaeology* III (eds. P. Vandiver, J. R. Druzick, G. S. wheeler and I Freestone) pp. 495-518. Pittsburgh: Material Research Society.
14. Kenoyer, J. M., M. Vidale and K. K. Bhan 1991: Contemporary Stone Bead making in Khambhat India: patterns of craft specialization and organization of production as reflected in archaeological record. *World Archaeology* 23(1): 44-63.

15. Kenoyer, J. M. M. Vidale and K. K. Bhan 1994: Carnelian Bead Production in Khambhat India: An Ethnoarchaeological Study, in *Living Tradition: Studies in Ethnoarchaeology of South Asia*, (ed.) B. Allchin, pp. 281-306. Oxford and IBH, New Delhi.
16. Purdy, Barbara 1979: Pyrotechnology: Prehistoric application to Chert Material and in North America**,** in *Early Pyrotechnology: The Evolution of the first fire-using technologies* (ed.) T. A. Wertime and S. F. Wertime, pp. 31-44. Washington D.C.: Smithsonian.
17. Harrison. H. S., 1954: Fire – Making, Fuel and Lighting**,** in *History of Technology.* (eds.) Charles J. Singer, E. J. Holmyardm and A. R. Hall 1(215 - 237). Oxford: Clarendon Press. Detail account of fire in ancient times.
18. Hodges. H., 1971: *Artifacts***.** Chapters one and eighteen. pp. 19-41 and 194-202 Academic Press. John Baker.
19. Shepard, A. D., 1956: *Ceramic for Archeologist*, Washington. This is good book on pottery technology written especially for archaeologists.
20. Kingery W. D., H. K. Bowen and D. R. Uhlmnn 1976**:** Grain Growth, Sintering and Vitirifaction in *Introduction to Ceramics*, pp. 488-511. A Wiley-Interscience Publication.
21. Rice, Prudence M. 1984**:** The Archaeology Study of Specialized Pottery Production: Some aspects of Methods and Theory**,** in *Pots and Potters* (ed.) P. Rice Monograph XXIV, PP. 45-54. Los Angles: Institute of Archaeology, U.C.L.A.
22. Krishnan, K., and K. T. M. Hegde 1987: Chemical and Petrographic Studies in Pottery ofHarappan Culture in Gujarat. *Journal of M. S. University of Baroda* (Humanities) 35-36, 1 (1986-87) 27-56.
23. Krishnan, K 1992: An Analysis of Decorative Pigments on Harappan Pottery of Gujarat, in *South Asian Archaeology*. 8: 125 - 312.
24. Krishnan, K. 1997: Scientific Analysis of Pottery and their Culture Implications, in *Ancient Ceramics: Historical and Scientific Approaches*. (eds.) P. C. Pant and VidulaJayaswal, pp.177-196. Discusses methods used in ceramic studies and summarizes studies carried out in India.
25. Hegde, K. T. M. 1975: Analysis of Ancient Deluxe Wares, in *Archaeophysiko,* 10 (141-55). Bonn.This Paper discusses the manufacture of PGW and NBPW
26. Rice, M. P., 1989: Pottery Analysis: A Source Book. Part 3 (Pottery Manufacture and use, pp. 113-166); (Special Topics in Archaeology, Ethnoarchaeology, and EthnographicPottery Study, pp. 274-306). University of Chicago Press, Chicago.
27. Hodges. H., 1971: *Artifacts***.** Chapters two, three and eighteen. pp. 202 - 204 Academic Press. John Baker.
28. M. Halim and M. Vidale 1983**:** Kilns, Bangles and Coated vessels: Ceramic Production in closed Containers at Mohenjodaro, in *Interm Reports* (eds.) M. Jansen and G. Urban, Vol. 2 pp. 63-97. Aachen: IsMEO/ RWTH.
29. Vidale, M., 1987: More Information on a Protohistroic Ceramic Puzzle, in *Interm Report.* (ed.s) M. Jansen and G. urban, vol. 2, pp. 105-111. Aachen: IsMEO\RWTH.
30. Bhan K. K., M. Vidale and J. M. Kenoyer 1994: Harappan Technology: Theoretical and Methodological Issues, in *Man and Environment* XIX (1-2): 141-157.
31. Mehta Nikita 1997 Preliminary Ethnoarchaeological Studies of Traditional Copper \ Brass Casting in Western India. *M. A. Dissertation* submitted to Department of Archaeology, M. S. University, Baroda. Pp. 79 – 81. (Crucible and Mould making).
32. Kenoyer, J. M., 1994: Faience from the Indus Valley Civilization**,** *Ornament* 17(1-2): 39-54.
33. Hodges. H., 1971: ***Artifacts.*** Chapters four, five, six and nineteen Academic Press. John Baker.

34. Hegde, K. T. M., 1991: *An Introduction to Ancient Indian Metallurgy*. Geological Survey of India: Bangalore Mehta Nikita 1997 Preliminary Ethnoarchaeological Studies of Traditional Copper \ Brass Casting in Western India**.** *M. A. Dissertation* submitted to Department of Archaeology, M. S. University, Baroda.
35. Kenoyer J. M., and H. M.-L Miller 1999**:** Metal Technologies of the Indus Valley Tradition**,** in *TheAncient Metallurgy of the Asian Old World*, University Museum Monograph, no 89 (ed.) V. Pigott. The University Museum of Philadelphia.
36. Miller., Heather M. –L 1994: Metal Processing at Harappa and Mohenjodaro: Information From Non-Metal Remains in *South Asian Archaeology 1993*. (eds.) A. Parpola and K. Koskikallio. Pp. 497- 510. Tiedeakatemia, Helsinki, Finland.
37. Saklani. P.M. 2007. Ethno archaeology of Yamuna Valley, Delhi.

Course-2: History of Ancient Indian Religion

Unit-I: Vedic Religion

1. Pre Vedic & Early Vedic Religion.
2. Later Vedic Developments

Unit-II: Buddhism

1. Life and Teachings of Gautama Buddha and origins and development of Buddhism.
2. Buddhist Councils
3. Mahayana Buddhism**:** Evolution and composition of Mahayana; and Decline of Buddhism

Unit-III: Jainism

1. Life and teachings of Parsvanatha and Mahavira.
2. Jain Doctrines and Jain church after Mahavira

Unit -IV: Vaishnavism and Shaivism

1. Vaishnavism: Evolution of Vaisnava sects; their general history and characteristic doctrines; Bhagvat Geeta
2. Shaivism: Evolution of the cult of Siva and its characteristics.

Unit-V: Minor Religious Systems: Shaakta and Trantric

Recommended Reading:

1. Allchin, B. and Allchin, F.R., Rise of Civilization in India and Pakistan (Delhi, Select Book Service Syndicate, 1983).
2. ---------- Origins of a Civilization (Delhi, Viking, 1997).
3. Basham, A.L, The Wonder That Was India. (Mumbai, Rupa, 1971).
5. Chakrabarti, D.K. India: An Archaeological History, Paleolithic Beginnings to Early Historical Foundation (Delhi, OUP, 1999). Now available in paperback.
6. Chattopadhyaya, D.P., Indian Philosophy (New Delhi, Popular Publishing House, 1986).
7. Comprehensive History of India, Vols II (1957), III (Orient longman,1952), IV (Delhi, PPH, 1992).
10. Hiriyanna, M., Essentials of Indian Philosophy (Delhi, Motilal Banarsidass, 1995).
11. Jha, D.N. and Shrimali K.M., Prachin Bharat Ka Ithihas (Delhi, Hindi Directorate, 1990).
13. Kulke, H, and D. Rothermund, History of India (london, Routledge,1998).
14. Majumdar, R.C. et al., History and Culture of the Indian People, Vols 11, III, IV and V (Mumbai, Bhartiya Vidya Bhavan Series, 1970, 1979, 1980).
15. Munshi, V.K.M. and R.R. Diwakar, Bharatiya Vidya Bhavan Series -Indian Inheritance, 3 vols (Bombay, Bhartiya Vidya Bhavan, 1965, 1970).
16. Nilkanta Sastri, K.A., A History of South India from pre-historic times to the fall of Vijaynagar (Chennai, OUP, 1983).

20. Thapar, Romila, A History of India, Vol. 1 (Pelican, 1966, Penguin, Harmondsworth).
21. Pathak, V. S. Smarta Religious Tradition. Meerut. 1987.
22. Tripathi, G. C. Vedic Devmandal. (Hindi) Allahabad. 1992.
23. Zaehner, R.C. Hinduism. Oxford. 1962.
24. Thapar, Romila, Cultural Past, oxford press, 2005

Courses-XVIII (Group-C): The candidates are required to opt any one of the following courses:

Course-1: Geoarchaeology

Unit-I: Application of Geoarchaeology

1. Definition, Concept and scope of Geoarchaeology.
2. Geological time scale, origin of life during different periods and their evolutionary relationships
3. Quaternary geology and its relation with archaeology with special reference to India

Unit-II: Palaeoclimatic Studies

1. Palaeoclimatic changes, depositional behavior and landform formations.
2. Causes and evidence of climatic changes.
3. Methods of recording climatic changes.
4. Holocene cultural changes and its impact on development of agriculture and domestication.

Unit-III: Archaeometallurgy

1. Development of Archaeometallurgy in Indian Archaeology

Unit-IV: Quaternary Studies in India

1. Quaternary studies with special reference to Kashmir valley, Belan Valley, Soan Valley, Narwada Valley, and Didwana

Recommended Reading

1. Paul Goldberg, Richard I. Macphail: Practical and Theoretical Geoarchaeology, Wiley-Blackwell, 2006.
2. George (Rip) Rapp Jr. and Mr. Christopher L. Hill: Geoarchaeology: The Earth-Science Approach to Archaeological Interpretation, Second Edition, Yale University Press, 2006.
3. Carlos E Cordova : Millennial Landscape Change in Jordan: Geoarchaeology and Cultural Ecology, University of Arizona Press.
4. Geoarchaeology: The Earth-Science Approach to Archaeological Interpretation, Yale University Press, 1998.
5. Geoarchaeology of Landscapes in the Glaciated Northeast, New York State Museum, 2003.
6. Andrew S. Goudie, Ian Livingstone and Stephen Stokes: Aeolian Environments, Sediments and Landforms, Hardcover, 2000.
7. C. R. Thorne (Editor), Richard D. Hey (Editor), Malcolm D. Newson: Applied Fluvial Geomorphology for River Engineering and Management, 1998.
8. David S. G. Thomas: Arid Zone Geomorphology: Process, Form and Change in Drylands, 2nd Edition, 1998.
9. Richard Davis, Jr., Duncan Fitzgerald: Beaches and Coasts, Hardcover, Wiley-Blackwell, 2009.
10. David Gillieson: Caves: Processes, Development and Management, Wiley-Blackwell, 1996.
7. Andrew S. Goudie: The Changing Earth: Rates of Geomorphological Processes, Hardcover, Wiley-Blackwell, 1995.

8. Karl F. Nordstrom, Norbert Psuty and Bill Carter: Coastal Dunes: Form and Process, 1991.
9. Eric Bird: Coastal Geomorphology: An Introduction, 2nd Edition, 2008.
10. Olav Slaymaker and Richard Kelly: The Cryosphere and Global Environmental Change, 2007, Wiley-Blackwell.
11. Julie Laity: Deserts and Desert Environments, 2008, Wiley-Blackwell.
12. L. J. Bull and M. J. Kirkby: Dryland Rivers: Hydrology and Geomorphology of Semi-arid Channels, 2002.
13. Kevin Heffernan and John O'Brien: Earth Materials, 2010, Wiley-Blackwell.
14. Philip A. Allen: Earth Surface Processes, 1997, Wiley-Blackwell.
15. Bryn Hubbard and Neil F. Glasser: Field Techniques in Glaciology and Glacial Geomorphology, 2005.
16. Victor R. Baker, R. Craig Kochel and Peter C. Patton: Flood Geomorphology, Victor R. Baker, R. Craig Kochel, Peter C. Patton, 1988.

Course-2: Source of Ancient Indian History

Unit-I: Vedic and Dharmshastra Literature

1.Nature & classification

2.Historical value of Veda Vedanga and Dharmashastra

Unit-II: Other Ancient Indian Literature

1.Historical value of the Buddhist, Jain, Sanskrit and Tamil literature

2.Historical drama and Biographical literature, and accounts of foreign travelers

Unit-III: Archaeological Remains

1.Methods of obtaining information: explorations and excavations and importance of excavated remains for historical reconstruction

Unit-IV: Epigraphs and Coins

1.Epigraphy: meaning, scope and dating the historical events. Significance of palaeography and limitations of the sources

2.Classification and types of coins and historical reconstruction

Unit-V: Sculptures & Paintings

1.Media based classification: stone, metal, clay sculpture, paintings and their historical relevance.

Unit-VI: Monuments

1.Types of monuments and architectural remains

2.Methods of study and their historical relevance, and limitations of the sources

Recommended Reading

1. Allchin B & F.R. Rise of civilization in India & Pakistan, Delhi. 1983.
2. Agrawala, V.S. Bharatiya Kala (Hindi). Varanasi. 1965.
3. Banerjea, J.N. The Development of Hindu Iconography. New Delhi. 1985.
4. Bhandarkar, D.R. Carmichael Lectures on Ancient Indian Numismatics. Calcutta. 1917.
5. Brown, P. Indian Architecture. Vol. I. Bombay. 1985.
6. The Cultural Heritage of India, Vols. I&II (Relevant portions). Calcutta. 1982.
7. Majumdar, R.C. & Pusalkar, A.D. (ed.). The History and Culture of the Indian People (Bharatiya Vidya Bhawan Series). Vols. I-V (Portions on Art and Architecture). Bombay. 1988, 1980, 1988, 1984 & 1989.
8. Pandey, R.B. Indian Palaeography. Varanasi. 1965.
9. Wheeler, M. Archaeology from Earth. (Hindi) Prithvi se Puratattva.
10. Ghoshal, U.N. Studies in Indian History and Culture. Bombay. 1965.

11. Majumdar, R.C. & Pusalkar, A.D. (ed.). The History and Culture of the Indian People (Bharatiya Vidya Bhawan Series). Vols. I (Portions on Language and Literature). Bombay. 1988.
12. Pargiter, F.E. Ancient Indian Historical Traditions. Delhi. 1972.
13. Pargiter, F.E. The Purana Text of the Dynasties of the Kali Age. Oxford. 1913.
14. Rapson, E.J. The Cambridge History of India. Vol. I Cambridge. 1922.
15. Winternitz, M. : History of Indian Literature. (Also in Hindi) Vols. I & II. Delhi. 1987.

Fourth Semester

Core/Compulsory Courses

Course-XIX Indian Iconography

Unit-I: Sources 0f iconographic studies and antiquity of image worship

Unit-II: Form of Vishnu Image – Incarnatory forms , Vaikunthchatumurti, Anantashayai

Unit-III: Siva-An iconic form and mukhlinga, Anugrha murti(Ravananugraha, Arjunanugrah, Chandeshnugrah), Saumyamurti (Uma-Maheshwar, Kalyansundar), Samharmurti(Tripurantaka, yamantaka , Kamantak, Andhakari), Natraj

Unit-IV: Surya images and Navagrahas, Shakti (matrikas, Mahismardini), Brahma, Ganesh , Kartikeya. Syncretic images- Harihara and Ardhnarishwara

Unit-V: Origin of Buddhas Image – Buddhas and Bodhisattvas(Manjushri, Avlokiteshwar)

Unit-VI: Evolution and features of Tirthankara images (Rishabnath, Parshwanath and Mahavir)

Suggested Readings:

1. Avasthi, R.-Khajuraho Ki Dev Pratimayen
2. Joshi, N. P.-Kushan Kalin Vishnu Pratimayen
3. Banerjee, J. N.-The Development of Hindu Iconography
4. Rao, T. A. G.-Elements of Hindu Iconography (2 Vols.).
5. Gupta, R. S.-Indian Iconography
6. Bhattacharya, B. C.-Indian Buddhist Iconography
7. Bhattacharya, B. C.-Jain Iconography
8. Sivaramamurti, C. -Art of India.
9. --do-- - "Geographical and Chronological Factors in Indian Iconography", Ancient India No. 6 pp.21-63.
10. Mishra, J.-Bhartiya Pratima Vidya (Hindi)
11. Mishra, Indumati-Pratima Vigyan (Hindi)
12. Singh, S. B.-Brahmanical Icons of Northern India
13. Rao , Ramchandra, S.K. Encylopedia of Indian Iconography ; Hindu, Buddhist and Jain (3vols).
14. Stultey, Margret The illustrated dictionary of Hindu iconography,
15. Bhattacharya ,A.K. Indian and East Asian Art and Iconography
16. Sthapati , V, Sampati Indian Sculpture and Iconography: Forms and measurements

Course-XX Early Indian coinage

Unit – I: Coinage of Foreign Rulers; Greek, Bacterian-Greek and Indo-Greek Coins

Unit – II: Kushana coins

Unit – III: Early coins of South and Western India: Satvahanas and western Kshatrappas

Unit – IV: Gupta Coins; Chandragupt I, Samudragupta, Ramgupta, Chandragupta II,

Kumargupta I, Skandagupta

Recommended Readings

1. Bopearachchi, O. Indo-Greek, Indo-Scythian and Indo-Parthian Coins in the Smithsonian Institution, Delhi.
2. Dani, A. H. Bactrians and Indo Greeks- A Romantic Story from their coins. Lahore.
3. Elliot, Coins of Southern India.
4. Gupta, P. L. The Roman Coins from Andhra Pradesh Govt. Museum. Hyderabad. 1965.
5. Gupta, P.L. Bharat Ke Purva Kalik Sikke, Varanasi, 1996.
6. IMC, I, Smith
7. Kosambi, D. D. Indian Numismatics, Delhi. Orient Longman. 1981.
8. Lahiri, A. N. Indo-Greek Coins (Section on Metrology only). Calcutta. 1995
9. Lahiri, A. N. The Corpus of Indo-Greek Coins. Calcutta. 1956.
10. Narain, A. K. Greek-Bharteeya athava yavana. Varanasi. 1996.
11. Narain, A. K. Indo-Greeks. Oxford. 1957.
12. PMC, Whitehead
13. Rapson, E. J. A Catalogue of The Indian Coins in The British Museum - Coins of the Andhra Western Kshatrapas Dynasty. London 1968.
14. Sharma, I. K. Coinage of the Satavahana Empire. Delhi. 1980.
15. Shastri, A. M. (ed.) Coinage of the Satavahanas and coins from Excavation, Nagpur. 1972.

Course-XXI Ancient Indian Architecture

Unit-I: Stupa Architecture

1. Origin and Development of stupa architecture: Bharhut, Sanchi and Amravati

Unit-II: Rock-Cut Architecture

1. Origin and Development of Rock cut architecture.
2. Chaityas and Viharas with special reference to Bhaja, Karle and Ajanta.

Unit-III: Temple Architecture

1. Evolution of the Temples
2. Gupta Temples: Dasavatar Temple, Deogarh and Bhitargaon Temple
3. Orissan Temples
4. Central Indian Style: Khajuraho
5. Pallava Architecture: Rock-Cut and Structural Temples
6. Chola Temples and Temples of Uttarakhand

Recommended Readings

1. Brown, Percy- Indian Architecture (Buddhist and Hindu Period)
2. Ferguson, J.-History of Indian and Eastern Architecture, (2 Vols)
3. Kramrisch, Stella -The Hindu Temple
4. Chandra, Pramod -Studies in Indian Temples
5. Sundaram, K.-Monumental Art and Architecture of India
6. Krishna, Deva-Temple of North India
7. Srinivas, K. R.- Temple of South India
8. Saundarajan K. V.-Indian Temple Styles
9. Jauhari, M.-South India and its Architecture
10. Shukla, L. K.-Study of Hindu Art & Architecture
11. Mitra, Debla-Buddhist Monuments
12. Rowland, B.-The Art and Architecture of India
13. Bajpai, K. D.-Bhartiya Vastu-Kala Ka Itihas
14. Agarwal, P. K.-Gupta Temple Architecture

15. Gupta, R. S.-The Art and Architecture of Aihole.
16. Ganguly, O. C.- Indian Architecture
17. Nautiyal, K. P.- The Archaeology of Kumaon
18. Gupta, S. P.-The Roots of Indian Art.
19. Deva, Krishna- Khajuraho
20. Longhurst-Pallava Architecture
21. Khanduri, B. M. - Archaeology of Alaknanda Valley
22. Dahejia-Early Buddhist Rock Temples
23. Meister, Michaeol-Encyclopedia of Temple Architecture
24. Barret, D.-Guide to the Karle Caves
25. Cunningham, A.- Stupa of Bharhut
26. Chandra, P.- Guide to the Elephanta Caves
27. Fergusson, J. & - Cave Temples of India
28. Misra, R. N.-Bharahut
29. Mitra, Debla-Ajanta
30. --do- - Bhuvaneswar
31. Mitra Debla-Konark
32. --do- - Sanchi
33. Sarkar, H.-Studies in Early Buddhist Architecture
34. --do- - Amravati
35. Sivaramamurti, C.-Mahabalipuram
36. Gupta, R. S.-Ajanta, Ellora and Aurangabad Cave
37. Ghosh, A.-Jaina Art and Architecture (3 Vols.)
38. Kail, O. C.-Buddhist Cave Temples of India
39. Srinivasan, K. P.-Cave temples of the Pallavas

Elective/Optional Courses

The candidates are required to select any three courses/papers from the following groups of courses:

Course-XXII (Group-A): The candidates are required to opt any one course of the following courses:

Course-1 Conservation and Preservation of archaeological artifacts

Unit-I: History of archaeological Conservation/Preservation

1. Definition and Concept of Archaeological Preservation and Conservation.
2. Agents of Deterioration/Decay and Preservation. General Techniques of Preservation and Conservation (Retrieval of Artifacts and Associated information from deposit, marking and Leveling Artifacts, Examination and Cleaning, recording etc.).

Unit-II: Outdoor Conservation

1. Preservation, Restoration and Reconstruction of Monuments: Structural Monuments, Rock-cut Monuments and Monolithic caves.
2. Aquatic Architecture (Wells, Tanks, Lakes, Baolis etc.) and methodological study of Salvaging, Transplantation and Restoration.
3. Conservation of Archaeological sites.

Unit-III: Indoor Conservation

1. Preservation and Conservation of Siliceous Inorganic objects: Stone Objects and Terracotta objects; Potteries; Glass and Glass made objects**;** Faience, Stucco etc.

2. Preservation and Conservation of Non-Siliceous Inorganic objects: Ferrous Metal: Iron and alloys of Iron; Non-Ferrous Metal: Lead, Tin, Copper, Silver, Gold and their alloys.
3. Cleaning and Preservation of Organic Materials : Birch Bark, Bhurjapatra, Papyrus, Textiles, Palm Leaf, Parchment, Wood and Wooden Objects; Miniature Paintings, Hand and Machine Made Papers. Skin and Gut products, Hair, Horns, Feathers, Furs, Ivory, Tortoise shell and Shells of Sea animals, leather and minerals of organic origin like Amber etc. Skeletal Remains and bone artifacts such as Tools, Weapons, Carvings etc.
4. Conservation of Paintings: Murals Painting; Miniature Paintings; Easel Paintings.

Unit-IV: Various types of Display techniques

Recommended Reading

1. Cronyn, J. M.: The Elements of Archaeological Conservation, Routledge, London, 1990.
2. Feilden Bernard: Guideline for Conservation (A Technical Manual), New Delhi, 1989.
3. Ghose, Arun: Conservation and Restoration of Cultural Heritage, Agam Kala, Prakashan, New Delhi, 1989.
4. Singh, A.P.: Conservation and Museum Techniques, Agam Kala, Prakashan, New Delhi, 1987.
5. Batra, N.L.: Heritage Conservation, Preservation and Restoration od Monuments, Aryan Books International, New Delhi, 1996.
6. Bhaumik, Swarn Kamal: Prachin Kalakritiyon Kee Suraksha avam Sambhal (Hindi Translated by P.K. Trivedi and Y.s. Rawat), department of Museum, Gujrat State, vadodara, 1988.
7. Limbrey, S.: Soil Science in archaeology, Academic Press, London, 1975.
8. Bhismpal, H.: Sanskritik Dharohar Ka Sanrakshan, Hindi Acadami, Delhi, 1994.
9. Brown, C.H.: Structural Materials in Animals, Pitman, London, 1971.
10. Crafts Council: An Introduction to Materials, Science for Conservation, Book-1, London, 1982.
11. Crafts Council: Cleaning, Science for Conservation, Book-1, London, 1983a.
12. Crafts Council: Adhesives and Coatings, Science for Conservation, Book-1, London, 1983b.
13. Plenderleith, H.J.: Conservation of Antiquities and Works of arts, London, 1957.
14. UNESCO: Conservation of Cultural Property, Switzerland, 1968.
15. Marshall, John: conservation Manual, London, 1923.
16. Gairola, T. R.: A Hand Book of Chemical Conservation, Baroda, 1960.
17. Agrawal, O.P.: Conservation of Cultural property in India, Delhi, 1973-74,

Corse-2 Historical Geography of Ancient India

Unit-I: 1. The Country, its mountains and rivers

2. Janapadas, peoples, land and sea-routes.

Unit-II: Literary Geographical data

1. Mahabharata, Ramayana and Panini's Ashtadhyayi
2. The Mahabhashya, Pali literature, Jain Agama literature, Arthashastra and the Puranic Bhuvanakosha.

Unit-III: Historical Geography of Uttarakhand Himalaya

1. Ancient and medieval sources of geography of Uttarakhand Himalaya.

Recommended Reading

1. Cunningham: Geography of Ancient India.

2. Sircar, D.C.: Studies in Ancient and Medieval Geography of India.
3. Motichandra: Geographical and Economic Data in the Upayana Parva.
4. Pargiter, F.F : Geography of Rama's Exile.
5. Agrawala, V.S.: Geographical data in the Ashtadhyayi, (Chapter from India as Known to Panini.).
6. Vidyalankara, J.C. : Bharat Bhumi aur uske Nivasi.
7. Law, B.C.: Historical Geography of Ancient India.
8. Law, B.C.: Some Kashatriya Tribes of Ancient India.
9. Law B.C.: Ancient Mid-Indian Kshatriya Tribes.
10. Jain, J.C.: India as described in the Early Jain Canonical Literature (Geographical chapters

Course-XXIII (Group-B): The candidates are required to opt any one of the following courses:

Corse-1 Application of GIS, Remote Sensing and Computer in Archaeology

Unit-I: 1. Principles of remote sensing in Archaeology and historical development in the Remote sensing technology.

2. Principle of GIS and application of GIS in Archaeology

Unit-II: Computers and Archaeology

1. Application and scope of computer in Archaeological study.

Unit-III: Development and Role of Computer aided Techniques in exploration

1. Techniques used in Archaeological exploration i.e. Total Station, GPS, Magnetometer and Electrical Resistivity techniques.

Unit-IV: Various types of computerized techniques used in the laboratory

1. Use of 3D Graphics in Archaeological studies, Laser Scanner and 3d recording of Archaeological artifacts and sculptures
2. Utility of Auto-CAD in Archaeological Pottery drawings
3. Resources of Archaeology on Internet and Google Earth
4. Development of software in archaeology

Recommended Readings

1. Using Computers in Archaeology: Towards Virtual Pasts, Gary Lock.
2. Contemporary themes in archaeological computing, David Wheatley, Graeme Earl, Sarah Poppy, 2002.
3. Computer applications and quantitative methods in archaeology 1993, John Wilcock, Kris Lockyear, Alexandra Bayliss, 1995.
4. Oxbow Books (Oxbow Monograph 27), Oxford. English Heritage, 1992.
5. Managing the urban archaeological resource, London. Handy, C. 1985.
6. U.K. Chapter of Computer Applications and Quantitative Methods in, Caitlin E. Buck, 2000.
7. The reconstruction of archaeological landscapes through digital, Maurizio Forte, Patrick Ryan Williams – 2003.
8. Contemporary themes in archaeological computing, Archaeology Monograph no.3, Oxford, Oxbow.
9. On the Theory and Practice of Archaeological Computing, Oxford, Oxbow Books.
10. Digital archaeology: bridging method and theory.
11. Thomas Laurence Evans, Patrick T. Daly, 2006.
12. Computer archaeology .Gary Lock, John Wilcock, 1987.
13. Contemporary themes in Archaeological Computing, Oxbow Books, Oxford. Fisher, PF (1991).
14. Journal of field archaeology, Association for Field Archaeology, Boston, 2003
15. Archaeology and the information age: a global perspective - Paul Reilly, S. P. Q. Rahtz – 1992.
16. Beyond the Map: Archaeology and Spatial Technologies, Lock, G. (ed), 2000.
17. Geographic Information Analysis, O'Sullivan, D. and D.J. Unwin, 2003.
18. GIS and Archaeological Site Location Modeling, Mehrer, M., 2005.
19. Historical GIS: Technologies, Methodologies and Scholarship.Gregory, I. and P.S. Ell, 2007.
20. Interpreting Space: GIS and Archaeology, Allen, K.M., et al. (eds.), 1990.
21. Landscape Archaeology and GIS, Chapman, H., 2006.
22. Practical Applications of GIS for Archaeologists: A Predictive Modeling Toolkit, Wescott, K.L. and R.J. Brandon (eds.), 2000.
23. Spatial Technology and Archaeology, Wheatley, D. and M. Gillings. 2002.
24. Virtual Reality in Archaeology, 2000, Juan A. Barceló, Maurizio Forte and Donald H. Sanders Archeo Press, Oxford.
25. FORTE, M (ed), 1997 Virtual Archaeology: Great Discoveries Brought to Life Through Virtual Reality, Thames and Hudson, London.
26. REILLY, P., 1990, 'Towards a virtual archaeology." *Computer Applications in Archaeology* 1990.
27. REILLY, P., 1992, 'Three-Dimensional modelling and primary archaeological data." In Archaeology and the Information Age.
28. WOOLEY, B., 1992, *Virtual Worlds*. Oxford: Blackwell.

Course-2 Post-Gupta Coinage of India

Unit-I: Maukharies and Vardhan Coins

1.Gupta Imitations 2. Coins of Maukharies 3. Coins of Vardhan dynasty.

Unit-II: Post-Gupta Coins of Kashmir and North West India

1. Coins of Kashmir..
2. Indo-Sassanian & Yaudhey Coins.

Unit-III: Coins of Central India

1. Coins of Kalachuries of Tripuri
2. Coins of Kalachuries of Ratanpur
3. Coins of Chandellas
4. Coins of Gahadavals

5. Coins of Paramaras. 5. Coins of Chalukyas

Recommended Reading

1. A. Cunningham, Coins of Medieval India
2. A.V. Narasmiha Murthy
3. Biddulph, C.H.
4. Burn, R. : Some coins of the Maukharis and of the Thanesvar line, JRAS, 1906.
5. D.J. Paruck, Sassanian Coins.
6. Devahuti, D. : The Coins of Harsha Siladitya, A Reappraisal, JNSI, XXVI.
7. Gopal, L. : Weight standards of the coins of Early Medieval India, JNSI., XXV, II, pp. 145-53.
8. Gopal, L. Early Medieval Coin Types of North India.
9. J.P. Singh, Monetary Development in Early Assam, 1989.
10. John Deyell, Living without silver
11. N.G. Rhodes & S.K. Bose, The Coinage of Assam, Vol. I, Calcutta, 2003.
12. Roy, P.C. The Coinage of Northern India.
13. Singh O.N. : Gupta kalin Uttar Bhartiya Mudrayne. Varanasi. 1977.
14. Smith, IMC T. Desikachari, Thakur, U. : The Huna Coinage, JNSI, XXIX, Part I A.Vidya Prakash

Course XXIV (Group-C): The candidates are required to opt any one of the following courses

Course-1 Protohistoric and Early historical sites and their significance

Unit-I: Harappan Sites: Dholavira, Surkotda, Lothal, Kalibangan and Rakhigarhi

Uni-II: Chalcolithic sites: Kayatha, Daimabad, Inamgaon

Unit-III: Early historical sites: Hastinapur, Brahmgiri, Arikamedu

Recommended Reading

1. Agrawal, D. P. & Chakrabarti, D. K. (eds.) Essays in Indian Protohistory. Delhi. 1979.
2. Agrawal, D. P. Archaeology of India.New Delhi, 1982.
3. Agrawal, D.P.& J.S. Kharakwal. Bronze Age and Iron Age in South Asia. New Delhi, 2003.
4. Allchin, B. & Allchin F. R. : The Rise of Civilaisation in India and Pakistan. London. 1982.
5. Allchin, F.R. The Archaeology of Early Historic South Asia : Emergence of City and States. Cambridge. 1995.
6. Chakrabarty, D. K. The Early use of Iron in India, Oxford University Press. 1992.
7. Dhavalikar, M. K. , H. D. Sankalia and Z. D. Ansari, Excavations at Inamgaon, Pune. 1988.
8. Dhavalikar, M.K. Indian Proto-history. New Delhi. 1997.
9. Gaur, R. C. : (ed.) : Painted Grey Ware, Jaipur. 1994.
10. Gaur, R.C. Excavations at Atranjikhera. Delhi. 1983.
11. Ghosh, A. (ed). An Encyclopedia of Indian Archaeology. Gaur, R. C. : (ed.) : Painted Grey Ware, Publication Scheme, Jaipur, 1994.Vols. I & 2. ICHR. New Delhi. 1989.
12. Ghosh, A. The City in Early Historical India. Shimla. 1973.
13. Possehl, Gregory (ed.) Harappan Civilization. Delhi. 1982.
14. Rao, S. R. : Lothal: A Harappan Port Town-1955-62, A. S. I., New Delhi. 1985.
15. Sali, S. R. : Daimabad, 1976-79, A.S.I., New Delhi, 1986.
16. Sankalia, H.D., et.al. Chalcolithic Navdatoli, Pune, 1971.
17. Sinha, B.P. & S.R. Roy. Vaisali Excavations 1958-62. Patna 1969.
18. Sinha, K.K. Excavations at Sravasti 1959. Varanasi.
19. Tripathi, Vibha. The Age of Iron in South Asia : Legacy and Tradition. Delhi. 2001.
20. Tripathi, Vibha. The Painted Grey Ware and Iron Age Culture of Northern India. Delhi. 1976.

Course-2 World Prehistory

Unit-I: Lower Palaeolithic Cultures in Africa, Europe and South East Asia.

Unit-II: The Middle and Upper Palaeolithic cultures of Europe; development of Post Acheulian Culture, Stratigraphy and chronology

Unit-III: Mesolithic culture of Europe and Africa.

Unit-IV: Development of Neolithic culture and the beginning of domestication of plants and animals: a global perspective.

Recommended Readings

1. Bordes, Fancois 1968. *The Old Stone Age.*
2. Braidwood. R. J. (ed) 1968. *Courses towards Urban Life*
3. Butzer, K. W and G.L. Isaac 1975. *After the Australopithecene*, The Hague
4. Clark, J. G. D 1977. *World Prehistoryin: New Perspective*, Cambridge
5. Clark, J. G. D 1935. *The Mesolithic Settlement of Northern Europe*, Cambridge
6. Daniel, G. J. *Hundred years of Archaeology*
7. Isaac, G. L 1971. The Diet of Early Man. *World Archaeology* 2:278 -229
8. Klein, R. G 1999. *The Human Career, Human Biological and Cultural Origins*,The University of Chicago press Chicago.
9. Lee, R. B. and DeVore, I (Ed) 1968 : *Man the Hunter* Chicago: Aldine.
10. Leori-Gourhan, A. 1982. *The Dawan Of European Art: An Introduction to Palaeolithic Cave Painting*, Cambridge , Cambridge University Press.
11. Paddayya, K. 1990. *New Archaeology and Aftermath*. Ravish publishers, Pune
12. Paddayya, K. 1994. C. J. Thomsen and the Three Age System, *Man and Environment* XVIII (2): 129-140.
13. Petrecia Philip. *Prehistoric Europ.*
14. Philipson , D.W. 1988. African Archaeology Cambridge University Press, Camridge.
15. Prucel, R. W. 1991. Processual and Post-Processual Archaeologies Multiple Ways of Knowing the Past CAI, Southern Illinois University at Carbondale, Occasional Paper No.10
16. Roe, Derek The Palaeolithic. In Peter Hammond (Ed.) Physical Anthropology and *Archaeology.*
17. Trigger, B.G 1989. *History of Archaeological Thought.*
18. Wenke, R. J 1987. *tterns in Prehistor.*
19. West,F.H. (Ed.) 1996 American Beginnings: The Prehistory and Palaeo-ecology of Beringia Chicago, University of Chicago Press.
20. Hoffecker, J.F et al. 1993The colonization of Beringia and the Peopling of the New World. Science 259: 46-53
21. White, P. J and Connell, J.F . 1982. A Prehistory of Australia, New Guinea and Saul. ew York, Academic Press
22. Flannery, K.V. 1973: The Origins of agriculture. *Annual Review of Anthropology* 2: 217-310
23. Reed, Charles.A (ed.) 1977 *Origin of Agriculture.* The Hauge Mouton Publishers
24. Ucko, P. J and G.W. Dimbleby 1969: *The Domestication and Exploitation of Plants and Animals.* Chicago
25. Aldine Wendorf, Fred and R. Schild 1981: the Earliest Food Producers. *Archaeology* 34 (5):30-36
26. Wright. G. A. 1972: "Origins of Food Production in Southwestern Asia: A summary of Ideas" *Current Anthropology* 12 (4&5):447-77.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – BIOTECHNOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Department of Biotechnology

M. Sc. Biotechnology

Course Contents

&

Syllabus

Hemvati Nandan Bahuguna Garhwal University

(A Central University)

Srinagar, Garhwal, 246 174, Uttarakhand

M. Sc. Biotechnology

(Effective from July 2020)

Code	Course Contents	L T P C	M.M
Semester I (July to November)			
S0LS/MBT/C0001	Biochemistry	3 0 0 3	100
S0LS/MBT/C0002	Cell Biology & Membrane Biophysics	3 0 0 3	100
S0LS/MBT/C0003	Molecular Biology & Genetics	3 0 0 3	100
S0LS/MBT/C0004	Bio-Analytical Techniques	3 0 0 3	100
S0LS/MBT/C0005	Lab Course based on course C0001 & C0002	0 0 3 3	100
S0LS/MBT/C0006	Lab Course based on course C0003 & C0004	0 0 3 3	100
	Core Credits= 18		**600**
Semester II (December to April)			
S0LS/MBT/C0007	Immunology	3 0 0 3	100
S0LS/MBT/C0008	Microbiology & Microbial Genetics	3 0 0 3	100
S0LS/MBT/C0009	Genetic Engineering & Applications	3 0 0 3	100
S0LS/MBT/C0010	Biostatistics & Bioinformatics	3 0 0 3	100
S0LS/MBT/C0011	Lab Course based on course C0007 & C0008	0 0 3 3	100
S0LS/MBT/C0012	Lab Course based on course C0009 & C0010	0 0 3 3	100
S0LS/MBT/SS001	Epigenetics & Cancer Biology	0 0 0 3	100
S0LS/MBT/SS002	Biomedical Technology		
	Core Credits = 18		**600**
Semester III (July to November)			
S0LS/MBT/C0013	Plant Biotechnology	3 0 0 3	100
S0LS/MBT/C0014	Intellectual Property Rights, Bioethics, Bio-Entrepreneurship	3 0 0 3	100
S0LS/MBT/C0015	Lab Course based on course C0013 & C0014	0 0 3 3	100
S0LS/MBT/E0001a	Protein engineering	3 0 0 3	100
S0LS/MBT/E0001b	Immunotechnology		
S0LS/MBT/E0001c	Nanobiotechnology		
S0LS/MBT/E0002a	Food & Beverages Biotechnology	3 0 0 3	100
S0LS/MBT/E0002b	Animal Biotechnology		
S0LS/MBT/E0002c	Enzymology & Enzyme Technology		
S0LS/MBT/E0003	Lab Course based on course E0001 & E0002	0 0 3 3	100
S0LS/MBT/SS003	Research Methodology: Tools & Techniques	0 0 0 3	100
S0LS/MBT/SS004	Science Communication & Scientific Writing		
	Core Credits 09 + Elective Credits 09; Total Credits = 18		**600**
Semester IV (December to April)			
S0LS/MBT/C0016	Environmental Biotechnology	3 0 0 3	100
S0LS/MBT/C0017	Fermentation & Bioprocess Technology	3 0 0 3	100
S0LS/MBT/C0018	Lab Course based on course C0016 & C0017	0 0 3 3	100
S0LS/MBT/E0004a	Advanced Bioinformatics	3 0 0 3	100
S0LS/MBT/E0004b	Herbal Biotechnology		
S0LS/MBT/E0004c	Genomics & Proteomics		
S0LS/MBT/E0005	Dissertation	0 0 0 6	100
S0LS/MBT/SS005	Vaccines & Drug Development	0 0 0 3	100
S0LS/MBT/SS006	Molecular Virology		
	Core Credits 09 + Elective Credits 09; Total Credits = 18		**500**
	Grand Total Credits: Core - 54 + Elective - 18 = 72		**2300**

Max. Marks (MM) for each paper: 100 (Two Sessional Tests of 20 each + 60 End Term Test)

Sessional Tests:- (Mid Term Test, Assignment, Tutorials, Classroom Seminar & Lab Work, Journal Club; winter / summer training / Internship; Academic tours / visits to Industries / Institutes / Universities; training based report writing & presentation**)**

All 2-year Master's Programs will have the following components, *viz.*

(i) Core Course **(C)**: Minimum 54 Credits
(ii) Electives **(E)**: Minimum 18 Credits
(iii) Self study **(SS)**: Maximum 09 credits (one minimum 03Creditscourse shall be mandatory but not to be included while calculating the grades)

Paper - I: Biochemistry

(Course Code: S0LS/MBT/C0001)

No. of Credits = 3

UNIT - I

Enzymes: Classification (rationale, overview and specific examples) 0.5
Zymogens and their activation (Protease and Prothrombin)
Enzyme substrate complex: Concept of E-S complex, binding sites, active site, specificity, Lock and Key Hypothesis, Induced-Fit Hypothesis, Michaelis-Menten equation and its derivation, Different plots for the determination of Km and Vmax, Enzyme Inhibition

UNIT - II

Carbohydrate – Classification, structure and functions 0.75
Carbohydrate Metabolism I: Pathway and regulation of Glycolysis, Gluconeogenesis, Glycogenolysis, Glycogenesis
Carbohydrate Metabolism II: Citric acid cycle and its regulation, Electron transport Chain and Oxidative phosphorylation, Pentose phosphate pathway and its regulation.

UNIT - III

Amino acids – structure and functional group properties, peptides and 0.75
covalent structure of proteins, primary and higher order structures, Ramachandran plot.
Protein – Classification, structure and functions
Amino Acid Metabolism: overview of amino-acid biosynthesis and degradation
Urea cycle (Linkage between urea cycle and citric acid cycle) and its regulation.
Conversion of nitrogen to ammonia by microorganisms

UNIT - IV

Fatty Acids - Classification and structure. 0.5
Fatty Acid Metabolism: Fatty Acid Oxidation and regulation, β-oxidation, Oxidation of unsaturated fatty acids and odd chain fatty acids, β-oxidation in peroxisomes, Ketone bodies and their overproduction.
Fatty Acid Biosynthesis and Regulation. Reactions of fatty acid synthase, Synthesis of triglycerols, Cholesterol biosynthesis and regulation.

UNIT - V

Nucleic Acid - structure and functions. Nucleic Acid Metabolism: Purine 0.5
biosynthesis and its regulation, Pyrimidine biosynthesis and its regulation.
Formation of deoxyribonucleotides. Salvage pathway for Purine and Pyrimidine nucleotides, Degradation of purines and pyrimidines into uric acid and urea.

Recommended Books: -

1. Lehninger: Principles of Biochemistry, 4th ed., Nelson & Cox, WH Freeman and Company, 2007
2. Voet & Voet: Biochemistry, 2nd ed., Wiley & Sons.
3. Berg, Tymoczko, Stryer: Biochemistry, 5th ed., WH Freeman and Company, 2003.
4. Garett & Grisham: Biochemistry, 4th ed., Brooks/Cole Cengage learning, 2010.
5. Murray, Granner, Rodwell: Harper's Illustrated Biochemistry, 27th ed. McGraw Hill, 2006.
6. Conn & Stumpf: Outlines of Biochemistry, 5th ed., Willey India, 2007.

Paper - II: Cell Biology & Membrane Biophysics

(Course Code: S0LS/MBT/C0002)

No. of Credits = 3

UNIT - I

Plasma membrane: Structure, Organisation, Lipid bilayer, Proteins and Glycoconjugates, Liposomes, lipid protein interactions,membrane rafts, hydrophobiceffect. Elasticity of the membrane. Function- ionic transport, Types of transport (symport, antiport, active & passive), Channel proteins-Introduction. 0.5

UNIT - II

Intracellular compartmentalization:Structure, organization and functions of Nucleus, Mitochondria, Lysosome, Golgi body, Chloroplast, Peroxisome, Endoplasmic reticulum (Rough and smooth). Cell motility and Shape: Structure and functions, Microfilament, Microtubules and Intermediate filament. 0.5

UNIT - III

Protein Sorting: Anterograde & Reterograde mode of protein trafficking, Vesicular traffic in the secretory and Endocytic pathway: Transport from Endoplasmic reticulum through the Golgi network to Lysosome, Endocytosis, Exocytosis, Molecular mechanisms of vesicular transport and maintenance of compartments diversity. Cell signaling : General principles (Types of signaling), Cell surface receptor mediated signaling (ion channel, G protein and enzyme linked). 0.75

UNIT - IV

Cell cycle: Molecular events and regulation. Cell division: General strategy & regulation, Molecular mechanism of mitosis and meiosis. Cancer- Biology: Types of cancer, Onset of cancer, Proto-oncogenes and tumor suppressor genes, Oncogenic mutations affecting cell proliferation, Cell cycle and Genome stability, Programmed cell death, Apoptosis 0.5

UNIT - V

Membrane transport, diffusion, electro-diffusion, types of transportation, thermodynamic model, chemical potential, osmotic pressure, water permeability, structure, selectivity & permeability of channel proteins, Voltage-gated channels, Ligand-gated channels, Na^+, K^+ and Ca^{2+} channels, pumps as channels. Conduction of electrical activity Spread of electrical signals: passive vs. active, the action potential and its propagation through nerves, chloride channels and muscle excitability, Target cell adaptation 0.75

Recommended Books: -

1. Lodish et al.: Molecular Cell Biology (4th ed.)
2. Alberts et al.: Molecular Biology of the cell (3rd ed.)
3. Scott F. Gilbert: Developmental Biology (5th ed.)
4. Zubay, Parson & Vance: Principles of Biochemistry
5. Joshua Zimmerberg, Membrane Biophysics. Current Biology Vol 16 No 8 R272, https://www.cell.com/current-biology/pdf/S0960-9822(06)01347-9.pdf
6. Mohammad Ashrafuzzaman and Jack Tuszynski: Membrane Biophysics, Part of the Biological and Medical Physics, Biomedical Engineering book series (BIOMEDICAL), Springer

Paper - III: Molecular Biology & Genetics

(Course Code: SOLS/MBT/C0003)

No. of Credits = 3

UNIT - I

Chemical and physical properties of nucleic acids 0.5
Structure and types of RNA and DNA, The Watson-Crick model. DNA as genetic material. Different forms of DNA.
Topological properties of DNA. DNA renaturation kinetics.

UNIT - II

Mechanism of DNA replication in prokaryotes and eukaryotes. 0.75
Mechanism of transcription in prokaryotes and eukaryotes. Reverse transcription.
Post transcriptional processing of RNA: (capping, polyadenylation, splicing, RNA editing)
Mechanism of translation in prokaryotes and eukaryotes.

UNIT - III

Concept of genetic code, Gene expression and regulation in prokaryotes (Lac operon and trp operon). Gene expression and regulation in eukaryotes. 0.5
Introduction to various types of DNA damage and repair.

UNIT - IV

Mendelism: Basic principles and applications of inheritance, exceptions to Mendelian law. Chromosomal basis of Mendelism (chromosomal theory of heredity) 0.75
The molecular structure of chromosome in eukaryotes: structure of chromatin and higher order packaging in chromosome. Centromere and Telomere,
Giant chromosome: Polytene and Lampbrush chromosome.
Linkage, recombination and chromosome mapping in eukaryotes. Cytoplasmic inheritance.

UNIT - V

Chromosomal Aberrations: Change in number and structure 0.5
Allelic variation and gene function. Sex chromosome and sex determination.
Dosage compensation of X-linked gene. Sex linked genes in human. Pedigree analysis.

Recommended Books: -

1. Lewin: Genes, Vol. VII Oxford, 1998, Indeed.
2. Snustad et al: Principles of Genetics 1997, John Wiley & Sons,
3. De Robertes & Robertis: Cell & Molecular Biology, 1987, Lee & Fabiger Philadelplna
4. Strickberger: Genetics, 1996, Prentice Hall
5. Friefelder: Molecular Biology (2nd ed.), 1996 Narosa Publ. House,
6. Alberts et al: Molecular biology of the cell (4th ed.) 1994, Garland Publ. New York.
7. Elliott & Elliott: Biochemistry and Molecular Biology, 1996, Oxford

Paper - IV: Bio-Analytical Techniques

(Course Code: S0LS/MBT/C0004)

No. of Credits = 3

UNIT - I

Chromatography - General principles and applications. 0.75
Adsorption chromatography, Partition chromatography, Gas chromatography, Liquid chromatography, Paper chromatography, Thin layer chromatography, Gel filtration chromatography, Ion exchange chromatography, Affinity chromatography, HPLC (High Performance/Pressure Liquid chromatography).

UNIT - II

Electrophoresis - General principle and applications 0.5
Paper electrophoresis, Moving boundary method, Gel electrophoresis (Native, Denaturing & Reducing), Disc gel electrophoresis, Slab gel electrophoresis, Isoelectric focussing (IEF), Isotachophoresis

UNIT - III

Centrifugation: Basic principles, Common centrifuges used in laboratory, Clinical 0.5
High speed & Ultra centrifuges. Sedimentation rate, Sedimentation coefficient, Zonal Centrifugation, Equilibrium density gradient centrifugation. Types of rotors (fixed angle, swinging bucket), Types of centrifugation: Preparative, Differential & Density gradient

UNIT - IV

Basic knowledge of the principles and applications of Microscopy: Light, Phase 0.5
Contrast, Fluorescence and Confocal Microscopy, Scanning and Transmission Electron Microscopy. Biosensors: Introduction & principles, Cell based biosensors, Enzyme immunosensors.

UNIT - V

Spectroscopic methods: Principle and applications of UV-visible, IR, NMR, ESR 0.75
Spectroscopy. Principle & applications of X-ray crystallography. Applications of radioisotopes in biology. Properties and units of radioactivity. Radioactive isotopes and half life. Measurement of radioactivity: GM Counter, Gamma & Liquid scintillation counter.

Recommended Books: -

1. Sharma, V.K.: Techniques in Microscopy and Cell Biology Tata McGraw Hill, 1991.
2. Alberts et al.: Molecular Biology of the cell (2nd ed.), Garland, 1989.
3. Biochemical Technique: Theory & Practical J.F. Robyt& B.J. White. Waveland Press, Inc.
4. Wilson & Walker: Practical Biochemistry (4th ed) University of Hertfordshire Cambridge University Press
5. Jayraman: Laboratory Manual in Biochemistry
6. Arnold L. Demain& Julian E. Davies: Manual of Industrial Microbio. & Biotech. 2nd ed.

Paper - V: Immunology

(Course Code: S0LS/MBT/C0007)

No. of Credits = 3

UNIT - I

Overview of the Immune system; Cells and organs of the immune system 0.5
Antigens, Antigenicity vs. Immunogenicity; Haptens & Epitopes;
Immunoglobulins: Structure and function

UNIT - II

Organization & Expression of Immunoglobulin Genes: Multigene organization of 0.75
Genes, variable- region gene rearrangements, Generation of antibody diversity,
Class switching among constant-region genes, Expression of Ig genes
Major Histocompatibility Complex; Antigen processing and presentation

UNIT - III

Structure and functions of BCR & TCR. Cytokines, Properties, General physiology, 0.75
Interferons, Application of cytokine for therapy. The complement system
Cell mediated cytotoxicity: Mechanism of T cell & NK cell mediated lysis,
Ab-dependent cell mediated cytotoxicity (ADCC)

UNIT - IV

Overview of hypersensitivity, Autoimmunity and there types 0.5
Organ transplantation: Introduction, Types and Challenges, Graft rejection
Vaccines: Active and Passive Immunization

UNIT - V

Overview of Monoclonal Antibodies and Hybridoma Technology, 0.5
Types of Antigen-Antibody Interactions: Precipitation reaction, Agglutination reactions,
RIA, ELISA, Western Blotting, Immuno-precipitation, Immuno-fluorescence

Recommended Books: -

1. Roitt, Male & Brostof : Immunology (3rd ed).
2. Kuby : Immunology (4th ed.)
3. Elgert & Elgert : Immunology
4. Wilson & Walker: Practical Biochemistry (4th ed.)
5. Practical Immunology, 4th Ed., F.C. Hay, O.M.R. Westwood, Blackwell Publishing, 2002
6. Selected Methods for Antibody and Nucleic Acid probes, Vol. 1, S. Hockfield, S. Carlson, C. Evans, P. Levitt, J. Pintar, L. Silberstein, Cold Spring Harbor Laboratory Press, 1993.
7. Antibodies Laboratory Manual, Ed Harlow, David Lane, Cold Spring Harbor, Laboratory Press, 1988.

Paper - VI: Microbiology & Microbial Genetics

(Course Code: SOLS/MBT/C0008)

No. of Credits = 3

UNIT - I

Classification of living organisms and general account of microorganisms: Bacteria, Fungi and Viruses. 0.75
Introduction to bacteriology: Classification; Fine structure of bacteria;
Laboratory identification and staining techniques
Introduction toMycology: Classification, general structure, characteristics of fungi.

UNIT - II

Media for microbial culture, Selective, Differential and Enriched media, Pure culture techniques, Sterilization techniques. 0.5
Introduction to virology: Classification, General structure and reproduction of viruses.
Cultivation of bacteriophages, Plant Viruses, Animal Viruses.

UNIT - III

Microbial growth: Synchronous &Diauxic, Factors affecting microbial growth, Measurement of microbial growth (cell number & cell count). 0.5
Modes of nutrition: Photoautotrophs, Photo-organotrophs, Chemolithotrophs, Chemo-organotrophs.
Microbial metabolism: Overview of energy production and utilization, N_2 fixation.

UNIT - IV

Modes of genetic recombination in bacteria: Conjugation, F-factor, conjugal transfer process, high frequency recombination (Hfr) strains. 0.75
Transformation – competence, DNA uptake by competent cells.
Mechanism of transformation.

UNIT - V

Transduction – General & specialized transduction. 0.5
Genetics of bacteriophages: Lytic and lysogenic cycle, expression of phage genes
In regulation of lytic and lysogenic circuit.

Recommended Books: -

1. Tortora, Funke, Case: Microbiology, (9th ed.) Pearson Education, Inc, 2009.
2. Prescott, Harley & Kliens: Microbiology (7th ed.) McGraw-Hill International Edition, 2008.
3. Michael J. Pelezar, E.C.S. Chan, Noel R. Krieg: Microbiology (5th ed.) Tata McGrall-Hill, 2008.
4. Alcamo's Jeffrey C. Pommerville: Fundamental of Microbiology (8th ed.) Jones & Bartlet Publ. 2007.

Paper - VII: Genetic Engineering & Applications

(Course Code: SOLS/MBT/C0009)

No. of Credits = 3

UNIT - I

Introduction to Recombinant DNA technology and applications. 0.75
Cloning vectors: Plasmids, Phages, Cosmids, Yeast cloning vectors,
Animal and plant viruses as vectors. BAC, PAC & YAC.
Nucleic acid modifying enzymes. Restriction endonucleases.
Isolation of nucleic acid from Plant, animal & bacteria.

UNIT - II

Basic steps of gene cloning: Cloning strategies. 0.75
Synthesis of cDNA. Construction of cDNA and genomic libraries.
Selection of r DNA clones and their expression products, Chromosome walking.
Expression of cloned genes in heterologous host.

UNIT - III

DNA sequencing: Chemical and enzymatic methods. 0.5
PCR: Types and applications. Real Time PCR. Site directed mutagenesis.
Ribonuclease protection assay, Gel retardation assay,
DNA foot printing, DNA finger printing, DNA profiling.

UNIT - IV

Genomic analysis: S-1 mapping, RFLP, RAPD, AFLP. 0.5
Probe labeling and hybridization. Blotting techniques: Southern, Northern and
Western blotting (Methodologies and applications)

UNIT - V

Transgenic Technology: Types, approaches & applications (Plant & Animals), 0.5
Gene therapy: Principles, strategies and ethics of gene therapy.
Genome editing technologies: Principles and applications.

Recommended Books: -

1. Gene cloning T.A Brown:
2. Molecular Biotechnology, Glick & Pasternak: Panima Publ. Corporation, 1994
3. Molecular biology & Biotechnology (3rded), Walker &Gingold: Panima Publ. Corporation,1999
4. Lewin: Genes, Vol. VII Oxford, 1998, Inded.
5. Straehan& Read: Human Molecular Genetics 1999, John Wiley & Sons Pte. Ltd.
6. Gene cloning, Glover: 1984
7. Recombinant DNA, Watson et al: 1983
8. Genetic Engineering Vol. 1-4, Villiamson (ed)
9. Genetic Engineering Vol. 1-7 Setton and Bolanden (ed)

Paper - VIII: Biostatistics & Bioinformatics

(Course Code: S0LS/MBT/C0010)

No. of Credits = 3

UNIT - I

Importance of statistics in biological research. 0.75
Primary and Secondary data, Methods of data collection. Mean, Mode, Median, Range, Mean deviation, Standard deviation.
Standard error, Skewness & Kurtosis. Correlation & Regression, Probability

UNIT - II

Characteristics, Validity and Applications of Chi square test 0.5
Test for significance- comparison of means of two samples,
Comparison of means of three or more samples (f-test, t-test).
Tabulation and Graphical representation of Statistical data.
Data calculation in MS Excel & Power point presentation.

UNIT - III

Introduction to bioinformatics: Objectives, application and scopes, 0.5
Information technology in biology, Bioinformatics resources on NET, Internet,
Word wide web, Web Browsers.
Biological databases-Primary, Secondary database, GEN BANK,
EMBL, DDBJ, PDB, UNIPROT. Search engine-Entrez, SRS, Web Server-NCBI, EBI.

UNIT - IV

Sequence alignment and applications: Sequence similarity searching tools – 0.75
FASTA, BLAST; Statistical and biological significance.
Multiple sequence alignment and applications, Software and tools for MSA.
Phylogenetic analysis, Tools for phylogenetic analysis, Applications

UNIT - V

Protein Structure Prediction Tools, Molecular Modeling (Homology modeling); 0.5
Refinement, Validating structural model; Visualization tools, Pymol, Chimera, Ligplot.
Annotation of proteins, Assignment of function to proteins.

Recommended Books: -

1. Lesk: Introduction to Bioinformatics, Wiely Publication.
2. ROM and Holmas EC: Molecular Evolution: a phylogenetic approach, Blackwell science.
3. Des Higgins and Willie Taylor: Bioinformatics: Sequences, structure and databanks, Oxford University Press
4. Sharma, Munjal, Shankar: A Text Book of Bioinformatics, Rastogi Publication
5. Bioinformatics: Methods and Applications Genimics Proteomics and Drug Discovery, S C Rastogi, N Mendiratta, P. Rastogi: Prentice Hall of India Private Ltd
6. Mahajan: Methods in Biostatistics (4thed.) Jaypee Bros. 1984.
7. Sokal & Rohlf: Introduction to Biostatistics, Freeman, Toppan, 1993

Paper - IX: Epigenetics & Cancer Biology

(Course Code: S0LS/MBT/SS001)

No. of Credits = 3

UNIT - I

Introduction: Growth characteristics of cancer cells; Morphological and ultrastructural properties of cancer cells. Types of growth: Hyperplasia, Dysplasia, Anaplasia and Neoplasia. Nomenclature of neoplasms. Differences between benign and malignant tumors. 0.75

UNIT - II

Cancer biology and biochemistry: Aberrant metabolism during cancer development; Para-neoplastic syndromes; Tumor markers; Cellular proto oncogenes- oncogene activation. Growth factors-EGF, TNF, TGF and growth factor receptors. Signal transduction in cancer. Role of transcription factors. 0.5

UNIT - III

Carcinogenesis: Radiation and chemical carcinogenesis, Stages in chemical carcinogenesis- Initiation, promotion and progression. Free radicals, Antioxidants in cancer. Cell Cycle Regulation: Tumor suppressor genes p53, p21, Rb, BRACA1 and BRACA2. Telomeres, Telomerase, and Immortality; Cell adhesion-invasion and metastasis - VEGF signaling, angiogenesis. 0.75

UNIT - IV

Epigenetics-Role of DNA methylation in gene silencing- epigenetic silencing of tumor-suppressor genes; Apoptosis in cancer-Cell death by apoptosis, Role of caspases; Death signaling pathways-Mitochondrial and death receptor pathways. 0.5

UNIT - V

Detection of Cancer, Prediction of aggressiveness of Cancer, Different forms of therapy, Chemotherapy, Radiation therapy, and Immuno therapy: Advantages and limitations. Epigenetics of cancer, Identification of targets for drug development. 0.5

Recommended Books: -

1. The Biological Basis of Cancer: R. G. McKinnell, et al 2nd Ed, Cambridge University Press, 2006.
2. The Biology of Cancer: R. A. Weinberg. Garland Science. 2006.
3. The Molecular Biology of Cancer: S. Pelengaris, M. Khan. Blackwell Publication.
4. Introduction to modern Virology, Dunmock N.J and Primrose.S.B., Blackwel Scientific Publications. Oxford, 1988.
5. An Introduction to Cellular & Molecular Biology of Cancer, Oxford Medical publications, 1991
6. Gene expression systems. Joseph M. Fernandez & James P. Hoeffler. Academic Press, 1999.
7. Cancer Biology IV Ed Volume 2 Raymond W Ruddon M.D.(2007)
8. Cancer Biology (3rd_Edition) Roger J.B. et al (2006)
9. Advances in Cancer Stem Cell Biology, Roberto Scatena, Alvaro Mordente& Bruno Giardina (Ed) – Springer (2012)

Paper - IX: Biomedical Technology

(Course Code: S0LS/MBT/SS002)

No. of Credits = 3

UNIT - I

Cellular Pathology: Causes of cell injury, necrosis, biochemical mechanism, Ischemic and hypoxic injury. Apoptosis (Biochemical features, mechanisms) Immunological basis of diseases: Hypersensitivity (I – IV). Autoimmune diseases Preparation of polyclonal antisera: Characterization of antisera, Immunodiagnostic techniques 0.75

UNIT - II

Mutations and Genetic disorders. Single gene disorders, Receptor proteins (hypercholesterolemia). Cytogenic disorders (Trisomy, Klinefelters). Mutation in mitochondrial genes (LHDN), Fragile X-Syndrome. 0.5

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UNIT - III

Types and grading of cancer. Introduction to molecular diagnosis of cancer. (Southern & Northern blot analysis, PCR based diagnosis). Gene therapy, immunotherapy and chemotherapy of cancer cells. 0.75

UNIT IV

Chemical mutagens. Carcinogenic agents and their cellular interactions. Radiation as health hazard. (Types, measurements, effects & protective measures) Introduction to DNA damage and repair mechanism. 0.5

UNIT - V

Molecular diagnosis (genetic disease, gene diagnosis, gene tracking & other diagnostic application of RDT) MRI, CT-SCAN. Reproductive Health Technologies – Intracytoplasmic sperm injection (ICSI), In-vitro fertilization (IVF). 0.5

Recommended Books: -

1. Biomedical Technology and Devices Handbook, James E Moore, George Zouridakis, CRC Press(2004)
2. Palermo GD, O'Neill CL, Chow S, et al. Intracytoplasmic sperm injection: state of the art in humans. Reproduction. 2017;154(6):F93-F110. doi:10.1530/REP-17-0374
3. Alukal JP, Lamb DJ. Intracytoplasmic sperm injection (ICSI)--what are the risks?.UrolClin North Am. 2008;35(2):277-x. doi:10.1016/j.ucl.2008.01.004
4. Wang J, Sauer MV. In vitro fertilization (IVF): a review of 3 decades of clinical innovation and technological advancement. TherClin Risk Manag. 2006;2(4):355-364. doi:10.2147/tcrm.2006.2.4.355

Paper - X: Plant Biotechnology

(Corse Code: SOLS/MBT/C0013)

No. of Credits = 3

UNIT - I

Laboratory and materials requirement for plant tissue culture technologies, Aseptic techniques, Plant tissue culture media-composition & preparation, Totipotency Clonal propagation / micropropagation, types and its applications Meristem culture, Callus culture, organogenesis, suspension culture, Conservation of plant genetic resources *in vitro*, its applications and limitations. 0.5

UNIT - II

Haploid culture: Androgenesis & Gynogenesis, Embryo culture & Embryo rescue, Protoplast culture & protoplast fusion – Cybrids, Symmetric & Asymmetric hybrid. Somatic embryogenesis and Somaclonal variation, cryo-preservation, production of synthetic seeds. Selection of stress tolerant cell lines: resistance to cold, high temperature, salt, drought, diseases and inhibitors. 0.75

UNIT - III

Transformation techniques, *Agrobacterium* mediated gene transfer, Biolistics, Comparison of DNA delivery techniques in plants, Integration of transgenes, action of transgenes, Antisense RNAi, and Overexpression approach for transgenics, Biotechnology related to fruit ripening, miRNA and stress response 0.5

UNIT - IV

Insect resistance, Bt crops, Cry protein and action, Molecular mechanisms- Flavr-savr tomato, Golden Rice and, Terminator gene technology. Plant pathogen interactions, strategies utilized by pathogens, genetic basis of plant pathogen interactions, Resistance genes (R genes) in plants, Phytohormones and cross talk, Molecular mechanisms of Oxidative stress and heat stress (HSPs etc.) in plants and genes related for stress tolerance. 0.75

UNIT - V

Plant growth promoting bacteria, PGPR traits, uses and applications, Biofertilisers, Phyto-priming for stress responses, Plants for cleaning contaminated soils- phytovolatization, phytodegradation, phytostalilization, phytoextraction, Arsenic related biotechnological aspects 0.5

Recommended Books: -

1. P.K. Gupta: Elements of Biotechnology, Rastogi and Co. Meerut, 1996
2. R.J. Hanry: Practical Application of Plants Molecular Biology, Champan and Hall, 1997
3. H.D. Kumar: Modern Concepts of Biotechnology, Vikas Publ. Pvt. Ltd.
4. B.D. Singh: Biotechnology, Kalyani Publ.
5. Bhojwani SS and Razdan MK: Plant Tissue Culture: Theory and Practice- Elsevier
6. Stewart CN. Plant Biotechnology and Genetics. 2007. Wiley.

Paper - XI: Intellectual Property Rights, Bioethics & Bio-entrepreneurship

(Corse Code: S0LS/MBT/C0014)

No. of Credits = 3

UNIT - I

Introduction to intellectual property (IP); History and evolution of patent law, types of IP: patents, trademarks, copyright & related rights, Idea-expression dichotomy, industrial design, traditional knowledge, geographical indications, Significance of IPR. Introduction & Classifications of Patents, Patentability criteria. 0.75

UNIT - II

International conventions and Treaties- History of GATT & TRIPS Agreement, World Trade Organization, Post TRIPS scenario, Madrid Agreement; Hague Agreement; Budapest Treaty; Patent Cooperation Treaty; Indian Patent Act 1970 & recent Amendments, International framework for the protection of IP, India's IPR policy, World Intellectual Property Organization (WIPO) 0.5

UNIT - III

Discovery vs Invention, concept of 'prior art', invention in context of "prior art" Complexity arising in IP of Biotechnology, Case studies- Diamond vs Chakraborty IP as a factor in R&D; IPs of relevance to biotechnology, Legal and IPR issues in Biotechnology, Different Categories of IPR Instruments to Protect a Biotechnology IP, Licensing and compulsory licensing; Patent infringement, legal action, 0.5

UNIT - IV

Introduction to bioethics- definition, scope, Principles, significance. Issues of-ownership, monopoly, biodiversity, traditional knowledge access & benefit sharing., Social ethical issues in biotechnology. Biological weapons and their social and ethical implications, Bioethical issues in GMOs, Ethical issues in human cloning 0.5

UNIT - V

Concept of entrepreneurship, Introduction and scope in Bio-entrepreneurship, Risk and Benefits. General idea of the strategy and operations of bio-sector firms, Steps involved in commercialization of a biotechnological product, Introduction to the entrepreneurship development programs of public and private agencies (MSME, DBT, BIRAC, Make In India), Incubation Centre, Start-Up India 0.75

Recommended Books: -

1. Ganguli, P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy. New Delhi: Tata McGraw-Hill Pub.
2. National IPR Policy, Department of Industrial Policy & Promotion, Ministry of Commerce, GoI
3. Complete Reference to Intellectual Property Rights Laws. (2007). Snow White Publication Oct.
4. Office of the Controller General of Patents, Design & Trademarks; Department of Industrial Policy & Promotion; Ministry of Commerce & Industry; Government of India. http://www.ipindia.nic.in/
5. Karen F. Greif and Jon F. Merz, Current Controversies in the Biological Sciences -Case Studies of Policy Challenges from New Technologies, MIT Press
6. World Trade Organisation. http://www.wto.org
7. World Intellectual Property Organisation. http://www.wipo.int

Paper - XII: Protein Engineering

(Corse Code: S0LS/MBT/E0001a)

No. of Credits = 3

UNIT - I

Protein engineering – Introduction, definition and applications; Protein engineering as a tool to alter affinity and specificity; Spectroscopic properties; Stability to changes in parameters as pH, temperature and amino acid sequence, aggregation propensities, etc. Protein engineering with unnatural amino acids and its applications. 0.75

UNIT - II

Protein stability measurement; Spectroscopic study of physicochemical properties of proteins: Fluorescence; UV absorbance; CD & ORD; Hydrodynamic properties–viscosity, hydrogen-deuterium exchange; Introduction to NMR spectroscopy and its importance in protein studies 0.5

UNIT - III

Protein stabilizing forces – Van der Waals, electrostatic, hydrogen bonding and weakly polar interactions, hydrophobic effects; Entropy – enthalpy compensation; Experimental methods of protein engineering: directed evolution like gene site saturation mutagenesis; Module shuffling; Guided protein recombination, etc. 0.5

UNIT - IV

Optimization and high throughput screening methodologies like GigaMetrix, High throughput microplate screens etc., Engineering antibody affinity by yeast surface display; Applications to vaccines, Peptidomimetics and its use in drug discovery. 0.5

UNIT - V

Computational approaches to protein engineering: sequence and 3D structure analysis, Data mining, Ramachandran map, Mechanism of stabilization of proteins from psychrophiles and thermophiles vis-à-vis those from mesophiles; Protein design, Directed evolution for protein engineering and its potential. 0.75

Recommended Books: -

1. Edited by T E Creighton, (1997), Protein Structure: a Practical Approach, 2nd Edition, Oxford university press.
2. Cleland and Craik, (2006), Protein Engineering, Principles and Practice, Vol 7, Springer Netherlands.
3. Mueller and Arndt, Protein Engineering Protocols, 1st Edition, Humana Press. Ed. Robertson DE, Noel JP, (2004), Protein Engineering Methods in Enzymology, 388, Elsevier Academic Press.
4. J Kyte; (2006), Structure in Protein Chemistry, 2nd Edition, Garland publishers.

Paper - XII: Immunotechnology

(Course Code: S0LS/MBT/E0001b)

No. of Credits = 3

UNIT - I

Antigen – Antibody Interactions: Precipitation Reactions and application, Immunlogical Assays: Immunodiffusion, Immunoelectrophoresis, Immunohistochemistry, Immunohistopathology; Agglutination Reactions and application, Complement Fixation, RIA, ELISA, Immunofluorescence, Western Blotting 0.5

UNIT - II

Introduction & production of monoclonal antibodies and hybridoma technology, Advantages and limitations of monoclonal Antibodies, Characterization & storage of monoclonal Antibodies, Commercial production of monoclonal antibodies, 0.5

UNIT - III

Monoclonal Ab production by recombinant DNA technology, Hybridoma technology vs RDT, application in diagnosis. Engineered Monoclonal Antibodies: Chimeric and hybrid Monoclonal Antibodies, Monoclonal Antibodies constructed from Ig-gene libraries, Catalytic Monoclonal Antibodies (Abzymes). Cancer Immunotherapy 0.75

UNIT - IV

General physiology of cytokines, Application of cytokine for therapy, Future development in cytokine therapy, Interferon colony stimulating factor, Preparation of lymphokines by r-DNA Technology. Vaccines: Introduction and Types: Inactivated, Attenuated, Toxoid, Subunit And Multivalent vaccines, Purified macromolecules, Conjugate Vaccines. 0.5

UNIT - V

New generation vaccines: Synthetic peptide vaccines, Recombinant antigen vaccines, DNA vaccines. Immune stimulants, Adjuvants, Novel vaccine delivery systems. Vaccines for specific diseases: Tuberculosis, Malaria, HIV/AIDS. New emerging diseases and vaccine development: Ebola virus disease, SARS. 0.75

Recommended Books: -

1. Practical Immunology, 4th Ed., F.C. Hay, O.M.R. Westwood, Blackwell Publishing, 2002
2. Selected Methods for Antibody and Nucleic Acid probes, Volume1, S. Hockfield, S. Carlson, C. Evans, P. Levitt, J. Pintar, L. Silberstein, Cold Spring Harbor Laboratory Press,1993.
3. Antibodies Laboratory Manual, Ed Harlow, David Lane, Cold Spring Harbor, Laboratory Press, 1988.
4. Spicuzza L, Spicuzza A, La Rosa M, Polosa R, Di Maria G. New and emerging infectious diseases. Allergy Asthma Proc. 2007 Jan-Feb;28(1):28-34. doi: 10.2500/aap.2007.28.2870. PMID: 17390754.
5. Trovato Maria, Sartorius Rossella, D'Apice Luciana, Manco Roberta, De BerardinisPiergiusepp. Viral Emerging Diseases: Challenges in Developing Vaccination Strategies . Frontiers in Immunology 2020 Vol. 11:2130
6. The Vaccine Book (2nd Ed.), Rafi Ahmed, Roy M. Anderson et. al.Editor(s): Barry R. Bloom, Paul-Henri Lambert, Academic Press, 2016, Pages xxi-xxiv, ISBN 9780128021743.

Paper - XII: Nanobiotechnology

(Course Code: S0LS/MBT/E0001c)

No. of Credits = 3

UNIT - I

Introduction to Nanobiotechnology; Concepts, historical perspectives. 0.75
Nanoparticles and nanotechnology, History, origin, principles.
Chemical synthesis approach of nanoparticles, Physical synthesis of nanoparticles, Green synthesis approach for different nanoparticles applications and uses.
Applications and limitations using physical and chemical approach.
Advantages of using green synthesis using different examples

UNIT - II

Characterization of synthesized nanoparticles using XRD, SEM, TEM, HR-TEM, 0.5
FTIR, UV spectrophotometer, Dynamic light scattering etc., Different types of nanoparticles and applications with examples, Safety and toxicity aspects of nanoparticles

UNIT - III

Nanoparticles for drug delivery, concepts, optimization of nanoparticle properties for 0.75
suitability of administration through various routes of delivery, advantages, strategies for enhanced permeation through various anatomical barriers

UNIT - IV

Nanocomposites: Properties and applications; Nanoparticles for diagnostics and 0.5
imaging (theranostics); Clinical Applications of Nanopaticles, Nanotech and cancer,

UNIT - V

Environmental impact of nanomaterials – Exposure and risk assessment – Mechanism 0.5
of toxicity, Toxicological impacts of Nanomaterials-Ecotoxicological impact of Nanomaterials, Nanotechnology in Agriculture, Nanofactories

Recommended Books: -

1. Gero Decher, Joseph B. Schlenoff, (2003); *Multilayer Thin Films: Sequential Assembly of Nanocomposite Materials*, Wiley-VCH Verlag GmbH & Co. KGaA
2. David S. Goodsell, (2004); *Bionanotechnology: Lessons from Nature*; Wiley-Liss
3. Neelina H. Malsch (2005), *Biomedical Nanotechnology*, CRC Press
4. Greg T. Hermanson, (2013); *Bioconjugate Techniques*, (3rd Edition); Elsevier
Recent review papers in the area of Nanomedicine

Paper - XIII: Food & Beverages Biotechnology

(Course Code: S0LS/MBT/E0002a)

No. of Credits = 3

UNIT - I

Food and Microorganism: Microorganism in food & beverage industry, contamination of food. General principles underlying spoilage and chemical changes 0.5

UNIT - II

Contamination and spoilage of different kinds of food & beverages: 0.75
Cereals & Cereal products, sugar and sugar products,
Vegetables and Fruits, Meat, Fish, Poultry & Eggs, Sea food, Milk & Milk products,
Canned foods, Alcohol & alcoholic beverages
Fruit juices & soft drinks etc.

UNIT - III

Biotechnology of food and feed; Cultures & Fermentation, 0.5
Beverage production: Alcohol & Alcoholic beverages, Fruit furies, Soft drinks, Feed production, SCP, Fats, Amino acid, Food additives.

UNIT - IV

Food, Beverages & Disease: Food borne illness due to bacterial food poisoning, 0.5
Infection and Intoxication.
Food-borne disease outbreaks, Disease-investigation, Materials & Equipments, Laboratory testing, Field analysis, Interpretation of data and preventive measures.

UNIT - V

Food hygiene: Food sanitation, Bacteriology of water and food products, Food manufacturing practice. Hazard analysis critical points. 0.75
Food control: International agencies, Federal agency and law of state agencies, Processing industry and microbial criteria of food. Principles of food preservation, Preservation by high temperature, low temperatures, drying, food additives and radiation.

Recommended Books: -

1. Ashok Pandey, Guocheng Du, Maria Ángeles Sanromán, Carlos Ricardo Soccol, Claude-Gilles Dussap (2016) Current Developments in Biotechnology and Bioengineering. Food and Beverages Industry [1 ed.] Elsevier
2. Food Biotechnology. S.Bielecki, et al - (Ed) Elsevier Science (2000)
3. Food Biotechnology. Kalidas Shetty et al – CRC Press (2005)
4. Guadalupe Virginia Nevárez-Moorillón (editor), Arely Prado-Barragán (editor), José Luis Martínez-Hernández (editor), Cristobal Noé Aguilar (editor) (2016) Food Microbiology and Biotechnology: Safe and Sustainable Food Production [1 ed.] Apple Academic Press
5. Johnson-Green, Perry (2018) Introduction to Food Biotechnology Ed. 1. CRC Press

Paper - XIII: Animal Biotechnology

(Course Code: S0LS/MBT/E0002b)

No. of Credits = 3

UNIT - I

Animal cell culture: History; Basic requirements; Cell culture media and reagents; Animal cell, tissue and organ cultures; Primary culture, secondary culture; Continuous cell lines; Suspension cultures; Transfection andtransformation of cells; Stem cells and their application; Induced Pluripotency. 0.5

UNIT - II

Animal reproductive biotechnology: structure of sperms and ovum; cryopreservation of sperms and ova of livestock; artificial insemination; embryo recovery and *in vitro* fertilization; cryopreservation of embryos; embryo transfer technology. Transgenic Animals: applications of transgenic animal technology; Techniques of gene transfer: Microinjection, Lipofection, Electroporation, Chemical based transformation, Viral Vectors. 0.75

UNIT - III

Animal Genomics: Introduction to animal genomics; Different methods for for characterization of animal genomes, SNP, STR, RFLP, RAPD, proteomics, metabolomics; Genetic basis for disease resistance; Gene knock out technology and animal models for human genetic disorders. Animal cloning - basic concept, cloning for conservation for conservation endangered species 0.75

UNIT - IV

Applications of Animal Cell Cultures: Cell Culture based products, Vaccines, Hybridoma technology, Monoclonal antibodies, *In vitro* testing of drugs; Production of pharmaceutical proteins; Stem Cells and their Use, Using Animals Cells for heterologous gene expression. Introduction to the concept of vaccines, conventional methods of animal vaccine production. 0.5

UNIT - V

Immunological and nucleic acid based methods for identification of animal species; DNA Barcoding; Detection of adulteration in meat using DNA based methods; Detection of food/feed adulteration with animal protein; Identification of wild animal species using DNA based methods. 0.5

Recommended Books: -

1. Pörtner, R. (2007). Animal Cell Biotechnology: Methods and Protocols. Totowa, NJ: Humana Press
2. Primrose, S. B., &Twyman, R. M. (2006). Principles of Gene Manipulation and Genomics. Malden, MA: Blackwell Pub.
3. Gordon, I. (2005). Reproductive Techniques in Farm Animals. Oxford: CAB International.
4. Levine, M. M. (2004). New Generation Vaccines. New York: M. Dekker
5. R.E. Spier and J.B. Griffiths (1985). Animal Cell Biotechnology. Vol I and II, Academc Press.

Paper - XIII: Enzymology & Enzyme Technology

(Course Code: S0LS/MBT/E0002c)

No. of Credits = 3

UNIT - I

Properties of enzymes : Catalytic power, specificity, Holoenzymes, Apoenzyme, Coenzyme and Cofactor. Nomenclature and classification of enzymes, active site- Fischer and Koshland models. Collision theory, activation energy and transition state energy, the law of mass action and order reaction. 0.5

UNIT - II

Enzyme kinetics: Kinetics of single substrate enzyme catalyzed reaction, Equilibrium steady state assumption (Michaelis-Menten), transformation of Michaelis Menten equation, Lineweaver Burk, Eadie-Hofstee, Hanes plots. Determination of Vmax, Km, Kcat and their significance. Effect of pH, temperature, enzyme and substrate concentration on enzyme activity. Single displacement and double displacement reaction. 0.75

UNIT - III

Enzyme Inhibition: Reversible inhibition- competitive, uncompetitive and non competitive inhibition, allosteric and irreversible inhibitions. Assay of enzymes: Coupled kinetic assay, units of enzyme activity (IU), Turnover number, purification of enzymes and criteria of purity. 0.5

UNIT - IV

Enzyme catalysis: Tapping the enzyme -substrate complex, use of substrate analogues, enzyme modifications by chemical procedures affecting aminoacid chain, treatment with protease, site directed mutagenesis,
Allosteric enzymes with special reference to aspartate transcarbomylase and phosphofructokinase. Concerted and sequential models. Isozymes- special reference to lactate dehydrogenase. Ribozymes. 0.75

UNIT - V

Mechanism of enzyme action: General mechanistic principle, Factors contributing to the catalytic efficiency-proximity and orientation, nucleophilic and covalent covalent catalysis, acid-base catalysis, metal ion catalysis. 0.5
Mechanism of reactions catalyzed by enzymes: Specific examples (Chymotrypsin, Lysozyme, Ribonuclease and Carboxypeptidase).

Recommended Books: -

1. Lehninger Principles of Biochemistry, Seventh Ed. 2017, Nelson & Cox, Macmillan Publishers.
2. Text book of Biochemistry, West, E.S., Todd, Manson & Vanbruggen. Macmillon.
3. Organic Chemistry Vol 2: Stereochemistry and the Chemistry of Natural Products, 5th, Fifth Edition
4. Biochemistry, Zubay, G. Fourth Edition, Wm.C. Brown Publishers, 1998.
5. Enzymology, Devasena T. 2010. Oxford University Press.

Paper - XIV: Research Methodology: Tools & Techniques

(Course Code: S0LS/MBT/SS 003)

No. of Credits = 3

UNIT - I

Importance and need of scientific research. 0.75
Problem identification, objectives, significance, scope and limitations.
Literature survey: Use of books, journals, libraries, online survey.
Importance and designing of the problem to be undertaken.

UNIT - II

Field survey, site selection, source selection for data acquisition. 0.5
Sampling techniques: Simple and random sampling,
Systematic sampling, Stratified sampling, Multistage sampling,
Cluster sampling, Multiphase sampling, Sample size,
Frequency, Bias, Error.

UNIT - III

Methods: Data collection, types of data, qualitative and quantitative data. 0.75
Primary and secondary data, data summarization
Data representation: Tabular and diagrammatic representation of data.
Measures of central tendency: Use of mean, mode, median. Data interpretation.

UNIT - IV

Measures of dispersion: Use of range, variance, standard deviation, standard error. 0.5
correlation, multiple correlations,
regression, multiple regressions, standard error of estimate.
Test of significance: t-test, 95% confidence limit,
Chi square test, F-test, Multivariate test.

UNIT - V

Project Report Preparation: Introduction of the problem, Materials and methods, 0.5
Review of literature, Results, Discussion (interpretation of results),
Referencing technique, Summary of research/Abstract etc.
Publication of scientific data, writing research paper & report.

Recommended Books: -

1. Holmes, Moody, Dine: Research Methods for the Biosciences, 1st Indian ed., Oxford University Press, 2006.
2. N. Gurumani: Research Methodology for Biological Sciences, 1st ed., MJP Publishers, 2008.
3. Schmauder: Methods in Biotechnology, Taylor & Francis Publishers, 2003

Paper - XIV: Science Communication & Scientific Writing

(Course Code: S0LS/MBT/SS004)

No. of Credits = 3

UNIT – I

Concept of effective communication- setting clear goals for communication; determining outcomes and results; initiating communication; avoiding breakdowns while communicating; creating value in conversation; 0.75

UNIT - II

Barriers to effective communication; power of effective listening; Presentation skills - formal presentation skills; preparing and presenting using over-head projector, PowerPoint; defending interrogation; scientific poster preparation & presentation; participating in group discussions; 0.5

UNIT - III

Use of ICT in Biology, Computing skills for scientific research - web browsing for information search; search engines and their mechanism of searching; Keywords and its importance in scientific research; internet as a medium of interaction between scientists;
effective email strategy for communication with peers and collaborators/scientists. 0.75

UNIT - IV

Importance of communicating science, problems during communication 0.5
Technical writing skills - types of reports; layout of a formal report;
Scientific writing skills – types; importance Importance of reading scientific communications
Platforms for scientific reading

UNIT - V

Plagiarism, why there is need to plagiarize, Image and text plagiarism, softwares for plagiarism; publishing scientific papers - peer review process and problems, recent developments such as open access and non-blind review; plagiarism; characteristics of effective technical communication; scientific presentations; ethical issues; scientific misconduct. 0.5

Recommended Books: -

1. Valiela, I. (2001). *Doing Science: Design, Analysis, and Communication of Scientific Research.* Oxford: Oxford University Press.
2. *On Being a Scientist: a Guide to Responsible Conduct in Research.* (2009). Washington, D.C.: National Academies Press.
3. Gopen, G. D., & Smith, J. A. *The Science of Scientific Writing*. American Scientist, 78 (Nov-Dec 1990), 550-558.
4. Mohan, K., & Singh, N. P. (2010). *Speaking English Effectively*. Delhi: Macmillan India.
5. Movie: Naturally Obsessed, The Making of a Scientist

Paper - XV: Environmental Biotechnology

(Course Code: XIX:S0LS/MBT/C0016)

No. of Credits = 3

UNIT - I

Introduction to environment; pollution types and its control; pollution indicators; sources of wastes and pollutants of water and soil, waste management: Domestic, industrial treatment of liquid waste, aerobic and anaerobic waste water treatment, Treatment of solid waste, Landfills, hazards of landfill contributions of biotechnology to waste treatment 0.5

UNIT - II

Bioremediaton: Fundamentals, methods and strategies 0.5
Phytoremediation: Fundamentals and description of major methods and application
Application of bacteria and fungi in bioremediation uses, advantages vs disadvantages.
Bioremediation of metals, radionuclides, organic pollutants (PAHs, PCBs, Pesticides, TNT, xenobiotic compounds), technological aspects of bioremediation (*in situ, ex situ*)

UNIT - III

Environmental Biotechnology and biofuels: biogas; bioethanol; biodiesel; biohydrogen; microorganisms involved and biotechnological interventions for optimization of production; Microbiologically enhanced oil recovery (MEOR); Bioleaching of metals; Production of bioplastics; Production of biosurfactants: bioemulsifiers 0.5

UNIT - IV

Biofungicides: Description of mode of actions and mechanisms (e.g.*Trichoderma, Pseudomonas fluorescens)*; Biofertilizers: Plant growth promoting rhizobacteria (PGPR) – uses, practical aspects and problems, PGPR and heavy metals, Halotolerant PGPR and prospects, Phytoremediation: Fundamentals and description of major methods of application (phytoaccumulation, phytovolatilization, rhizofiltration, phytostabilization), Biotechnological aspects of phytoremediation, biodegradation of xenobiotic compounds, 0.75

UNIT - V

Bioinsecticides and biopesticides: *Bacillus thuringiensis*, genetic modifications and aspects of safety in their use; Role of GMOs in environment clean-up, Dye removal using biotechnological interventions, Oil spillage and biotechnological remedies, Biosensors for environment monitoring and analysis, Nanotechnology and its applications, metallic nanoparticle uses, Green nanomaterials for environmental cleaning, Algal biotechnology- concepts, uses and applications, Use of mixed microbial populations 0.75

Recommended Books: -

1. Frederick W Pontinus, Water Quality & Treatment. American water works Association, MC Graw Hill
2. Fundamentals of Environmental Science: G. S. Dhaliwal, G. S. Sangha and P. K. Raina, Kalyani Publication
3. Perry L. McCarty; Bruce E. Rittmann (2020) Environmental biotechnology: principles & applications 2nd Ed Springer
4. Pramod Kumar; Vipin Kumar (2018) Textbook of Environmental Biotechnology. Woodhead Publishing India
5. Raman Kumar, Anil Kumar Sharma, Sarabjeet Singh Ahluwalia (eds.) (2017) Advances in Environmental Biotechnology [1 ed.] Springer Singapore

Paper XVI: Fermentation & Bioprocess Technology

(Course Code: S0LS/MBT/C0017)

No. of Credits = 3

UNIT - I

Introduction to fermentation and its types, Isolation, screening, improvement and preservation of Industrially important microbes; Microbial growth kinetics in batch, continuous and fed-batch processes. 0.5

UNIT - II

Media formulation for industrial fermentation, Requirement of precursors, inducers and antifoam agents as media additives; Medium optimization; Volumetric mass-transfer coefficient and its measurement, Kinetics of sterilization. 0.5

UNIT - III

Types of bioreactors (CSTR, bubble column, airlift, fluidized bed, packed bed): General configuration and applications; Scale up and scale down; Measurement and control of bioprocess parameters 0.75

UNIT - IV

Down Stream Processing: Cell disruption techniques; Separation techniques: filtration, centrifugation, sedimentation, flocculation, liquid-liquid extraction, precipitation, reverse osmosis, ultrafiltration; Drying; Crystallization; Storage and packaging. 0.5

UNIT - V

Industrial production (Microorganisms and raw material/media used, fermentation conditions and purification steps) and uses of fermentation products: Ethanol, Butanol, Antibiotics (Penicillin, Tetracycline), Alcoholic beverages, Enzymes (Glucose isomerase, Protease), Xanthan gum, Baker's yeast. Solid state fermentation and its applications 0.75

Recommended Books: -

1. Shuler, M. L., &Kargi, F. (2002). Bioprocess Engineering: Basic Concepts.Upper Saddle River, NJ: Prentice Hall.
2. Stanbury, P. F. & Whitaker, A. (2010). Principles of Fermentation Technology. Oxford: Pergamon Press.
3. Blanch, H. W., & Clark, D. S. (1997). Biochemical Engineering. New York: M. Dekker.
4. Bailey, J. E., &Ollis, D. F. (1986). Biochemical Engineering Fundamentals. New York: McGraw-Hill.
5. El-Mansi, M., & Bryce, C. F. (2007). Fermentation Microbiology and Biotechnology. Boca Raton: CRC/Taylor & Francis.

Paper - XVII: Advanced Bioinformatics

(Course Code: SOLS/MBT/E0004a)

No. of Credits = 3

UNIT - I

Introduction, definition and history of Bioinformatics. 0.5
Introduction to Internet, bibliographic and non bibliographic search, PubMed
Introduction biological databases (primary, secondary and composite databases).
Biological information system: SRS, ENTREZ (Structure and use on web).

UNIT - II

Introduction to Data mining**:** Classification, clustering, data collection, 0.75
data Warehousing, data preprocessing, Applications of data mining and genomes mining. Databases: Nucelotide sequence information sources: GenBank, EMBL, EBI, DDBJ, UCSC. Protein sequence information sources: PIR, ExPASy, UniProt KB, SwissProt, TrEMBL,
Protein structure information sources: PDB, SCOP, CATH, HSSP.

UNIT - III

Biocomputing **:** Introduction to String matching algorithms, 0.75
Database search techniques, sequence comparison and alignment techniques, Use of Biochemical scoring matrices, Introduction to Graph Matching Algorithms, Automated genome comparison and its implication, Automatedgene prediction, Gene arrays, Analysis of gene arrays. Introduction to signaling pathways and pathway regulation (KEGG), Systems biology-an introduction

UNIT - IV

Genoinformatics, Genome Annotation: Introduction, ORF's. 0.5
Gene mapping and applications: Genetic and physical mapping,
Transcriptome and Proteome- General account. Sequence Alignment: Pairwise and multipule alignment, Dynamic programming. Softwares (SSearch, BLAST, FASTA, CLUSTAL W), Phylogenetic analysis: Phenatic and Cladistic approach.
Phylogenetic tree construction (rooted and unrooted method),
Completed Genomes: Bacterium, nematode, plant and human

UNIT - V

Production of protein structure & modeling. Protein primary & secondary structure, 0.5
prediction Methods – Introduction to various methods. Tertiary structure prediction (Homology & Threading Methods) Profiles, Motifs – Regular expressions. Repeat finding and pattern recognition. Molecular modeling, Docking and rational Drug design.

Recommended Books: -

1. Moorhouse & Barry: Bioinformatics, Biocomputing and Perl (Wiley-liss publications).
2. Jones & Prvzner: Introduction to Bioinformatics Algorithm, Anne Press.
3. Pevsner: Bioinformatics & Functional Genomics, Wiley-publication.
4. Bourne &Weissig: Structural Bioinformatics, Wiley-Liss Publication.
5. Gustafson, Shoemaker, Snape: Genome Data Mining Exploitation: the Genome.
6. Richard S Larson: Bioinformatics and drug discovery,humana press.
7. Sharma, Munjal& Shankar: A Text Book of Bioinformatics, Rastogi Publication

Paper - XVII: Herbal Biotechnology

(Course Code: SOLS/MBT/E0004b)

No. of Credits = 3

UNIT - I

Herbal medicines: history and scope. Local health traditions, ethnomedicines 0.5
Important Medicinal and aromatic plants (MAPs) of Garhwal Himalayas- their diversity, distribution, traditional knowledge,

UNIT - II

Phytochemistry - active principles of herbal drugs-Biological testing, phytochemical screening for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds, fatty acids, tannins, glycosides and volatile oils etc.) 0.75
Knowledge of few important MAPs, their uses etc. *Aconitum*, *Andrographis*, *Nardostachys jatamansi, Picrorhiza, Coleus, Rhododendron, Acorus calamus, Swertia chirata, Tinospora cordifolia, Berberis* etc.

UNIT - III

Phytometabolites of medicinal importance, Important genes and proteins related to metabolites, Signaling pathways, Transgenic plants- Overexpression and downregulation approach to manipulate the metabolite levels in few medicinal plants like *Andrographis paniculata* etc. 0.5

UNIT - IV

Diseases associated with raw/processed medicinal plants, and diagnostics related 0.75
Few initiatives for cultivation and conservation of medicinal plants,
Plant Tissue culture as an alternative for conservation of MAPs- prospects and challenges, Demand and supply, Herbal Industries at national and state levels.
Ministry of AYUSH, National/ State Medicinal plant board- Organization, aims, objectives and mandate Ayurveda Biology, Role of herbal drugs at International levels

UNIT - V

Economic importance, biotechnological applications and challenges of 0.5
herbal biotechnology. Green synthesis of nanoparticles using medicinal plants
Phytopharmaceuticals: examples and applications
Neutraceuticals: examples and applications

Recommended Books: -

1. B.D. Singh A textbook of biotechnology.
2. G. Patrick, Medicinal Chemistry. (2002)
3. Shah and Seth, Text book of Pharmacognosy and phytochemistry (2010) Elsevier publications

Paper - XVII: Genomics & Proteomics

(Course Code: SOLS/MBT/E0004c)

No. of Credits = 3

UNIT - I

Basics of genomics and proteomics, Brief overview of prokaryotic and eukaryotic genome organization; Chromatin organization; Extra-chromosomalDNA: bacterial plasmids, mitochondria and chloroplast. 0.5

UNIT - II

Genome mapping, Genetic and physical maps; methods and techniques used for gene mapping, physical mapping, linkage analysis, cytogenetic techniques, FISH technique in gene mapping, comparative gene mapping 0.5

UNIT - III

Genome sequencing projects; Human Genome Project, genome sequencing projects for microbes, plants and animals, accessing and retrieving genome project information from the web.
Comparative genomics; Identification and classification of organisms using molecular markers- 16S rRNA typing/sequencing, SNPs. 0.75

UNIT - IV

Proteomics; Aims, strategies and challenges in proteomics; proteomics technologies: MALDI-TOF, yeast 2-hybrid system, Surface Plasmon Resonance (SPR), proteomicsdatabases. 0.5

UNIT - V

Functional genomics and proteomics; Transcriptome analysis, functional annotation of gene, Contig assembly, mining functional genes in genome, gene function- forward and reverse genetics, protein-protein and protein-DNA interactions; protein chips and functional proteomics; clinical and biomedical applications of proteomics. 0.75

Recommended Books: -

1. Primrose, S. B., Twyman, R. M., Primrose, S. B., & Primrose, S. B. (2006). *Principles of Gene Manipulation and Genomics*. Malden, MA: Blackwell Pub.
2. Liebler, D. C. (2002). *Introduction to Proteomics: Tools for the New Biology.*Totowa, NJ: Humana Press.
3. Campbell, A. M., &Heyer, L. J. (2003). *Discovering Genomics, Proteomics, and Bioinformatics*. San Francisco: Benjamin Cummings

Paper - XVIII: Vaccines & Drug Development

(Course Code: S0LS/MBT/ SS005)

No. of Credits = 3

UNIT - I

Molecular Basis of Disease: Bacterial, Overview of Pathogenesis, diagnosis and treatment; Viral Overview of Pathogenesis, diagnosis and treatment, Host-virus Interaction, Progression of viral disease in host, Challenges in treatment. 0.5

UNIT - II

Biology of Parasites: Malaria, Dengue, Filariasis, Amebiasis. Parasite life cycle, Parasite-vector interactions, Parasite-Host Interactions, Pathogenesis, Diagnosis, Treatment and drug resistance. 0.5

UNIT - III

Drug Designing, Molecular Modeling, Molecular docking, Structure based Drug Designing, rational drug design, Lead Molecule Identification and optimization, validation. Drug Target Discovery, *in silico* drug discovery, Mechanism of action. Challenges 0.5

UNIT - IV

History of vaccines, Conventional vaccines; Bacterial vaccines; Viral Vaccines; Live attenuated and inactivated vaccine; Subunit Vaccines and Toxoids; Peptide Vaccine, vector vaccines, anti-idiotype vaccines; Multivalent subunit vaccines; immune stimulants. 0.75

UNIT - V

Vaccine delivery systems (liposome, microsphere and nanoparticle mediated) and immunostimulatory adjuvants, Edible vaccines. General account of the different stages in development of new vaccines and clinical trials, Overview of the different steps in vaccine manufacture. 0.75

Recommended Books: -

1. Janeway, C. A., Travers, P., Walport, M., & Shlomchik, M. J. (2005). Immuno Biology: the Immune System in Health and Disease. USA: Garland Science Pub.
2. Kindt, T. J., Osborne, B. A., Goldsby, R. A., &Kuby, J. (2013). Kuby Immunology. W.H. Freeman.
3. Kaufmann, S. H. (2004). Novel Vaccination Strategies. Weinheim: Wiley-VCH.
4. Journal Articles (relevant issues) from: Annual Review of Immunology, Annual Review of Microbiology, Current Opinion in Immunology, Nature Immunology, Expert review of vaccines
5. https://www.nature.com/subjects/structure-based-drug-design
6. D.J. Abraham, Structure-Based Drug Design – A Historical Perspective & the Future, Ed(s): John B. Taylor, David J. Triggle, Comprehensive Medicinal Chemistry II, Elsevier, 2007, Page 65-86.
7. J.S. Mason, Introduction to the Volume and Overview of Computer-Assisted Drug Design in the Drug Discovery Process, Editor(s): John B. Taylor, David J. Triggle, Comprehensive Medicinal Chemistry II, Elsevier, 2007, Pages 1-11,

Paper - XVIII: Molecular Virology

(Course Code: S0LS/MBT/SS006)

No. of Credits = 3

UNIT - I

History of Virology and Biosafety: History and principles of virology, Virus taxonomy. Structures of animal and plant viruses and their morphology. 0.75
Principles of biosafety, containment facilities, maintenance and handling of laboratory animals, and requirements of virology laboratory.

UNIT - II

Virus Replication: Structure and replication strategies of bacteriophages - T7, λ, ΦX174, and plant viruses - ss RNA virus (TMV) and ds DNA virus (CaMV). Structure and replication strategies of animal viruses - Influenza virus, Adeno virus and Retro virus. 0.5

UNIT - III

Interferon and Antiviral Agents: Viral Interference and interferons. Nature and source of interferons, Classification of interferons. Induction of interferon. 0.5
Antiviral agents (chemical and biological) and their mode of actions.

UNIT - IV

Cultivation of Viruses and Viral Vaccines: Cultivation of viruses in embryonated egg, Tissue culture and Laboratory animals. Conventional vaccines - Killed and attenuated. 0.5
Modern vaccines - Recombinant proteins, subunits, DNA vaccines, peptides, Immunomodulators (cytokines). Vaccine delivery and adjuvants, Large-scale manufacturing.

UNIT - V

Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods. Quantitative diagnostic methods - Haemagglutination, Complement fixation, neutralization, 0.75
Nucleic acid based diagnosis - PCR, microarray and nucleotide sequencing.

Recommended Books: -

1. General Virology - Luria and Darnel Virology and Immunology - Jokli
2. Text book of Virology - Rhodes and Van Royen
3. Genetics of bacteria and their viruses - W. Hayes
4. Molecular Biology of the gene - Watson, Roberts, Staitz and Weiner
5. Virological Procedures - MitchalHaskingVirologoy - Wilson and Topley
6. Infection and Immunity DH Davies, MA Halablab,, et al (1998) Taylor & Francis Ltd, 1, London

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – BOTANY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

DEPARTMENT OF BOTANY AND MICROBIOLOGY

SYLLABUS

M.Sc. (BOTANY)

HNB GARHWAL UNIVERSITY, SRINAGAR-GARHWAL

SYLLABUS

SCHOOL OF LIFE SCIENCES

PROGRAMME- M.Sc. BOTANY

2015-2016 ONWARDS

(Two Year Course- Semester System)

Admission of the Master's Program in Botany shall be through entrance examination conducted by the University and the program shall be based on credit system in which credit defines the quantum of content/ syllabus prescribed for a course system and determines the number of hours of instruction per week.

The student shall be eligible for admission to a Master's Degree Program in Botany after he/she has successfully completed a three year undergraduate degree or earned prescribed number of credits (under CBCS) through the examinations conducted by University as equivalent to an undergraduate degree.

Core courses prescribed for every Semester shall be mandatory for all students registered for the Master's Program in Botany and shall carry minimum 54 credits. Besides this there shall be Elective courses offered in semester III and IV and shall carry a minimum of 18 credits. A self study course would comprise of maximum 09 credits of which one minimum 03 credits shall be mandatory which shall not be included while calculating grades.

Each candidate is expected to participate in the field surveys and excursions required for the Laboratory Courses as and when organized by the Department. Subsequent to that the student would have to present a detailed report of such visits at the time of Semester Practical examination.

In order to qualify for a two year master's degree, a student must acquire a minimum of 72 credits including a minimum of 18 credits in electives choosing at least two elective (leading to a minimum 06 credits) offered by other departments and one qualifying self study course of minimum 03 credits.

Dissertation is an elective one. The dissertation is to be allotted in the beginning of III Semester and would be submitted during the examination of the IV Semester. In lieu of dissertation any two of the given elective papers of 03 credits each and one lab course (of both elective papers) of 03 credits (total 09 credits) may be chosen by those students who

secure less than 75% up to IInd semester level. The Dissertation may be allotted at the start of IIIrd semester to those students who secure 75% or more up to IInd semester level and the Dissertation would be submitted at the time of IV Semester practical examination.

M.Sc. I Semester (July - November)

Code	Paper	Credits				MM
		L	T	P	C	
SLS/BOT/C001	Mycology and Microbiology	3	0	0	3	100
SLS/BOT/C002	Phycology and Bryology	3	0	0	3	100
SLS/BOT/C003	Pteridology, Gymnosperm and Palaeobotany	3	0	0	3	100
SLS/BOT/C004	Taxonomy and Diversity of Flowering Plants	3	0	0	3	100
SLS/BOT/C005	Laboratory Course I	0	0	3	3	100
SLS/BOT/C006	Laboratory Course II	0	0	3	3	100
				Total		**600**

Core Credits = 18

M.Sc. II Semester (December - April)

Code	Paper	Credits				MM
		L	T	P	C	
SLS/BOT/C007	Plant Development and Reproductive Biology	3	0	0	3	100
SLS/BOT/C008	Resource Utilization, IPR and Ethnobotany	3	0	0	3	100
SLS/BOT/C009	Cytogenetics and Molecular Biology	3	0	0	3	100
SLS/BOT/C010	Plant Breeding and Biostatistics	3	0	0	3	100
SLS/BOT/C011	Laboratory Course – I	0	0	3	3	100
SLS/BOT/C012	Laboratory Course – II	0	0	3	3	100
				Total		**600**

Core Credits = 18 with additional 03 Credits of Self Study*

M.Sc. III Semester (July - November)

Code	Paper	Credits				MM
		L	T	P	C	
SLS/BOT/C013	Plant Physiology and Biochemistry	3	0	0	3	100
SLS/BOT/C014	Ecology and Remote Sensing	3	0	0	3	100
SLS/BOT/C015	Laboratory Course – I	0	0	3	3	100
SLS/BOT/E001A	Recombinant DNA Technology	3	0	0	3	100
SLS/BOT/E001B	Forest Ecology	3	0	0	3	100
SLS/BOT/E001C	Natural Resource Management in Himalaya	3	0	0	3	100
SLS/BOT/E001D	Palynology and Pollination Biology	3	0	0	3	100
SLS/BOT/E001E	Any other elective course offered by other department	3	0	0	3	100
SLS/BOT/E002A	Plant Health Management	3	0	0	3	100
SLS/BOT/E002B	Diversity and Cultivation of Mushrooms	3	0	0	3	100
SLS/BOT/E002C	Applied Plant Anatomy	3	0	0	3	100
SLS/BOT/E002D	Ecosystem Analysis, GIS and Remote Sensing	3	0	0	3	100
SLS/BOT/E002E	Any other elective course offered by other department	3	0	0	3	100
SLS/BOT/E003	Laboratory Course – II	0	0	3	3	100
			Total			**600**

Total Credits = 18 (Core Credits 09+ Elective Credits 09) with additional 03 Credits of Self Study*

M.Sc. IV Semester (December - April)

Code	Paper	Credits				MM
		L	T	P	C	
SLS/BOT/C016	Conservation Biology	3	0	0	3	100
SLS/BOT/C017	Biotechnology and Genetic Engineering of Plants and Microbes	3	0	0	3	100
SLS/BOT/C018	Laboratory Course – I	0	0	3	3	100
SLS/BOT/E004	Dissertation	0	0	9	9	300
				Total		**600**

Dissertation/ Project Work

Anatomy of Himalayan woods

Chromosome Analysis and Indexing of Himalayan Flora

Conservation of endangered species

Environment Impact Assessment

High altitude Ecology and Climate Change

Invasion Ecology

Inventorization of unexplored Areas and Hotspots

Limnology

Plant Biodiversity Assessment

Pollution Monitoring

Population/weed/ Reproductive Biology

Survey of Less known Economic Plants

Any other current trends / topics suggested by the Departmental committee

The distribution of marks for the Dissertation will be as below:

Periodical Presentation : 60 Marks

Dissertation : 180 Marks

Viva Voce : 60 Marks

Total : 300 Marks

The dissertation/ project report shall be evaluated jointly by the supervisor and one external examiner.

In lieu of dissertation any two of the following papers with their practical (03 credit each) can be opted .

Code	Paper	Credits				MM
		L	T	P	C	
SLS/BOT/E005A	XXIIb. Propagation Techniques	3	0	0	3	100
SLS/BOT/E005B	XXIIc. Environment Management with Reference to Wes Himalaya.	3	0	0	3	100
SLS/BOT/E005C	XXIId. Bioinformatics and Biological Database	3	0	0	3	100
SLS/BOT/E005D	XXIIe. Seed Pathology	3	0	0	3	100
SLS/BOT/E006	Laboratory Course – II	0	0	3	3	100
(Any two papers and their Lab. Course)				**Total**		**300**

Total Credits = 18 (Core Credits 09+ Elective Credits 09) with additional 03 Credits of Self Study*

Grand Total: Core Credits 54+ Elective Credits 18= 72

With a total of 09 Credits (3+3+3 Credits in II, III and IV semester) of Self Study (2 Seminars equivalent to 2 sessionals plus one end term written examination).

Maximum Marks for each paper is 100 (Sessional Tests- 40 + End Term Test- 60).

01 Credit= 01 hour of lecture/instructions per week; 01 Credit course= 15 hours of lectures per semester.

03 hours of laboratory course shall be considered equivalent to 01 hour of lecture.

The 2- Year Masters Programme will have the following components:

1. **Core course:** Minimum 54 credits.

2. **Elective course:** Minimum 18 credits choosing at least two Electives (leading to a minimum 06 credits) in Semester III offered either by the parent department or other departments and one Elective course as Dissertation (09 credits) in IV Semester.

3. **Self study course:** Maximum 09 credits (one minimum 03 credits shall be mandatory but not to be included while calculating grades).

SLS/BOT/C001. Paper I: MYCOLOGY AND MICROBIOLOGY

MYCOLOGY

1. History of Mycology; India and abroad.
2. General characters of Fungi: Substrate relationship in fungi; Cell ultra structure; unicellular and multicellular organization, nutrition (saprobic, biotrophic, symbiotic); reproduction (vegetative, asexual, sexual); Recent trends in the classification.
3. Phylogeny of Fungi; General account of *Mastigomycotina*, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina; Fungi in industry, medicine and as food. Mycorrhizae; Fungi as biocontrol agents.
4. Symptoms, causal organisms of plant phogens belonging to various fungal classes i.e. *Mastigomycotina*,Zygomycotina, acomycotina, basidiomycotina and deuteromycotina.

MICROBIOLOGY

5. A brief history of Microbiology, the diversity of micro-organisms, microbial growth.
6. Archaebacteria and Eubacteria: General account; ultrastructure, nutrition and reproduction; biology and economic importance; cyanobacteria- classification, salient features and economic importance.
7. Viruses: Characteristics; isolation and purification of viruses; chemical nature, replication, Transmission of viruses; economic importance.
8. Phytoplasma: General characteristics and role in causing plant diseases. (e.g. sandal spike disease, sesamum phyllody, little leaf of brinjal)
9. Immunology: Structure of antigens and antibodies, antigen- antibody reaction, , Mechanism of antigen-antibody reactions. Vaccines and toxoids, Hypersensitivity

SUGGESTED READINGS:

1. Ainsworth, G.C. 1971. Ainsworth and Bisby's Dictionary of Genera of Fungi. Central Myco. Inst. Kew, Surrey.UK.
2. Alexopoulus, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. John Willey & Sons Inc.
3. Bilgrami, K.S. 1982. Physiology of Fungi. Bishen Singh Mahendrapal Singh, Dehradun.
4. Clifton, A. 1958. Introduction to the Bacteria. McGraw-Hill book Co., New York.
5. Mandahar, C.L. 1978. Introduction to Plant Viruses. Chand & Co. Ltd., Delhi.
6. Mehrotra, R.S. and Aneja, R.S. 1998. An Introduction to Mycology. New Age Intermediate Press.
7. Webster, J. 1985. Introduction to Fungi. Cambridge University Press.
8. Doelle, H.W. and C.G, Heden 1986. Applied Microbiology, Kluwer Academic Press, London.
9. Pelczar, M.J., Chan, ECS and Kreig, N.R. 1993. Microbiology, Concept and Applications. Mc Graw Hill, New York.
10. Ross, F.C. 1983. Introductory Microbiology. Charles E. Merril. Publ. Co. Columbus, Ohio.
11. Alexander, M. 1991. Microbial Ecology. John Wiley and Sons. New York.

12. APHA. 1971. Standard Methods for the Examination of water and Waste Water. Washington DC
13. Atlas. R. M. Principle of Microbiology.
14. Board, R.G. and D.W., Lovelock 1975. Some Method for Microbiological Assay. Acadmic Press. New York
15. Casida, L.E. 1968. Industrial Microbiology. John Wiley and Sons, New York.
16. Clifford, H.T. and W. Stephenson 1975. An Introduction to Numerical Classification, Academic press, New York.
17. Doelle, H.W. and C.G., Heden 1986. Applied Microbiology. Kluwer Acad. Press, London.
18. Kaushik, P. 1996. Introductory Microbiology. Emkay Publ, Delhi.
19. Miller, B.M. and W. Litsky 1976. Industrial Microbiology. Mc Graw Hill New York.
20. Mukherjee, K.G. and Ved Pal Singh, 1997. Frontiers in Applied Microbiology. Rastogi Publ. Meerut.
21. Norris, J.R. and D.W. Ribbons 1970. Methods in Microbiology. Academic Press, London.
22. Power, C.B. and H.F. Daginawala 1996. General Microbiology 2 Vols. Himalaya Pub. House, New Delhi.
23. Ross, F.C. 1983. Introductory Microbiology. Charles E. Merril Publ. Co. Columbus. Ohio.

SLS/BOT/C002. Paper II: PHYCOLOGY AND BRYOLOGY

PHYCOLOGY

1. Algal habitats .
2. Thallus organization, cell structure and reproduction (vegetative, asexual and sexual).
3. Algal Classification, Criteria for classification of algae: pigments, reserve food and flagella.
4. Phylogeny and interrelationships of algae.
5. Classification and salient features of Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta and Cyanophyta.
6. A knowledge of algal life cycles; alternation of generation in algae; cytology and sexuality; physiology and biochemistry of algae; nitrogen fixation; parasitic algae.
7. Economic importance of Algae, Algal blooms, algal biofertilizers, algae as food, feed and uses in industry.

BRYOLOGY

8. Morphology, structure reproduction and life history.
9. Classification and Phylogeny of various groups.
10. General account of Marchantiales, Jungermanniales, Calobryales, Sphaerocarpales, and Anthocerotales.
11. Sphagnales, Andreales, Funariales, and Polytrichales.

12. Knowledge of the distribution of bryophytes in the Himalaya. Ecology of bryophytes, their association with other organisms.
13. Fossil bryophytes , general account.

SUGGESTED READINGS:

1. Cavers, F. 1979. The Interrelationships of the Bryophytes Reprint. Bishen Singh Mahendrapal Singh, Dehradun.
2. Fritsch, F.E. 1979. The Structure and Reproduction of Algae. Reprint. Bishen Singh Mahendrapal Singh, Dehradun.
3. Kashyap, S.R. 1968. Liverworts of the Western Himalayas and Punjab Plains. The Chronica Botanic Co. Delhi.
4. Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhl.
5. Morris, I. 1986. An Introduction to the Algae. Cambridge University Press, U.K.
6. Parihar, N.S.1991. Bryophyta. Central Book Depot, Allahabad.
7. Presscott, G.W. Algae: A Review. Bishen Singh Mahendrapal Singh.
8. Puri, P. 1980. Bryophytes. Atma Ram & Sons, Delhi.
9. Ram Udar. Fifty years of Bryology in India. Golden Jubilee Series. IBS, New Delhi
10. Round, F.E. 1986.The Biology of Algae. Cambridge University Press, Cambridge.
11. Smith, G.M. 1955. Cryptogamic Botany. Vol. I and II. Tata Mc Graw Hill, New Delhi.
12. Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.

SLS/BOT/C003. Paper III: PTERIDOLOGY, GYMNOSPERMS AND PALAEOBOTANY

PTERIDOPHYTA

1. History, origin, classification, present and past distribution, morphology and life history of the following types.
   a. Psilophyta: Psilophytales (*Psilophyton*) and Psilotales (*Psilotum*).
   b. Lycophyta: Lepidodendrales (*Lepidodendron*), Lycopodiales (*Phylloglossum*), Lepidospermales (*Lepidocarpon*) and Isoetales (*Isoetes*).
   c. Sphenophyta :Salient features of order Hyeniales, Sphenophyllales and Calamitales
   d. Pterophyta: A general account of Ophioglossales Osmundales Filicales,and Salviniales .

GYMNOSPERMS

1.Classification and distribution of Gymnosperms in India with special reference to Himalaya. Study of their morphology, structure and life-history as illustrated by the following and indicated in the practical work.

e. Pteridospermales: Palaeozoic and Mesozoic groups with references to Lyginopteridaceae (*Lyginopteris*) and Medullosaceae (*Trigonocarpus*), A general account of Glossopteridaceae.

f. Bennettitales: A general account of Cycadeoidaceae, Williamsoniaceae and Wielandiellaceae.

g. Cycadales: A detailed account including distribution of living Cycads.

h. A general account of Pentoxylales and Cordaitales.

i. Ginkgoales: *Ginkgo.*

j. A general account of fossil and living Coniferales and Taxales.

k. Ephedrales, Welwitschiales and Gnetales: A general account.

2. Economic importance of Gymnosperms.

PALAEOBOTANY

3. Definition of fossil, different types of plant fossil as per their mode of preservation, concept of form genus.
4. Indian Gondwana Sequence, a general account.
5. Introductory idea of Continental Drift Hypothesis.

SUGGESTED READINGS:

1. Andrews, HN. 1961. Studies in Palaeobotany. New York.
2. Baker, J.G. 1995. Handbook of the Fern Allies. Reprint. Bishen Singh Mahendra Pal Singh, Dehradun.
3. Bhatnagar, S.P. and Mitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi.
4. Beddome, R.H. 1966. The Ferns of British India. 2 Vols. Oxford and IBH, New Delhi.
5. Chamberlain, C.J. 1955. Gymnosperms: Structure and Evolution. Chicago.
6. Eams, A.J. 1969. Morphology of Lower Vascular Plants.
7. Parihar, N.S. 1996. Biology & Morphology of Pteridophytes. Central Book Depot Allahabad.
8. Raizada, M.B and Sahni, K.C. 1958. Living Indian Gymnosperms.
9. Sahni, K.C. 1996. Gymnosperms of India and Adjacent Countries. Bishen Singh Mahendrapal Singh, Dehradun.
10. Seward, A.C. 1919. Fossil Plants for Students of Botany and Geology. 4 Vols. Cambridge.
11. Sporne, K.R. 1991. The Morphology of Pteridophytes. Hutchinson Library Series London.
12. Sporne, K.R. 1991. The Morphology of Gymnosperms. Hutchinson Library Series London.

SLS/BOT/C004. Paper IV: TAXONOMY AND DIVERSITY OF FLOWERING PLANTS

1. Origin of intra- population variation: Population and the environment; ecads and ecotypes; evolution and differentiation of species- various models.
2. The species concepts; taxonomic hierarchy, species, genus, family and other categories; principles used in assessing relationship, delimitation of taxa and attribution of rank.
3. Salient features of the International Code of Botanical Nomenclature.
4. Taxonomic evidences and Taxonomic tools: anatomy, palynology, embryology, phytochemistry, histological, cytological, phytochemical, serological, biochemical and molecular techniques.
5. Systems of angiosperm classification: Phenetic versus phylogenetic systems; cladistics in taxonomy; major systems of classification (Bentham and Hooker, Hutchinson, Cronquist) and their relative merits and demerits.
6. Herbarium and Botanical gardens: General account.
7. Plant exploration in India with reference to North west and Uttarakhand Himalaya
8. Status of flowering plant diversity in Garhwal Himalaya.

9. A study of the following families and their relationships:

a. Dicotyledons:, Magnoliaceae, Berberidaceae, Fumariaceae, Violaceae, Meliaceae, Apiaceae, Sterculiaceae, Tiliaceae, Geraniaceae, Combretaceae, Asteraceae, Campanulaceae, Ericaceae, Primulaceae, , Asclepiadaceae, Convolvulaceae, Verbenaceae, Scrophulariaceae, Oleaceae, , Amaranthaceae, Chenopodiaceae, Loranthaceae, Urticaceae, Juglandaceae, Fagaceae and Salicaceae.

b. Monocotyledons: Hydrocharitaceae, Orchidaceae, Amaryllidaceae, Arecaceae, Araceae, Lemnaceae, Poaceae and Cyperaceae .

Besides these families, the students are also expected to have a complete knowledge of families which they have studied at under graduate syllabus of this University.

SUGGESTED READINGS

1. Babu, C.R. 1976. Herbaceous Flora of Dehradun. CSIR, New Delhi.
2. Cole, A.J. 1969. Numerical Taxonomy, Academic Press, London.
3. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New york.
4. Davis, P.H. and Heyhood, V.H. 1973. Principles of angiosperms Taxonomy. Robert E. Kreiger Pub. Co., New York.
5. Gaur, R.D. 1999. Flora of District Garhwal: NW Himalaya. Transmedia, Srinagar, Garhwal.
6. Grant, V. 1971. Plant Speciation. Columbia University Press, New York.
7. Grant, W.F. 1984. Plant Biosystematics. Academic Press, London.
8. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Hieman Educationnal Books Ltd., London.
9. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London
10. Hutchinson, J. 1973. The Families of Flowering Plants. 2 Vols. Oxford University Press, Oxford.
11. Jain, S.K. and Rao, R.R. 1977. A handbook of Field and Herbarium methods. Today and Tomorrow, New Delhi.
12. Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Species. Hieman & Co. Educational Books Ltd., London.
13. Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematic (2^{nd} edition). McGraw- Hill Book Co., New York.
14. Lawrence, H.W. 1951. Taxonomy of Vascular Plants. Reprint Oxford and IBH, New Delhi.
15. Naithani, B.D. 1985. Flora of Chamoli. 2 Vols, BSI, Calcutta.Nordenstam, B., El Gazaly, G. and Kassas, M. 2000. Plant Systematic for 21^{st} Century. Portlant Press Ltd., London.
16. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper & Row Publications, USA.
17. Singh, H. 1978. Embryology of Gymnosperms. Encyclopaedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.

18. Solbrig, O.T. 1970. Principles and Methods of Plant biosystematics. The MacMillan Co. - Collier- MacMillan Ltd., London.
19. Solbrig, O.T. and Solbrig, D.J. 1979. Population Biology and Evolution. Addison- Wesley Publication Co. Inc., USA.
20. Stace, C.A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London.
21. Stebbins, G.L. 1974. Flowering Plant- Evolution above Species Level. Edward Arnold Ltd., London.
22. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold Ltd., London.
23. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
24. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall, New Jersey.

SLS/BOT/C005 PaperV LABORATORY COURSE I

1. Study of representative genera of Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.

2. Symptomatology of at least one diseased specimen of plant phogens belonging to various fungal classes i.e. *Mastigomycotina,*Zygomycotina, acomycotina, basidiomycotina and deuteromycotina, bacteria and viruses.

3. Aseptic methods and demonstration of instruments viz., autoclave, hot air oven, incubator, laminar air flow.

4. Direct examination of root nodule bacteria under microscope and isolation of *Rhizobium* in root nodules.

5. Isolation and enumeration of microbes from natural samples (soil and water) by agar plate technique.

6. Morphological study of representative members of algae: *Microcystis, Lyngbya, Cylindrospermum, Gloeotrichia, Scytonema, Pandorina, Eudorina, Scendesmus, Pediastrum, Hydrodictyon, Ulva, Enteromorpha, Drapernaldiopsis, Stigeoclonium, Fritschiella, Coleochaete, Bulbochaete, Cosmarium, Caulerpa, Nitella, Dictyota, Gelidium, Gracillaria, Batrachospermum* and *Polysiphonia.*

7. Study and identification with suitable preparations of *Ricciocarpus, Targionia, Cyathodium, Plagiochasma, Asterella (Fimbriaria), Dumortiera, Sewardiella, Pellia, Fossombronia, Porella, Calobryum, Notothylas, Sphagnum, Polytrichum* and *Funaria,*

SLS/BOT/C006 Paper VI LABORATORY COURSE II

Study and identification with suitable preparations of the following:

A. PTERIDOPHYTES

Psilotum, Isoetes, Ophioglossum, , Osmunda,, Polypodium, Azolla, Salvinia and important fossil types.

B. GYMNOSPERMS

Cycas, Ginkgo, Abies, Cedrus, Cryptomeria, Cupressus, Podocarpus, Cephalotaxus, Araucaria, Taxus, and *Gnetum.*

C. PALAEOBOTANY

1. Study of available fossil flora through specimens and slides, etc.

D. TAXONOMY

1. Identification and description of locally available plants belonging to families included in the syllabus from fresh specimens, herbarium or preserved materials. After identification up to family level any suitable regional Flora may be provided for generic identification if required.
2. Description of a species based on various specimens to study intra specific variation.
3. Studies to find out the location of key characters and preparation of keys at generic level.
4. Field trips, compilation of field notes, the preparation of herbarium sheets and submission of herbarium and museum specimens and/or live potted specimens of taxonomic interest and submission of the excursion report.

SEMESTER II

SLS/BOT/C007. Paper VII: PLANT DEVELOPMENT AND REPRODUCTIVE BIOLOGY

1. Seed germination and seedling growth: Mobilization of food reserves; tropisms; hormonal control of seedling growth.
2. Shoot development: Organization of the shoot apical meristem (SAM); cytological and molecular analysis of SAM; control of cell division and cell to cell communication.
3. Cambium and its functions: formation of secondary xylem; general account of wood structure in relation to conduction of water and minerals.
4. Leaf growth and differentiation: Origin, development and phyllotaxy.
5. Root development: Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; lateral roots; root hairs; root-microbe interactions.
6. Reproduction: Vegetative options and sexual reproduction; flower- a modified shoot, structure, functions; structure of anther and pistil; Genetics of floral organ differentiation.
7. Male gametophyte: Structure of anthers; microsporogenesis, role of tapetum; pollen development and gene expression.
8. Female gametophyte: Ovule development; megasporogenesis; organization of the embryo sac .
9. Pollination, pollen-pistil interaction and fertilization: Pollen-stigma interactions, sporophytic and gametophytes self-incompatibility (cytological, biochemical and molecular aspects); double fertilization; *in vitro* fertilization.
10. Seed development and Fruit growth: Endosperm development ; embryogenesis, polyembryony; apomixis; embryo culture; biochemistry and molecular biology of fruit maturation.
11. Latent life–Dormancy: Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy.
12. Senescence and programmed cell death (PCD): Basic concept, types of cell death, PCD in the life cycle of plant, metabolic change associated with senescence and its regulation; influence of hormones and environmental factors on senescence.

SUGGESTED READINGS:

1. Atwell, B.J., Kriedermann, P.E. and Jurnbull, C.G.N. (Eds) 1999. Plants in Action: Adaptation in Nature, Performance in Cultivation. MacMillan education, Sydney, Australia.
2. Bewley, J.D. and Black, M. 1994. Seeds: Physiology of Development and Germination. Plenum Press, New York.
3. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4^{th} revised and enlarged edition). Vikas Publishing House, New Delhi.
4. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
5. Chopra, V.L. 2001. Plant Breeding: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.

6. Chopra, V.L. 2001. Plant Breeding: Field Crops. Oxford & IBH Pvt. Ltd., New Delhi.
7. Eams, A.J. 1989. An Introduction to Plant Anatomy. Reprint. Bishen Singh Mahendra Pal Singh, Dehradun.
8. Fageri, K. and Van der Pijl, L. 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
9. Fahn, A. 1982. Plant Anatomy. (4th edition). Pergamon Press, Oxford.
10. Fosket, D.E. 1994. Plant Growth and Development. A Molecular Approach.Academic Press, San Diego.
11. Howell, S.H. 1998. Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.
12. Leins, P., Tucker, S.C. and Endress, P.K. 1988.Aspects of Floral Development. *J. Cramer*, Germany.
13. Lyndon, R.F. 1990. Plant Development. The Cellular Basis. Unnin Hyman, London.
14. Maheshwari, P. 1950. An Introduction to Embryology of Angiosperms. McGraw Hill, New York.
15. Metcalf, C.R. and Chalk, L. 1983. Anatomy of Dicotyledons and Monocotyledons. 2 Vols. Clarendon Press, Oxford.
16. Murphy, T.M. and Thompson, W.F. 1988. Molecular Plant Development. Prentice Hall, New Jersey.
17. Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
18. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
19. Raghavan, V. 1999.Developmental Biology of Flowering Plants. Springer- Verlag, New York.
20. Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1992. Biology of Plants (5^{th} edition). Worth, New York.
21. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4^{th} edition). Wadsworth Publishing, Belmont, California.
22. Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development (2^{nd}edition) Cambridge University Press, Cambridge.
23. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops. Academic Press, London.
24. Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge.
25. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A Laboratory Manual. Springer-Verlag, Berlin.
26. Shivanna, K.R. and Johri, B.M. 1985. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York.
27. The American Society of Plant Physiologists 1993. The Plant Cell. Special Issue on Reproductive Biology of Plants, Vol. 5 (10), Rockville, Maryland, USA.
28. Thorpe, T.A. 1996. In vitro Embryogenesis in Plants. Kluwer Academic Publ. London.

SLS/BOT/C008. Paper VIII: RESOURCE UTILIZATION, IPR AND ETHNOBOTANY

1. Plant resources: Concept, status, utilization and concerns.
2. World Centers of Primary Diversity of domesticated plants
3. Origin, evolution, botany, cultivation, cytotaxonomy and uses of (i) Cereals and millets (wheat, paddy, maize), (ii) Legumes (soybean, black gram and cowpeas), (iii) Sugar cane and starches (sugarcane, beetroot, potato, sweat potato, cassava), (iv) Forage and fodder crops.
4. Fiber crops, medicinal and aromatic.
5. Important firewood and timber yielding plants and non- wood forest products (NWFPs) such as bamboos, gums, tannins, dyes, resins, beverages.
6. Intellectual Property Rights, Concept, History, Protection of IPR; Patent- requirements, procedures and limitations; International convention on Biological Diversity.
7. Ethnobotany: Concept, linkage with other sciences, tools of ethnobotanical studies, world and Indian perspective with special reference to the Himalayas.
8. Green revolution: Benefits and adverse consequences.
9. Plants used as ornamentals and avenue trees.
10. Principles of conservation: Extinction ; Status of plants based on International Union for Conservation of Nature (IUCN).
11. Strategies for conservation: *In situ* conservation; Protected areas in India- sanctuaries, national parks and biosphere reserves.

SUGGESTED READINGS:

1. Ayensu, E.S., Heywood, V.H. and Lucas G.L. 1984. Our green and living world: The wisdom to save it. Cambridge Univ. Press. Cambridge.
2. Baenzinger, S.P., Kleese, R.A. and Barns, R.F. 1993. Intellectual Property Rights, Protection of plant materials; executive summary and work group reports. CSSA Publication No. 21. Crop Science Soc. of America, Wisconsin, Madison.
3. Bellamy, R. 1993. Ethnobotany in Tropical forests: expedition in field techniques, Royal Geographic Society of London.
4. Berlin, B. 1992. Ethnobiological Classification: Principles and categorization of plants and animals in traditional societies. Princeton Univ. Press. Princeton.
5. Chandel, K.P.S., Shukla, G. and Sharma, N.1996. Biodiversity in Medicinal and Aromatic Plants in India: Conservation and Utilization. National Bureau of Plant Genetic Resources, New Delhi.
6. Conway, G. and Barbier, E. 1994.Plants, Genes and Agriculture. Jones and Bartlett Publishers, Boston.
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8. Council of Scientific & Industrial Research (1948-1976). The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. New Delhi. Raw Materials I-XII, Revised Volume I-III (1985-1992) Supplement (2000).
9. Densmore, F. 1974. How Indians use wild plants for food, medicine and crafts, Dover Publication Inc. New York.
10. WWF INDIA 1993. Directory of Indian Wetlands, New Delhi and AWB, Kuala Lumpur.

11. Falk, D.A., Olwell, M. and Millan, C. 1996. Restoring Diversity. Island Press, Columbia, USA.
12. Frankel, O.H., Brown, A.H.D. & Burdon, J.J. 1995. The Conservation of Plant Diversity. Cambridge University Press, Cambridge, U.K.
13. Gadgil, M. and Guha, R. 1996. Ecology and Equity: Use and Abuse of Nature in Contemporary India. Penguin, New Delhi.
14. Gangulee, P. 1998. Gearing up for patents- the Indians Scenario. Univ. Press. Hyderabad.
15. Hill, A.F. 1952. Economic Botany. McGraw Hill., New York.
16. Kochar, S.L. 1998. Economic Botany in the Tropics. Mac Millan India Ltd. Delhi
17. Kothari, A. 1997. Understanding Biodiversity: Life Sustainability and Equity. Orient Longman.
18. Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh. Lovedale Educational, New Delhi.
19. Nair, M.N.B. *et al.* (Eds) 1998. Sustainable Management of Non-Wood forest Products. Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia
20. Paroda, R.S. and Arora, R.K.1991. Plant Genetic resources conservation and Management. IPGRI (Publication) South Asia Office, C/o NBPGR, Pusa Campus, New Delhi.
21. Rodgers, N.A. and Panwar, H.S. 1988. Planning a Wildlife Protected Area Network in India. Vol. 1. The Report. Wildlife Institute of India, Dehradun.
22. Sahni, K.C. 2000. The Book of Indian Trees, 2nd edition. Oxford University Press Mumbai.
23. Sharma, O.P. 1996. Hill's economic Botany (Lata Dr. A.F. Hill, adapted by O.P. Sharma). Tata McGraw Hill Co. Ltd., new Delhi.
24. Swaminathan, M.S. and Kocchar, S.L. (Eds.) 1989. Plants and Society. Macmillan Publication Ltd., London.
25. Thakur, R.S., Puri, H.S. and Husain, A. 1989. Major Medicinal Plants of India. Central Institute of Medicinal and Aromatic Plants, CSIR, Lucknow.
26. Walter, K.S. and Gillet, H.J. 1998. IUCN Red List of Threatened Plants. IUCN The World Conservation Union. IUCN, Gland, Switzerland, and Cambridge, U.K.

SLS/BOT/C009. Paper IX: CYTOGENETICS AND MOLECULAR BIOLOGY

1. The dynamic cell: Structural organization of the plant cell; specialized plant cell.
2. Cell wall: structure and functions; biogenesis, growth.
3. Plasma membrane: structure models and functions; sites for ATPases, ion carriers, channels and pumps, receptors.
4. Mitochondria and chloroplast: Structure, genome organization, gene expression.
5. Nucleus: structure, nuclear pores, nucleosome organization.
6. Ribosomes: Structure, cytoprotein synthesis.

7. Chromatin organization: Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, euchromatin and heterochromatin, specialized types of chromosomes; polytene, lampbrush, B-chromosomes and sex chromosomes.
8. Principles of inheritance: Mendelian laws along with molecular explanations, Exceptions to Mendelian laws, lethal alleles and Gene Interactions.
9. Structural and numerical alterations in chromosomes: Origin, occurrence, production and meiosis of haploids, aneuploids and euploids, induction and characterization of trisomics and monosomics.
10. Genetics of prokaryotes and eukaryotic organelles: genetic recombination of phage; genetic transportation, conjugation ant transduction in bacteria, cytoplasmic male sterility.
11. Gene structure and expression: Genetic fine structure, cis-trans test; fine structure analysis of eukaryotes, introns and their significance, regulation of gene expression in prokaryotes and eukaryotes. DNA damage and repair mechanism, defects in DNA repair; Initiation of cancer at cellular level, proto-oncogenes and oncogenes.
12. Genetic recombination and genetic mapping: Recombination; independent assortment and crossing over, linkage groups, genetic markers, construction of molecular maps.
13. Mutations: Spontaneous and induced mutations; physical and chemical mutation, molecular basis of gene mutation; mutations induced by transposons.
14. Nuclear DNA content; C-value paradox; Cot curves.

SUGGESTED READINGS:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1989. Molecular
2. Biology of the Cell (2nd edition). Garland Publishing Inc., New York.
3. Atherly, A.G., Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
4. Burnham, C.R. 1962. Discussions in Cytogenetics. Burgess Publishing Co., Minnesota.
5. Busch, H. and Rothblum, L. 1982. Volume X. The Cell Nucleus rDNA Part A. Academic
6. Press.
7. Barry, J.M. and Barry, B.M. 1973. Molecular Biology, Prentice Hall Of India
8. New Delhi.
9. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
10. De, D.N. 2000. Plant Cell Vacuoles: An Introduction. CSIRO Publication, Collingwood, Australia.
11. Gupta, P.K. 1998. Cytogenetics. Rastogi Publications. Meerut.
12. Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis (4th edition). Jones & Bartlett Publishers, Massachusetts, USA.
13. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA.
14. Krishnamurthy, K.V. 2000. Methods in Cell wall Cytochemistry. CRC Press, Boca Raton, Florida.
15. Lewin, B. 2000. Genes VII. Oxford University Press, New York.
16. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (4th Edition). W.H. Freeman and Co., New York, USA
17. Malacinski, G.M. and Freifelder, D. 1998. Essentials of Molecular Biology (3rd
18. edition). Jones and Bartlet Publishers, Inc., London.

19. Stent, G.S. 1986. Molecular Genetics. Bishen Singh Mahendra Pal Singh, Dehradun.
20. Watson, J.D. 1965. Molecular Biology of the Gene. Benjamin.
21. Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Publishing Co. California, USA.

SLS/BOT/C010. Paper X PLANT BREEDING AND BIOSTATISTICS

PLANT BREEDING

1. The role of plant breeding – historical aspects and genetic basis: mode of reproduction in relation to breeding methods, breeding techniques; method of plant breeding in relation to self-pollinated and cross pollinated plants.
2. Hybridization: Interspecific and inter generic; pure line; back cross hybridization; self-incompatibility system.
3. Heterosis: Its genetic and physiological basis.
4. Breeding for resistance to diseases, physiological races.
5. Role of mutation in crop improving and evolution.
6. Plant breeding work done in India with special reference to potato, paddy, wheat and sugarcane.
7. Maintenance of collection, registration of varieties, seed production, testing, certification and distribution.

BIOSTATISTICS

1. Bio-statistics and its application in life sciences.
2. Methods of representation of statistical data and measurements of central tendencies.
3. Correlation, regression, curve fitting and ratio of variation.
4. Probability and use of binomial trials.
5. Test of significance, X^2, 't' and 'f' tests.

SUGGESTED READINGS:

Plant Breeding:

1. Harihar, Ram, 1997. Vegetable Breeding; Principles and Practices. Jagminder Book Agency. New Delhi
2. Hill, J. 1997. Quantitative and Ecological Aspects of Plant Breeding, Jagminder Book Agency. New Delhi.
3. Kapoor, R.L. 1997. Plant Breeding and Crop Improvement. 2 Vols
4. Mc Donald, M.B. 1997. Seed Production: Principles and Practices.
5. Poehlman, J.M and D. Borthakur, 1969. Asian Field Crops. Oxford and IBH Publ. New Delhi.

6. Poelhman, J.M and Sleeper, D.R. 1995. Breeding Field Crops. Panima Publ. House, New Delhi.
7. Sharma, J.R. 1994. Principles and Practice of Plant Breeding. Tata McGraw Hill Publ. Co. Ltd. New Delhi.
8. Singh, B.D. 2002. Plant Breeding Principles and Methods. Kalyani Publ. New Delhi.

Biostatistics:

1. Bliss, C.I. 1967. Statistics in Biology. 2 Vols. Mc Graw Hill, New York.
2. Downey, N.M and Heath, R.W. 1960. Basic Statistical Methods, Harper International.
3. Rayner, A.A. 1969. A first Course in Biometry for Agriculture Students. Peitermaritzburg. University of Natal Press.
4. Singh, R.K. 1994. Biometrical Techniques in Breeding and Genetics. Bishen Singh Mahendra Pal Singh. Dehradun.
5. Watt, T. 1993. Introductory Statistics for Biology Students. Narosa, New Delhi.
6. Winer, B.J. 1962. Statistical Principles in Experimental Design. Mc Graw Hill,
7. New York.

SLS/BOT/C011 Paper X I LABORATORY COURSE I

a. Effect of gravity, unilateral light and plant growth regulators on the growth of young seedlings.
b. Role of dark and red light / far red light on the expansion of cotyledons and epicotylar hook opening in pea.
c. Study of cytohistological zones in the shoot apical meristem (SAM) in sectioned and double stained slides of suitable plants such as *Coleus, Kalanchoe, Nicotiana.* Examination in shoot apices in a monocot both in T. S. and L. S. to show the origin of leaf primordia.
d. Study of alternate and distichous, alternate and superposed, opposite and superposed opposite and decussate leaf arrangement. Examination of rosette plants (*Launaea, Mollugo, Raphanus, Hyoscyamus,* etc.) and induction of bolting under natural conditions as well as GA treatment.
e. Microscopical examination of vertical section of leaves, such as that of *Cannabis, Nicotiana, Zea mays* and *Triticum* to understand the internal structure of the tissue and trichomes, glands, etc. Also to study the anatomy of C3 and C4 plants.
f. Study of epidermal peels of leaves to study the development and final structure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.
g. Study the whole roots of dicots and monocots. Examination of root apical meristem and its derivatives (using maize, aerial roots of banyan, etc.). Study of lateral roots. Study of lateral roots with different types of nodules.
h. Study of microsporogenesis and gametogenesis in sections of anthers.
i. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (maize, grasses, *Cannabis sativa, Crotolaria, Tradescantia, Brassica, Petunia, Solanum melongena,* and locally available flowers).

ii. Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop and sitting drop cultures.

iii. Pollen storage, pollen–pistil interaction, self-incompatibility, *in vitro* pollination.

iv. Study of ovules in cleared preparations. Study of monosporic, bisporic and tetrasporic types of embryosac development through permanent slides.

v. Field study of types of flowers with different pollination mechanisms (wind pollination, insect pollination, etc.).

vi.Emasculation, bagging and hand pollination techniques to study pollen germination.

Study of seed dormancy and methods to break dormancy.

i. The practical course of this section is divided into three units: (1) Laboratory work, (2) Field survey and (3) Scientific visits

i. Food crops: wheat, rice, maize, chickpea, potato, tapioca, sweet potato, sugarcane; morphology, anatomy and micro chemical tests for stored food materials.

ii. Forage/fodder plants: Study of ten important fodder crops of the locality.

iii. Plant fibers: Textiles fibers (cotton, jute, sun hemp, cannabis, *Grewia*, etc.), Cordage fibers (coir), Stuffing fibers (silk cotton). Morphology, anatomy, microscopic study of whole fibers using appropriate, staining procedures.

iv. Medicinal and aromatic plants including narcotics and antibiotics.

v. Vegetable oils: Mustard, groundnut, soybean, coconut, sunflower and castor. Morphology, microscopic structure of oil yielding tissues, test for oil and iodine number.

vi. To prepare a water extract of vegetable tannins (*Acacia, Terminalia, Camellia, Cassia*) and dyes (*Curcuma longa*, *Bixa orellana, Indigofera, Butea monosperma, Lawsonia inermis, etc.).*

SLS/BOT/C012 Paper XII LABORATORY COURSE II

1. Study of mitotic chromosomes in root tips and leaf buds and meiotic chromosomes in floral buds.

2. Isolation of chloroplasts and SDS-PAGE profile of proteins to demarcate the two subunits of Rubisco.
3. Isolation of DNA and preparation of '*cot*' curves.
4. Restrictioin digestion of plant DNA, its seperation by agarose gel electrophoresis and visualization by ethidium bromide staining.
5. Isolation of RNA and quantitation by spectrophotometric method.
6. Southern blot analysis using a gene specific probe.
7. Northern blot analysis using a gene specific probe.
8. Western blotting and ELISA.
9. Genetical problems on Mendelian and post-Mendelian ratios, gene interactions, sex-linked inheritance, chromosomal mapping, etc.
10. Application of common plant breeding techniques
11. Identification of Indian varieties of important crops.
12. Floral biology of local food, pulse, vegetable and horticultural crops.
13. Collection of germplasm of different crops being grown in the area.
13. Study of techniques of biometrical studies.

14. To test the goodness of fit and independent assortment using Chi-square method.

Manuals for Laboratory Exercises.

Fakui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRC Press, Boca Raton, Florida.

Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.

Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co., Inc Menlo Park, California.

Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.

Harris, N. and Oparka, K.J. 1994. Plant Cell Biology: A Practical approach. IRL Press, at Oxford University Press, Oxford, U.K.

Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.

Snustad. D.P. and Simmons, M.J. 2000. Principles of Genetics (2nd edition). John Willey

& Sons Inc., USA.

Sharma, A.K. and Sharma, A. 1999. Plant chromosomes: Analysis, Manipulation and Engineering. Harwood academic Publishers, Australia.

Semester III

SLS/BOT/C013: PLANT PHYSIOLOGY AND BIOCHEMISTRY

1. Functional aspects of plant cell structure: colloidal systems, concept of water potential, diffusion, osmosis and imbibition. Life giving unique properties of water.
2. Energy flow: Principles of thermodynamics, free energy and chemical potential, redox reactions, structure and functions of ATP.
3. Biologically important molecules: Carbohydrates, Amino acids, Proteins and Lipids. Fundamentals of enzymology: General aspects of enzymes, allosteric mechanism, regulatory and active sites, isozymes, kinetic catalysis, Michaelis-Menton equation and its significance.
4. Membrane transport and translocation of water and solutes: Plant-water relations, mechanism of water transport through xylem and transport in cells. Absorption and transpiration of water.
5. Photophysiology and photosynthesis: General concepts and historical background, evolution of photosynthetic apparatus, photosynthetic pigments and light harvesting complexes, photo oxidation of water, light reaction, Z scheme and photophosphorylation, mechanism of electron transport, carbon assimilation – the Calvin cycle, photorespiration and its significance, the C_4 cycle, the CAM pathway, factors of photosynthesis.
6. Respiration and lipid metabolism: Overview of plant respiration, glycolysis, the TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidation system, photorespiration.
7. Nitrogen fixation, nitrogen and sulphur metabolism: Overview, biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and assimilation, sulfur uptake, transport and assimilation.
8. Phytohormones and Sensory photobiology: History of discovery of phytochromes and cryptochromes, and their photochemical and biochemical properties, photophysiology of light-induced responses, molecular mechanism of action of photomorphogenic receptors, signaling and gene expression.

SUGGESTED READINGS:

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (eds) 1997. Plant Metabolism (second edition). Longman, Essex, England.
3. Hooykaas, P.J.J., Hall, M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones. Elsevier, Amsterdam, The Netherlands.
4. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
5. Lodish, H., Berk, A., Zipursky, S.L., Maztsudaira, P., Baltimore, D. and Darnell, J.2000. Molecular Cell Biology (4th edition). W.H. Freeman and Company, New York, USA.
6. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag. New York USA.

7. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (Second edition). Academic Press, San Diego, USA.
8. Noggle, G.R and Fritz, G.F. 1977. Introductory Plant Physiology. Prentice Hall. New Delhi.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4^{th} edition). Wadsworth Publishing Co., California, USA.
10. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
11. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2^{nd} edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Prue, D. (1997) Photoperiodism in Plants (Second edition). Academic Press, San Diego, USA.

SLS/BOT/C014. Paper XIV ECOLOGY AND REMOTE SENSING

1. Vegetation organization: Concepts of community and continuum; analysis of communities (analytical and synthetic characters); community coefficient; interspecific associations; ordination; concept of ecological niche.
2. Vegetation development: Temporal changes (cyclic and non cyclic); mechanism of ecological succession (relay floristics and initial floristic composition; Facilitation, tolerance and inhibition models); changes in ecosystem properties during succession.
3. Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition (mechanism, substrate quality and climatic factors),
4. global biogeochemical cycles of C, N, P and S; mineral cycle (pathways, processes, budgets) in terrestrial ecosystems.

5. Ecosystem stability: Concept (resistance and resilience); ecological perturbation (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environmental impact assessment; ecosystem restoration.

6. Biological diversity: Concepts and levels; role of biodiversity in ecosystem functions and stability; speciation and extinction; IUCN categories of threat; distribution in global patterns; terrestrial biodiversity hot spots; inventory.
7. Climate, and vegetation pattern of the world: Life zones; major biomes, and major vegetations.
8. Soil : Definition, formation, profile and components and soil types of the world.

7. Air, water and soil pollution: Kinds; sources; quality parameters; effects on plants and ecosystems.

8. Climate change: Greenhouse gases (CO_2, CH_4, N_2O, CFCs; sources, trends and role); Ozone layer and ozone hole; consequences of climate changes (CO_2 fertilization, global warming, sea level rise, UV radiation).

9. Fire as an ecological factor: Types, role of fire, extent and causes of fire in forest, grasslands and in tropical savanna, fuel load, controlled burning, fire in different forest types in Uttaranchal; fire as management tool.
10. Ecological management: Concept; sustainable development, sustainability indicators.
11. Remote Sensing: Concepts and stages in the acquisition of remote sensing data; Spectral signature, Photographic and non photographic sensors, Space Plat forms.

12. Basic principles of Photogrammetry and Photo interpretation.
13. Application of remote sensing in ecological and forestry research.

SUGGESTED READINGS:

a. Barbour, M.G., Burk, J.H. and Pitts, W.D. 1987. Terrestrial Plant Ecology. Benjamin/ Cummings Publication Company, California
b. Begon, M., Harpor, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science, Cambridge, U.S.A.
c. Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
d. Heywood, V.H. and Watson, R.T.1995. Global Biodiversity Assesment. Cambridge University Press.
e. Kershaw, K.A. Quantitative and Dynamic Ecology. Oxford and IBH. Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
f. Odum, E.P. 1983.Basic Ecology. Saunders, Philadelphia
g. Smith, R.L. 1996. Ecology and Field Biology. Harper Collins, New York.

SLS/BOT/C015 LABORATORY COURSE I

A. Practical Exercises based on SLS/BOT/C013

1. To study the effect of temperature upon the permeability of the cytoplasmic membrane.
2. To determine the osmotic pressure (potential) of cell saps of living cells by plasmolytic method and also by using KNO_3 and sugar solution and to calculate the isotonic coefficient of sugar.
3. To determine the diffusion pressure deficit of plant cells.
4. To set up a Wilmott's bubbler and to study the effect of the following on the rate of photosynthesis (a) varying CO_2 concentration and (b) different wavelengths of light.
5. To extract the four pigments i.e. chlorophyll a & b, carotene and xanthophylls from the green leaves and preparation of their absorption spectrum.
6. To separate the four pigments i.e. chlorophyll a & b, carotene and xanthophylls from the green leaves by paper chromatography and column chromatography.
7. To separate the amino acids by paper chromatography.
8. Principles of colorimetry, spectrophotometry and flourimetry.

B. **Practical Exercises based on SLS/BOT/C014**

1. To determine the minimum size of the quadrat by species area curve method and minimum number of quadrats to be laid down in the field under study.
2. To determine the frequency, density and abundance of each species present in community.
3. To calculate relative frequency and relative density of each species in a given area.
4. To calculate mean basal cover and total basal cover of each species in a given area.
5. To compute the relative dominance and IVI (Importance Value Index) of each species in a given area.
6. To calculate the Alpha ($\propto$) diversity, Beta (β) diversity and total diversity of given community.
7. To calculate water holding capacity of three samples of various soil types and to find the percolation percentage of water in the given soil.
8. To find out the bulk density and porosity of different soil types
9. Stereo test.
10. To test the pH and the buffering properties of soils.
11. Study of types of aerial photos and satellite data products.
12. Orientation of stereo model under mirror stereoscope.

Suggested Manuals for Physiological Exercises

1. Bajracharya, D. 1999. Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.
2. Copeland, R.A. 1996. Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis. VCH Publishers, New York.
3. Dryer, R.L. and Lata, G.F. 1989. Experimental Biochemistry. Oxford University Press, New York.
4. Harborne, T.C. (1981). Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Chapman & Hall, London.
5. Ninfa, A.J. and Ballou, D.P. 1998. Fundamental Laboratory approaches for Biochemistry and Biotechnology. Fitzgerald Science Press, Inc., Maryland, USA.
6. Plummer, D.T. 1988. An Introduction to Practical Biochemistry. Tata McGraw- Hill Publishing co. Ltd., New Delhi.

Suggested Manuals for Ecological Exercises:

1. APHA- Standard Methods for the Examination of Water and Waste Water. American Public Health Association, Washington, DC.
2. Downie, N.M. and Heath, R.W. 1988. Basic Statistical Methods.
3. Kapoor /Govil. 2000. Experimental Plant Ecology.
4. Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York, USA.
5. Misra, R. 1968. Ecology Work Book. Oxford & IBH New Delhi.
6. Moore, P.W. and Chapman, S.B. 1986. Methods in Plant Ecology. Blackwell Scientific Publications
7. Pielou, E.C. 1984. The Interpretation of Ecological Data. Wiley New York.

SLS/BOT/E001A RECOMBINANT DNA TECHNOLOGY

1. Scope of rDNA technology in various sectors, Vehicles: Plasmid and Bacteriophage; Purification of DNA: total DNA, plasmid DNA and bacteriophage DNA; enzymes used in manipulation of purified DNA.

2. Cloning vectors based on *E. coli* plasmids, cloning vectors based on M13 bacteriophage and λ bacteriophage, vectors for genomic library construction, vectors for other bacteria. Vectors for yeasts and other fungi, higher plants, animal cells.

3. Rationale for the design of vectors for the over expression of recombinant proteins

4. Selection of suitable promoter sequences, ribosome binding sites, transcription terminator, fusion protein tags, purification tags, protease cleavage sites and enzymes, plasmid copy number, inducible expression system, promoter probe vectors.

5. Experiments using model systems: *E. coli, Yeast, Baculovirus, Agrobacterium tumifaciens.*

6. Basic idea of transformation, conjugation and transduction. Introduction of DNA into host cells.

7. Transformation and identification of recombinants, transfaction and identification of recombinants, transformation of non-bacterial cells.

8. Obtaining clone of a specific gene: the problem of selection, direct selection, methods of identification of clone from gene library.

9. Locating the cloned gene in plasmid and in chromosomes using southern hybridization and chromosome walking.

10. Transcript analysis, regulation of the gene expression and identifying and studying the translation product of a cloned gene (HRT and HART techniques).

11. DNA sequencing methods: Sanger-Coulson method & Maxam- Gilbert method. Automated sequencing.

12. Whole genome analysis- preparation of ordered cosmid libraries, bacteria artificial chromosome libraries. PCR & its application. DNA finger printing (RFLP & RAPD, REP-PCR etc.). Bioinformatics.

Suggested Reading:

1. Old & Primrose. Principals of Gene Manipulation.1994. Blackwell Scientific Publisher

2. Sambrook & Russel. Molecular Cloning. 3 Volumes. 2000. CHSL Press.

3. Genome Analysis. Four volumes 2000 CHS Press.

4. T.A. Brown. Gene Cloning: An Introduction. III ed. Stanley Thrones Publ.

SLS/BOT/E001B . FOREST ECOLOGY

1 Forests, forestry and man: Definition, forests in geological ages, forests in prehistoric era, shifting cultivation, forests in historical time, scientific forestry, forest policy, natural forest policy, private forest policy, panned forest development, forestry education in India.

2. Essential elements of forest ecology: Extent and boundaries, physical features, geology, river system, soil, land-use pattern, role in country's economy, forests and wild lands.

3. Forests and trees: Locality factors of the forests, forest influences, forest composition, stand structure, dynamics and growth, classification, forest types and their distribution, species diversity

4. Wild Life: Species and distribution, Sanctuaries, Biosphere reserves, wild life and recreation.

5. Forest conservancy and Potential Productivity: Soil, Water relation and nutrition, soil erosion and conservation, potential productivity of forests, site quality evaluation.

6. Forest Conservation and Management:

i) Impact of deforestation on soil and water, Role of fire: type, extent and cause of fire, fuel load, fire and different forest types of Himalaya.

ii) Forest resource management and forest resource information system.

iii) Forest cover in India-State of Art, Ground inventory. Application of Remote Sensing and Geographic Information System (GIS) in Land cover mapping. Vegetation and forest type maps.

7. Environmental Impact Assessment: Maintenance and conservational policies such as Joint Forest Management (JFM) and Agroforestry in the region.

SUGGESTED READINGS:

1. Bir, S.S. and Chatha, G.S. 1988. Forest Vegetation Characteristics of Indian Hills. Today and Tomorrow's Printers & Publ., New Delhi.
2. Dwivedi, A.P. Forestry in India. Jugal Kishor and Company, Dehradun.
3. Misra, R. Ecology Work Book. Oxford & IBH Publishing Co. New Delhi.
4. Mishra, R. and Gopal, B. Recent Advances in Tropical Ecology: Part I & II. International Society for Tropical ecology, Varanasi.
5. Negi, S.S. 1983. Forest Ecology. Bishen Singh Mahendra Pal Singh, Dehradun.
6. Puri, G.S., Gupta, R.K., Meher-Homji, V.M. and Puri, S. 1989. Forest Ecology: PlantForm, Diversity, Communities and Succession. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
7. Puri, G.S., Meher-Homji, V.M., Gupta, R.K. and Puri, S. Forest Ecology: Vol I & II. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
8. Singh, G. 1987. Forest Ecology of India. Rawat Publications, Jaipur
9. Singh, J.S. and Singh, S.P. 1992. Forests of Himalaya. Consul Book Depot. GyanodayaPrakashan, Nainital. India.
10. Singh, J.S. Singh, S.P. and Gupta, S.R. 2005. Ecology, Environment and Resource Conservation. Anamaya Publ., F-154/2 Ladosarai, New Delhi- 110 030
11. Singh, M.P. and Vishwakarma, V. 1997. Forest Environment and Biodiversity. Daya Publ. House, Delhi.
12. Wareing, R.H. and Schlesinger, W.H. 1985. Forest Ecosystems: Concepts andManagement. Academic Press, New York.

SLS/BOT/E001C NATURAL RESOURCE MANAGEMENT IN THE HIMALAYA

1. Introduction of Indian and Garhwal Himalaya, Topographic, geomorphic, socio-economic and demographic profile of Uttarakhand.
2. Natural resources and their classification. Utilization, consumption pattern emphasizing with sustainability of natural resource.
3. Natural resource use and management, policy and strategies for appropriate and sustainable natural resource management and its sustainable management and its potential to livelihood security.
4. Status of natural resources and its sustainable management in Garhwal Himalaya. Integrated approaches of natural resource management, natural resource issue and strategies for their management.
5. Concept of environment management, environmental protection and fundamental rights, man & environment.
6. Introduction to environment impact assessment, planning and significance.

7. Disaster management, classification, concept of landslide and earthquake in Garhwal Himalaya.
8. Global warming and climate change, weather & modification, loss of biodiversity. Indicators of climate change and consequences of climate changes. Retreating of glaciers.
9. Impact of climate change on natural resources with special reference to Garhwal Himalaya and strategies for mitigation.
10. Water resources, status and conservation in India.
11. Watershed management techniques (vegetation type conversion, water harvesting, reservoir construction, drainage channelization etc).
12. Water resources in Uttarakhand (glaciers, lakes and rivers of Uttarakhand), utilization pattern; Drainage systems of Ganga, Yamuna and Ramganga.
13. Environment and prospects of hydropower development, Hydro-electric projects and their effects on natural resource management in Uttarakhand. Strategies and policy for water conservation in Uttarakhand.
14. Agroecosystem, farming system, traditional agriculture practices, crop rotation; Land use pattern, land-form, land-use change, soil erosion and productivity, problems and curative measures.
15. Effect of climate change on agro-ecosystem; Conservation of crop diversity in Garhwal Himalaya, challenges of managing agro-biodiversity in Garhwal Himalaya.
16. Traditional seed supply system of mountain farmers, diversity and risks to crop genetic resources, agriculture policy.

SUGGESTED READINGS:

1. Heywood, H.V. 1995. Global Biodiversity Assessment.
2. Lochwood, M., Worboys, G.L. and Ashish, K. 2006. Managing Protected Areas: A Global Guide.
3. Singh, J.S. Singh, S.P. and Gupta, S.R. 2005. Ecology, Environment and Resource Conservation. Anamaya Publ., F-154/2 Ladosarai, New Delhi- 110 030. anamayapub@vsnl.net.in

SLS/BOT/E001D : PALYNOLOGY AND POLLINATION BIOLOGY

1. General Introduction, microsporogenesis, microspore tetrads and polarity of spores and pollen grains.
2. Pollen wall development and pollen chemistry, Chemical nature of sporopollenin, development of pollen wall, Ubisch body, pollen wall proteins, origin and formation exineless pollen grains; pollen expressed and pollen specific genes.
3. **Spore-pollen morphology:** Symmetry, shape, size, aperture patterns, NPC System for numerical expression of apertural details, exine stratification, surface structures and sculptures of sporoderm; LO-analysis and edge-analysis.
4. **Paynotaxonomy:** Systematic palynology, identification key and evolutionary trends among pollen grains based on palynotaxonomical works.
5. **Aeropalynology with reference to allergy:** AeroalIergens, introductory idea of Immune System with special reference to IgE. Study of airspora, identification of allergic taxa by *in-vivo* and *in-vitro* tests with spore-pollen extracts, chemical nature of exine-borne allergens, allergic taxa of North-West Himalaya.
6. **Melissopalynology:** Indian species of honey bees, importance of pollen grains as constituent of bee-bread, pollen-collecting mechanism of honey bees, analysis of pollen load and honey

sample in understanding bee forage, objectives of melissopalynological studies, important bee plants of North- West Himalaya.

7. **Palaeopalynology:** Introductory idea about palaeopalynological remains, significance of palaeopalynology.
8. **Forensic palynology:** Definition and significance, a few well-known case studies.
9. **Pollination Biology:** Pollen dispersal units; pollination types, contrivances for cross- and self-pollination; pollen vectors, pollination modes and flora organization, Pollen viability and storage, evolutionary trends in pollination modes.
10. Breeding systems, self-incompatibility and compatibility control with reference to pollen-pistil interactions and pollen biotechnology.

SUGGESTED READINGS:

1. Crane, Eva; Walker, Penelope and Day Rosemany.1984. Directory of Important World Honey Sources: International Bee Research Association, London.
2. Erdtman, G. 1952. Pollen Morphology and Plant Taxonomy, Angiosperms; Almquist and Wiksell, Stockholm.
3. Knut Segril, Johnson Iverson. 1975. Text book of pollen analysis 3rd edition. Blackwell Publ.
4. Nair, P.K.K. 1966. Essentails of Palynology; Asia Publication House Lucknow.
5. Woodhouse, R.P. 1935. Pollen Grains: Hafner Publication Co.

SLS/BOT/E002A PLANT HEALTH MANAGEMENT

1. Basic procedure in diagnosis of plant diseases: Significance of plant diseases.
2. Seed Pathology: Seed borne fungi. Disease transmitted through seeds. Biodeterioration of seed in storage. Control of seed borne fungi.
3. Nursery disease: Important disease of nursery plants.

   Plantation disease: Plantation disease of Chir pine, *Eucalyptus*, Sal, Teak, Shisam, *Populus*, *Acacia* (Catechu).

   Important disease of cash crops: Sugarcane, Potato and Ginger. How plants defend themselves against pathogen. Control of crop and forest disease. Treatment of wounds.

   Introduction and various forms of Mycorrhiza. Role of Mycorrhiza in Forestry.

   Diseases of cereals and Millets.

   Diseases of vegetables and fruit trees.

SUGGESTED READINGS:

1. Bilgrami, K.S. 1985. Text Book of Modern Plant Pathology. Bishen Singh Mahendra Pal
2. Singh Dehradun.
3. Butler, E.J. 1973. Fungi and Disease in Plants, Intern, Book Distributers. Dehradun.
4. Singh, R.S.1983. Plants Diseases. Oxford and IBH Publ. Co. New Delhi.
5. Singh, R.S. Principle of Plants Pathology. Oxford and IBH Publ. Co. New Delhi
6. Strobel, G.A. and D.E., Mathre 1970. Outlines of Plant Pathology. Van Nostrand
7. Reinhold Co. New York.
8. Tarr, S.A.J. 1972. The Principle of Plants Pathology. Winchester Press, New York.
9. Western, J.H. 1971. Diseases of Crop Plants. Mc Millan Press London.

SLS/BOT/E002B DIVERSITY AND CULTIVATION OF MUSHROOMS

1. General characteristics and life history: Reproduction,spore print, dissemination, growth size, colour and surface textures, odour, taste, Exudation and fairy rings; Bioluminescence and economic importance.
2. Biodiversity of Mushrooms.
3. Status of Mushroom research in India.
4. Ethnomycological approach of mushrooms, especially in Uttarakhand Himalaya.
5. Edible and poisonous mushrooms. Mushroom recipes, mushroom toxins, disease and pests of mushrooms.
6. Introduction to mushroom groups.
7. Taxonomic study of order Agaricales- Systematics of dark spored families viz., Boletaceae, Bolbiteaceae, Boudarzewiaceae, Cortivariaceae, Coprinaceae, Crepidotaceae, Entomataceae, Gomphideaceae, Paxillaceae, Russulaceae; Systematics of light spored families. Agaricaceae, Amanitaceae, Hygrophoraceae, Pluteaceae, Tricholomataceae.
8. Order Aphyllophorales: Introduction and Systematics of Cantharelloid forms, Thelephoroid forms, Cupuloid forms, Clavarioid forms, hydnoid forms and poroid forms.
9. Gasteromycetes: Introduction and Systematics of order Hymenogastrales, Lycoperdales, Nidulariales, Phallales, Podaxales and Sclerodermatales.
10. DNA isolation, amplification and ITS; RELP, RAPD Analysis; DNA Primers and markers; PCR machine and working knowledge; Gel Electrophoresis, Use of Geldoc, Sequence and Phylogenetic data analysis.
11. Computer application in Mushroom Science, Formation of clade, dendrograms and sequence alignment; Knowledge to submit mushroom sequence data online, NCBI, MEGA4 and Muttalign.
12. Ecology of mushrooms. Role of mushrooms in forest ecosystem.
13. Mycorrhiza ; endomycorrhiza (arbuscular mycorrhiza), Ectendomycorrhiza (arbutoid mycorrhiza), Ericoid mycorrhiza, Monotropoid mycorrhiza and orchid mycorrhiza.
14. Tissue culture in wild mushrooms.
15. Preparation of compost- paddy straw, saw dust.
16. Cultivation of edible and medicinal mushrooms: *Agaricus, Calocybe, Flammulina, Ganoderma, Hericium, Lentinus, Pleurotus* .

SUGGESTED READINGS:

1. Allen, M.F. 1991. The Ecology of Mycorrhiza. Cambridge Univ. Press, Cambridge.
2. Bakshi, B.K. 1974. Mycorrhiza and its role in forestry, FRI, Dehradun.

3. Chang, S.T. and W.A. Hayes. 1978. *The Biology and Cultivation of Edible Mushrooms*. Academic Press.
4. Hacskaylo, E. 1971. Mycorrhizae, USDA Forest Service Publ. No. 1189. US Govt. Printing Office, Washington, DC.
5. Hawksworth,DL; Sutton, B.C. and Ainsworth G.C. 1983. Dictionary of the Fungi. Kew, Surrey, England.
6. Krieger, LCC. 1967. The Mushroom Handbook. Dover Publications. INC New York.
7. Largent, D.L. 1977. How to identify Mushrooms to genus? I Macroscopic features. Mad River Press. Inc. Eureka.
8. Miller, O.K. Jr. 1981. Mushrooms of North America. EP Dutton, New York.
9. Singer, R. 1986. The Agaricales in Modern Taxonomy. BSMPS, Dehradun.
10. Stamets, P. and J.S. Chitton 1983. The Mushroom Cultivator, Agarikon Press, Olympia, Washington.

SLS/BOT/E002C : APPLIED PLANT ANATOMY

1. Different types of microscopes, their working and utility.
2. Sources of Timber. Importance of knowledge of wood structure.
3. How wood is formed: Cambium and its derivations, secondary growth, juvenile wood and mature wood.
4. Physical features of wood visible on the cross surface of log, sapwood and heart wood, growth rings and growth marks, colour, luster, odour and taste, weight, grain, texture.
5. Gross features of wood visible on longitudinal surface of wood.
6. Ultra structure of wood and techniques: Electron microscope, ultra structure of cell wall, micro-fibril angle.
7. Natural defects of wood: Reaction wood, Knots, Silica content and other defects due to stress. Defects of timbers to utilization.
8. Wood structure in relation to properties and uses.
9. Criteria and methods of assessment of wood quality in plantation grown timbers, viz: *Eucalyptus* and *Poplar* for pulp and timber.

SUGGESTED READINGS

1. Wilson and Whyte Text Book of Wood Technology. HP Brown, McGraw Hill, New York.
2. Indian Forest Utilization. FRI Vol. I and II. Comparative Wood Anatomy. Sherwin Carlquist.
3. Ramesh Rao, K and Junija. Field Identification of 50 important timbers of India, FRI.
4. Tieman Pitman. Wood Technology. New York.
5. Foster, AS, Nostrand, D Van. Practical Plant Anatomy. New York.
6. Gupta, S. Atlas of Indian Heartwoods- their anatomical features and photomicrographs.
7. Fahn, A. Plant Anatomy. Pergamon Press.

SLS/BOT/E002D ECOSYSTEM ANALYSIS, GIS AND REMOTE SENSING ANALYSIS

Aerial Photography and Photogrammetry (AP&P):

1. Fundamentals of Aerial Photography, History, Aerial film processing, Procurement, and Security of Aerial photographs, Energy source and atmospheric effects in aerial photography. Principles of Aerial Photos (flight planningon).
2. Introduction to Photogrammetry, Geometry of Aerial photos, Stereoscopic photography, Measurement of Height, Aerial Triangulation.
3. Principles and fundamentals of Aerial photo interpretation. Basics of Cartography.

Remote Sensing (RS):

4. Introduction to Remote Sensing. The electromagnetic spectrum, Energy instruction with atmosphere and earth surface, satellite and sensors, Remote sensing data acquisition.
5. Principles and basic concepts of Multi spectral, Thermal and hyperspectral Scanning: Across-track and Along Track multispectral Scanning. History of Space Imaging
6. Image Interpretation: Type of Imagery, elements of Interpretation**,** Techniques of Visual Interpretation, Role of remote sensing in ecological research.

Digital Image Processing (DIP):

7. Fundamentals of digital image processing, Image rectification, Restoration and Enhancement.

8. Image classification: Supervised classification, unsupervised classification, Hybrid classification, Post-classification smoothing and Classification accuracy assessment.

9. Principles of microwave sensing, Geometric characteristics, Spatial resolution. Spaceborne Radar System, Application of passive microwave sensing.

Geoinformatics (GIS):

10. Basics of Computer, Hardware and software,

11. Principles and basics of Geographic Information System: Raster and Vector GIS, Database creation and management. Network Analysis, Spatial data integration and Modelling.

12. Basics of Global Positioning System, GPS Satellites and GPS utility.

Suggested Readings:

1**.** Lillesand & Kieffer, Remote Sensing and Image Interpretation. John Wiley & Sons, New York.

2. Sabins, F.F., Jr. Remote Sensing: Principles and interpretation.

3. Bhatia, S.C. Fundamentals of Remote Sensing.

4. Chanda, Datta, Majumdar. Digital Image Processing & Analysis.

5. Chang, K.T. Introduction to Geographic Information Systems.

6. Rao, et al., Geographic Information System.

7. Johnston C.A. Geographic Information Systems in ecology.

8. Ahmed, E. I & Rabbany. Introduction to Global Positioning System.

9. Aronoff, S. 1991. Geographic Information Systems: A Management Perspective. Ottawa WDL Publ.
10. Barrett, E.C. 1982. Introduction of Environmental Remote Sensing. Chapman and Hall.
11. Burrough, P.A. 1986. Principle of Geographic Information System for Land Resources Assessment. Oxford University Press.
12. Colwell, R.N. 1983. Manual of Remote Sensing. Vol. I.II American Society of Photogrammetry.
13. Curran, P.J. 1985. Principle of Remote Sensing. Longman Group.
14. Dury, S.A. 1990. A Guide to Sensing. Interpreting Image of Earth. Wiley and Sons.
15. Hord, R.M. 1986. Remote Sensing: Method and Application, John Wiley and Sons.
16. Jenson, J.R. 1996 Introductory Digital Image Processing, Prentice Hall. New Delhi.
17. Johnson, P.l. 1969. Remote Sensing in Ecology. Univ. Georgia Press, Athens.
18. Rampal, K.K. 1982. Text Book of Photogrammetry. Oxford and IBH Press.,
19. Rees, W.G. 1990. Physical Principles of Remote Sensing, Cambridge University Press.
20. Schander, E. 1976, Remote Sensing for Environmental Sciences. Springer Verlag.
21. Ulaby, F.T. Moor, R.K. and Fung, A.K. 1982. Microwave Remote Sensing Active and Passive. Vol. I and II Wesley Pub.

SLS/BOT/E03 LABORATORY COURSE II
(Based on elective papers)

SLS/BOT/E001A

1. Isolation of DNA and plasmid.
2. Restriction digestion of vector and DNA.
3. Ligation of DNA construct and vector.
4. Demonstration of transformation and selection of recombinant clones.

SLS/BOT/E001B

1. To undertake studies on stand analysis, dominance, diversity and similarity coefficient.
2. To make studies on gradient analysis.
3. To identify different forest types of the locale.
4. Calculate the Pateron week index of any natural forest stand.
5. Study ordination and continuum of different forest stands.
6. Study interspecific Association in forest stands using Plot less technique.
7. Calculate analytical and synthetic characters of different forest stands.
8. Prepare profile diagram of forest stands using Single Plot Method.

SLS/BOT/E001C

1. Field surveys to study various types of natural resources in Uttarakhand Himalaya.
2. Study on the pressures impinging on the natural resources.
3. Observations on the Environment Impact Assessment of Hydroelectric Power Project in Uttarakhand Himalaya.
3. Observations on Natural disasters viz., floods, landslides, forest fires frequent in Himalayas
4. Visits to National Parks, Wild life Sanctuaries and Biosphere Reserves.

SLS/BOT/E001D

1. Pollen morphological studies of some pterodophytes, gymnosperms, and angiosperms representing different morphological types using acetolysis / alkali maceration method.
2. Extraction of pollen grains from honey sample and study of the frequency of different morpho-types.
3. Study of in vivo and in vitro germination of pollen grains.
4. Morpho-anatomical study of stigma and style.
5. Study of the growth of pollen tube through stigma and style.
6. Study of allergy producing pollen morpho-types.

SLS/BOT/E002A

1. Isolation and inoculation of mycorrhiza.
2. Study of seed borne pathogen. Description of pathogen, symptoms and section cutting.
3. Isolation of some important pathogens.
4. Procedure of equipments uses.
5. To establish a plant disease clinic in the department for advise to local people.

SLS/BOT/E002B

1. Collection, preservation and identification of wild mushrooms
2. Morphological features: field notes, chemical spot tests, photography, sporeprint, colour change, smell, taste, etc.
3. Anatomical features: Microscopic studies, Mycorrhizal studies.

4. Ecological Observation.

5. Tissue culture techniques: Media preparation, solid and liquid culture media preparation. Pure culture techniques. Sub culturing, Lyophilization, Maintenance of mushroom culture.

6. Cultivation of *Agaricus, Calocybe, Flammulilna, Ganoderma, Lentinus* and *Volvariella.*

1. DNA Isolation, amplification and ITS, RELP, RAPD analysis, DNA primers and markers. PCR and Gel electrophoresis.

SLS/BOT/E002C

1. Different types of Microscopes, their working and utility. Research, Polarized and Electron Microscopes.
2. Juvenile wood and mature wood: Maceration techniques.
3. Section cutting and mounting of different types soft and hard woods (locally available). Microscopic and anatomical features of wood viz: bamboo, canes and coconut.
4. Ultra structure of the wood and techniques. Study of cell wall, microfibril angle and proportion of tissues.
5. All physical features visible on cross surface of log.
6. Gross features of wood visible on longitudinal surface.

SLS/BOT/E002D

2. Stereo test and study of different types of aerial photos, Orientation of Stereomodel for interpretation and mapping.
3. Determination of Scale, Determination of Height and Slope.
4. Visual interpretation of aerial photos and satellite data on different scales, Study of different types of satellite data products.
5. Study of Multispectral data, Study of Image Processing Systems, Display of raw data, Histogram analysis.
6. Digital classification and Enhancement of satellite data, Information extraction using DIP techniques.
7. Study of Geographic Information System, Geo-referencing, designing GIS database, Editing spatial and attribute data, out put presentation.

SEMESTER IV

SLS/BOT/C016 CONSERVATIONAL BIOLOGY

1. Conservation: The basic concept, History of conservation biology.
2. The origin and evolution of organism; genetic plasticity a factor in evolution; the invasion of unoccupied ecological niches.
3. Patterns of biodiversity: Global and regional patterns of biodiversity, Distribution, Gradients, Magnitude of biodiversity, Hotspots, keystone species, effects of species deletion and addition on maintenance of biodiversity.
4. Uses of biodiversity: food, fodder, timber, fibre, medicine, etc.; biodiversity based products and industries; wild relatives of cultivated plants; scientific role of biodiversity.
5. Threats to biodiversity: Habitat loss and fragmentation, Genetic drift, Inbreeding, Disturbance, Pollution, Climate Change, Overexploitation, Invasive Species, Disease,
6. Global environmental problems: Global warming, ozone depletion, desertification.
7. Extinction to species: Susceptibility to extinction causes of species extinction, endangered species, Red and Green Data Books.
8. Environmental Impact Assessment (EIA) origin and development, development in India, Purpose and aims of EIA, Core values and principles, EIA process, components of EIA, Participants in EIA process, Impact identification methods.
9. Conservation of Biological diversity: Genetic principles in conservation, biodiversity assessment and inventory.
10. Survey and monitoring of biological resources: sampling population for biological conservation; Collection and analysis of inventory data, criteria on choice of species for conservation. People participation, biodiversity registers and their maintenance.
11. Conservation of energy resources; conservation and maintenance of non renewable fossil fuel resources; Conservation of biodiversity based renewable energy resources.
12. Conservation of biological resources: In situ and Ex Situ Conservation Strategies, Designing Networks of Protected Areas; Restoration of endangered species, Problems of Small Populations, Establishing New Populations; Sustainable use and public participation, Guidelines for Successful Monitoring, politics and economics in the decision-making process, Challenges for the future.
13. Protected Area Network, PAN with special reference to Uttarakhand and India. Indian biodiversity and its conservation: International efforts for conserving biodiversity viz., CITES, CBD, IUCN, MAB, UNEP, UPOV (Union for the Protection of New Plant Varieties), WTO etc.). International treaty on Plant Genetic Resources, International Agreement for conserving marine biodiversity, Wetland conservation, Rangeland management.
14. Ecosystem restoration, Strategies and plans for restoration, Passive restoration (natural recovery) and active restoration.
15. National Forest Policy 1929, Wildlife (Protection) act 1975, Forest (Conservation) Act 1980, Environment (Protection) Act 1986, Fisheries Act 1987, Wildlife (Protection) Amendment Act 1991, Biodiversity Act 2003, etc.

SUGGESTED READINGS

1. Cain, M.L., Bowman, W.D. & Hacker, S.D. 2008. Ecology. Sinauer Associates, Inc.
2. Dhar, U. 1993 (Ed.). Himalayan Biodiversity: Conservation Straegies, Gyanodaya Prakashan, Nainital

3. Groombridge, B. and Jenkins, M.D. 2000. Global Biodiversity. Earth's living resources in the 21th century, UK. World conservation Monitoring Center. Pp 246.
4. Hunter, M.L.J. 1990. Wildlife, forest and forestry: Principals of Managing forests for biological diversity. Prentice Hall. Englewood. Cliffs. New Jersey. 370 pp.
5. Hunter, Jr, M.L. & Gibbs, J.P. 2006. Fundamentals of Conservation Biology. Wiley Blackwell.
6. Pullin, A Conservation Biology. Cambridge University Press, The Edinberg Building, Cambridge CB2ZRU, UK.
7. Primack, R.B. 2006. Essentials of Conservation Biology. Sinauer Associates, Inc.
8. Primack, R.B. 2008. A Primer of Conservation Biology. Sinauer Associates, Inc.
9. Singh, J.S., Singh, S.P. & Gupta, S.R. 2007. Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi.
10. Western, D. and Pearl, M.C. 1989. Conservation for twenty-first century. Oxford University Press, Oxford UK. Pp 109-120.

SLS/BOT/C017 BIOTECHNOLOGY AND GENETIC ENGINEERING OF PLANTS AND MICROBES

1. Biotechnology: Basic concepts, principles and scope.
2. Plant cell and tissue culture: General introduction, history, scope, concept of cellular differentiation, totipotency.
3. Organogenesis and adventive embryogenisis: Fundamental aspects of morphogenesis, somatic embryogenesis and androgenesis, mechanisms, techniques and utility.
4. Somatic hybridization: Protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitations of protoplast research.
5. Applications of plant tissue culture: clonal propagation, artificial seed, production of hybrids and somaclones, production of secondary metabolites/natural products, cryopreservation and germplasm preservation.
6. Recombinant DNA technology: Gene cloning principles and techniques, construction of genomic and cDNA libraries, choice of vectors, DNA synthesis and sequencing, polymerase chain reaction, DNA finger printing.
7. Genetic engineering of plants: Aims, strategies for development of transgenics (with suitable examples), *Agrobacterium*- the natural genetic engineer, T-DNA and transposon mediated gene-tagging, chloroplast transformation and its utility, intellectual property rights, possible ecological risks and ethical concerns.
8. Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.
9. Genomics and proteomics: Genetic and physical mapping of genes, molecular markers for introgression of useful traits, artificial chromosomes, high throughout sequencing, genome projects, bioinformatics, functional genomics, microarrays, protein profiling and its significance.

SUGGESTED READINGS:

Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice (a revised edition). Elsevier Science Publishers, New York, USA.

Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.
Brown, T.A. 1999. Genomes. John Wiley & Sons (Asia) Pvt. Ltd., Singapore.
Callow, J.A., Ford-Lioyd, B.V. and Newbury, H.J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use. Cab International, Oxon, UK.
Chrispeels, M.J. and Sadava, D.E. 1994. Plants, Genes and Agriculture. Jones & Bartlett Publishers, Boston, USA.
Collins, H.A. and Edwards, S. 1998. Plant Cell Culture. Bioscientific Publishers, Oxford, UK.
Glazer, A.N. and Nikaido, H. 1995. Microbial Biotechnology. W.H. Freeman & Company, New York USA.
Gustafson, J.P. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
Henry, R.J. 1997. Practical Applications of Plant Molecular biology. Chapman & Hall, Landon, UK.
Jain, S.M., Sopory, S.K. and Veilleux, R.E. 1996. In Vitro Haploid Production in Higher Plants, Vols, 1-5., Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecht, The Netherland.
Jolles, O. and Jornvall, H. (Eds). 2000. Proteomics in Function Genomics. Birkhauser Verlag, Basel, Switzerland.
Kartha, K.K. 1985. Cryopreservation of Plant cells and Organs. CRC Press, Boca Raton, Florida, USA.
Old, R.W. and Primrose, S.B. 1989. Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford, UK.
Primrose, S.B. 1995. Principles of Genome Analysis. Blackwell Science Ltd., Oxford, UK.
Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.
Shantharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety & Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
Vasil, I.K. and Thorpe, T.A. 1994, Plant Cell and Tissue Culture. Kluwer Academic Publishers, The Netherlands.

SLS/BOT/C018 LABORATORY COURSE I

A. Laboratory/Field Exercises in Conservation Biology.

1. To study the pattern of regional biodiversity.
2. To study the Hot spots and key stone species.
3. Survey of biological resources.
4. Study of habitat loss with respect to plant species. To observe factors expediting habitat loss viz., floods, forest fires, land slides, natural and anthropological activities.
5. Visits to national parks, sanctuaries and biosphere reserves of Uttarakhand.
6. Visit to ecosystem restoration sites in mined areas in Uttarakhand Himalayas.

B. Laboratory/Field Exercises in Biotechnology and Genetic Engineering.

1. Growth characteristics of *E. coli* using plating and turbidimetric methods.
2. Isolation of plasmid of *E. coli* by alkaline lysis method and its quantitation spectrophotometrically.
3. Restriction digestion of plasmid and estimation of the size of different DNA fragments.

4. Cloning of a DNA fragment in a plasmid vector, transformation of the given bacterial population and selection of recombinants.
5. Demonstration of DNA sequencing by Sanger's dideoxy method.
6. Demonstration of protoplast fusion employing PEG.
7. Organogenesis and somatic embryogenesis using appropriate explants and preparation of artificial seed.
8. Co-cultivation of the plant material (e.g. leaf discs) with *Agro bacterium* and study GUS activity histo-chemically.

Manuals for Laboratory Exercises

1. Butenko, R.G. 2000. Plant Cell Culture. University Press of Pacific.
2. Collin, H.A. and Edwards, S. 1998. Plant Cell Culture. Bioscientific Publishers, Oxford, UK.
3. Dixon, R.A. (Ed.) 1987. Plant Cell Culture: A Practical Approach. IRL Press, Oxford.
4. Gelvin, S.B. and Schilperoort, R.A. (Eds.), 1994. Plant Molecular Biology Manual, 2nd edition, Kluwer Academic Publishers, Dordrecht, The Netherlands.
5. George, E.F. 1993. Plant Propagation by Tissue Culture. Part 1. The Technology, 2nd edition, Exegetics Ltd., Edington, UK.
6. George, E.F. 1993. Plant Propagation by Tissue Culture. Part 2.In Practice, 2nd edition, Exegetics Ltd., Edington, UK.
7. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
8. Glover, D.M. and Hames, B.D. (Eds), 1995. DNA Cloning 1: A Practical Approach; Core Techniques, 2nd edition, PAS, IRL Press at Oxford University Press, Oxford.
9. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/ Cummings Publishing Co., Inc Menlo Park, California.
10. Hall, R.D. (Ed.), 1999. Plant Cell Culture Protocols. Humana Press, Inc., New Jersey, USA.
11. Shaw, C.H. (Ed.) 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.
12. Smith, R.H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press, New York.

SLS/BOT/E004 Dissertation/ Project Work

Dissertation is an elective and optional for students scoring 75% or more upto second semester. The dissertation is to be allotted in the beginning of III Semester and would be submitted at the time of the examination of IV Semester. The distribution of marks for the Dissertation will be as below:

Periodical presentation	:	60 Marks
Dissertation	:	180 Marks
Viva-Voce	:	60 Marks
Total	:	300 Marks

The Dissertation would carry 09 credits in all.
The dissertation/ Project report shall be evaluated jointly by the supervisor and one external examiner.

Following topics/research fields are proposed to undertake Dissertation/ Project Work.
Any other current trends / topics suggested by the Departmental committee may also be considered for the dissertation/project work.

Anatomy of Himalayan woods

Chromosome Analysis and Indexing of Himalayan Flora

Conservation of Endangered Species

Environment Impact Assessment

High Altitude Ecology and Climate Change

Invasion Ecology

Inventorization of unexplored Areas and Hotspots

Limnology

Plant Biodiversity Assessment

Pollution Monitoring

Population/weed/ Reproductive Biology

Survey of Less known Economic Plants

Or

In lieu of dissertation any two of the following elective papers of 03 credits each and one lab course of 03 credits (total 09 credits) would be chosen by the student.

SLS/BOT/E005A : PROPAGATION TECHNIQUES

1. Environmental factors of Propagation: Fundamental microclimate and edaphic factors in the propagation environment; Managing the propagation environment; Management of edaphic factors in propagation; Management of Biotic factors-Pathogen and Pest Management; Post propagation care
2. Seed Propagation: Sources of seed, Harvesting and processing seeds, Seed testing and seed storage; Dormancy and regulation of germination; Field nurseries for transplant production
3. Vegetative Propagation: Selection and management of clones in vegetative propagation; Reasons for using clonal cultivars; Genetic basis of clones; Non-genetic variation within clones; Propagation sources of their management
4. Propagation by Cuttings: Observations of Adventitious root and bud formation; Factors affecting regeneration of plants from cuttings; Biochemical basis for Adventitious root formation; Importance and advantages of propagation by cuttings; Types of cutting, stock plants, rooting media; Management practices- Cutting nutrition, care of cuttings; Handling field propagated plants and container grown plants.
5. Propagation by Grafting: Reasons for grafting and budding, Natural grafting; Polarity and genetic limits of grafting, Graft incompatability; Types of grafts: Detached scion graftage, Approach graftage, Repair graftage; Scion-rootstock relationship; Aftercare of grafted plants.
6. Techniques of Budding: Rootstock for budding; Time of budding; Types of budding; Micro budding.
7. Layering and its natural modifications: Physiology of regeneration by layering; Procedures in Layering; Management of plants during layering; Plant modifications resulting in natural layering;
8. Micro-propagation: Micro-propagation of plantlets from tissue culture; Types of systems used to regenerate plantlets by micro-propagation Callus, cell and protoplast culture systems.

Practical course:

1. Seed testing of different species for variability
2. Working out the germination percentage of different types of seeds.
3. To study Plant propagation by seed (scarification, stratification)
3. Effect of pretreatments on germination of seeds.
4. Propagating different plants by using budding and layering in the field at some horticultural station,
5. Plant propagation by cutting and layering techniques.
6. Propagation through specialized vegetative structures and micro propagation.
7. Preparation of different types of tissue culture media.
8. Development of callus from different explants.
9. Regeneration of plants from callus.
10. Micropropagation of plants using different explants.
11. Developing somatic embryos.
12. Development of synthetic seeds.

SUGGESTED READINGS:

1. Bajaj YPS. (ed). 1988. *Biotechnology in Agriculture and Forestry*. Springer-Verlag.
2. Gupta P.K. 2000. *Elements of Biotechnology*. Rastogi Pub.
3. Kumar S. and Singh M.P. 2008. *Plant Tissue Culture*. APH Pub.
4. Mandal A.K and Gibson G.L. (ed.). 1997. *Forest Genetics and Tree Breeding*. CBS.
5. Hong, T. D. and Ellis, R. H. 1996. *A protocol to determine seed storage behaviour*. IPGRI Technical Bulletin No. 1. (J. M. M. Engels and J. Toll, vol. Eds.) International
6. Khullar, P. *et al*. 1992. *Forest seed*. ICFRE, New Forest, Dehra Dun.
7. Leadem, C.L. 1984. *Quick Tests for Tree Seed Viability*. B.C. Ministry of Forests and Lands, Canada.
8. Schmidt, L. 2000. *Guide to handling of tropical and subtropical forest seed*. DANIDA Forest Seed Centre, Denmark.
9. ISTA. 1993. *International Rules for Seed Testing*. International Seed Testing Association, Zurich, Switzerland.
10. Hartman, H.J. *et al*., 1990 : Plant propagation . Principles and practices. Prentice Hall, New Delhi.
11. Schwalz. M. 1975. Guide to commercial hydrophonics. Israel Univerisity, Jerusalem.
12. Sharma, V.K. 1996. Plant Nurseries: Techniques, production and management. Indian Pub. New Delhi.
13. Sadhu, M.K. 1989 : Plant propagation. New Age Pub. New Delhi.
14. S. S. Bhojwani and M. K. Razdan. 1996. Plant tissue culture: Theory and Practice. Elsevier Publishers, Amsterdam.
15. Dixon R. A. and Gonzales R. A. (Ed.) 1994. Plant cell culture, a practical approach. Second Edition. Oxford University Press, Oxford.
16. Gamborg O. L.and G. C. Phillips. 1995. Plant cell, tissue and organ culture, fundamental methods. Springer International student Edition.
17. Sharma,R.R. and Manish Srivastava**.** Plant Propagation and Nursery Management (Hardcover).
18. Aldriance GW and Brison FR (2000) Propagation of horticultural plants. Mc Grow Hill Book Company. Inc, New York.
19. Bose T. K., Mitra S.K., Sadhu M.K. and Das P. (1997) Propagation of Tropical and Sub tropical Horticultural Crops. IInd Edition, Naya Prakash, Calcutta.
20. Sharma RR (2002) Propagation of Horticultural crops: Principles and Practices. Kalyani Publishers, New Delhi.

SLS/BOT/E005B .ENVIRONMENT MANAGEMENT WITH REFERENCE TO WESTERN HIMALAYA.

1. Introduction to the Environmental Management, Major Environmental Problems, Environmental ethics; Resource and conflicts, Environmental Laws; Stockholm Conference, The Earth summit, The Copenhagen Conference, Environmental Protection and Fundamental rights, Environmental Governance in India, Man and Environment, Trade and Environment; the WTO and GATS, Environment Concerns and WTO.

2. Introduction to the Environmental Impact Assessment; Planning and Significance, EIA practices and future trends in India; Legal frame work for EIA. Impact of forest fires, Forest Fire

Assessment and Risk Zonation. Thermal power stations, Power line and roads, River valley projects, Urbanization and Industrialization, Mining activities, GHGs, CFCs, fossil fuels etc., Flood monitoring, Snow melt and Glaciers, Ozone Layer Depletion. Principles of Environmental Analysis, Role of remote sensing in EIA.

3. Environmental Management and Natural Resources, Air Pollution , Water Pollution and its Management, Environmental Pollution Act; Waste disposal and management, Integrated solid waste management, Recycling, Incineration, Sanitary landfill, Sewage disposal and sewage treatment; Hazardous wastes.

4. Environmental policy and environmental management system, Audit items and audit procedures, ISO Certification.

5. Watershed management: Definition and basic concepts, Aims and Principles, Importance of integrated watershed management, Principal watershed problems of India.

6. Basic concept of ecosystem and community, Biological populations and communities, Ecological niches, interaction among species, Key stone species, Species diversity and edge effects, Major terrestrial and aquatic biomes, Energy Flow, Food webs and trophic levels, Ecosystem diversity, Climate shifts, Species movements.

7. Biodiversity and conservation, *In-situ* and *ex-situ* conservation, Indigenous knowledge and biodiversity conservation, Loss of biodiversity- causes and its impact; Convention on biodiversity, Major Biodiversity resources. Global trends of invasive species, threats and managing invasive plants.

8. Protected areas concept and purpose, type of protected areas and threats, In situ conservation and protected areas; Role of local communities in protected area management.

9. Renewable Energy Production and Management: Energy concepts, present global energy use, future energy needs, renewable needs, energy conservation.

10. Biofuel plants- *Jatropha*, sugarcane and oil crops, Biofuel plantation, energy criteria for species selection, achievement of sustainable Biofuel production; Bioconversion, utilization of biomass sources, Incineration of organic wastes for energy. Alien invasive species and bioenergy production; Bioenergy and food production controversies. Carbon sequestration and carbon pools.

Practical:

1. Identification of Key stone species.
2. To study phytoplankton and benthos in aquatic bodies.
3. Analysis of water for dissolved oxygen.
4. Estimation of biological oxygen demand and chemical oxygen demand.

5. Case study of any hydroelectric power project in Uttarakhand with EIA prospective using remote sensing and GIS.

SUGGESTED READINGS

1. FAO Conservation Guide Nos. 12, 13/1, 13/3, 13/4, 13/6, 14. Rome.
2. Heywood, H.V. 1995. Global Biodiversity Assessment.
3. Lochwood, M., Worboys, G.L. and Ashish, K. 2006. Managing Protected Areas: A Global Guide.
4. Ramakrishnan, P.S., Saxena, K.G. and Chandrashekara, U.M. 1998. Conserving the sacred for Biodiversity Management. Oxford and IBH Publ. Co. New Delhi
5. Richard, P.P. 1998. Essentials of Conservation Biology. Boston University.

SLS/BOT/E005C BIOINFORMATICS AND BIOLOGICAL DATA BASE

1. Concepts, overview and scope of bioinformatics, Bioinformatics and the Internet, Basic principles of computing in bioinformatics, Use of databases in Biology: primary databases: Gene Bank, SWISSPROT, PDB; specialized databases: PFAM, SCOP, PROSITE; database querying using keywords and search engines.
2. Annotated sequence databases, Genome and organism-specific databases, miscellaneous databases, Sequencing DNA, RNA and proteins, determination of protein structure, Gene and protein extraction data.
3. Data retrieval with Entrez, DBGET/Link DB and SRS (sequence retrieval system), Sequences similarity searches, Amino acid substitution matrices, databases searches with FASTA and BLAST, Multiple sequences alignment and family relationships, Protein families and pattern databases.
4. Principles of genome annotation, Annotation tools and resources, Conceptual models of protein structure, protein structure and function, Obtaining, viewing and analysing structural data, Classification of proteins of known three-dimenstional structure: CATH and SCOP, Protein structure prediction, Secondary structure prediction.
5. Microarray data analysis, tools and resources, Sequences sampling and SAGE, Analysing data from 2D-PAGE gels, Analysing protein mass spectrometry data, modeling and restructuring molecular pathways, Protein interaction informatics, Higher-order models.
6. Phylogenetics, cladistics and ontology; Building phylogenetic trees; Evolution of macromolecular sequences.
7. Chemoinformatic resources, Conventions in representing molecules, Pharmainformatics.

SUGGESTED READINGS

1. Attwood, T.K. & Parry-Smith, D.J. 1999. Introduction to Bioinformatics. Addison Wesley Longman, Harlow, Essex.
2. Baxevanis, Andreas D. & Quellette, B.F. Francis 2004. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd edition. Wiley Blackwell.
3. Brown, T.A. 2006. Genomes 3. Garland Science.

4. Lesk, A.M. 2005. Introduction to Bioinformatics, 3rd edition. Oxford University Press, Oxford.
5. Mount, D.W. 2004. Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, U.S.
6. Parish, J.W. & Twyman, R.M. 2002. Instant Notes in Bioinformatics. Taylor & Francis.
7. Patthy, L. 1999. Protein Evolution. Blackwell Science Ltd., Oxford.
8. Primrose, S.B. & Twyman, R. Principles of Genome Analysis and Genomics. Blackwell, Oxford.
9. Zyelibil, M & Baum, J.O. 2007. Understanding Bioinformatics. Garland Science.

Database Sites

www.ncbi.nlm.nih.gov
www.dnalc.org
www.hugo-international.org
www.enseml.org

Practical course

1. Introduction to bioinformatics softwares and their downloading and installation.
2. Hands on experience on the database BLAST, FASTA.
3. Searching sequences, data analysis and modeling molecular pathways.
4. Constructing Phylogenetic trees.

SLS/BOT/E005D : SEED PATHOLOGY

1. Introduction, terminology and historical development, seed health and its importance.
2. Kinds of seed borne pathogens: fungi, bacteria, viruses, viroides and nematodes.
3. Types of damage caused by the seed borne fungi to seeds and crops.
4. Nature of seed infection. Systemic infection through flower, fruit and seed stock. Penetration through seed coat, natural openings and inflicted openings.
5. Longevity of seed borne pathogens. Factors influencing longevity.
6. Epiphytology of seed borne diseases, monocyclic and polycyclic diseases
7. Detection of seed borne pathogens, objectives of seed health testing. Testing methods for seed borne fungi, seed borne bacteria, seed borne viruses and seed borne nematodes.
8. Study of seed borne diseases of certain specific crops, cereals, millets, pulses, oil crops, fibre crops, and vegetable and timber crops
9. Control of seed borne pathogens: selection of seed production areas, crop management, seed treatment, certification, plant quarantine and disease resistance.

Practical:

1. Field inspection of seed crops and visual examination of seeds for infections.
2. Seed soaking for the detection of certain seed borne pathogens (fungi) and nematodes.
3. Seed washing tests and incubation methods.
4. Seedlings symptomatology tests.
5. Detection of bacteria by Agar Plate methods.

6. Viruses : Physical examination, Grow out tests, Enzyme linked immunoabsorbent assay (ELISA) and Polymerase Chain Reaction (PCR).
7. Visit to seed processing plants and seed testing laboratory.
8. Reduction of seed inoculum by chemical seed treatments.
9. Testing amount of pesticides in treated seeds.

SUGGESTED READINGS

1. Neegard P. 1977. Seed Pathology Vol I and II. MacMillan Press, London
2. Suryanarayan, D. 1978. Seed Pathology. Vikas Publ. House. Pvt. Ltd. New Delhi.
3. Jha, D.K. 1995. A Text Book of Seed Pathology. Vikas Publ. House. Pvt. Ltd. New Delhi.
4. Agarwal, V.K. 1978. Principles of Seed Pathology. In (ed.) James B.S. Sindair.CRC Press. II Edition.
5. Desai, B.B. Seed Handbook. CRC Press.
6. Singh, Gurnam, Seed Pathology. Pointer Publisher, Jaipur.
7. Sing, T. Seed Technology and Seed Pathology . Pointer Publisher, Jaipur.
8. Nene, Y.L. and Agarwal, V.K. 1978. Some seed borne diseases and their control. ICAR, New Delhi

SLS/BOT/E006 LABORATORY COURSE II

Students will have to choose two practical courses from the theory papers opted by the student. Syllabus of each practical course has been mentioned at the end of theory paper.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – BUSINESS MANAGEMENT

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Ordinance for Business Management Courses
Department of Business Management

(Approved copy of Syllabus based on credit System for two year full time Master in Business Administration Degree Programme)

1. Two Year Full time M.B.A. Degree Programme:

There shall be full time Master's Degree Programme in Business Administration (M.B.A). The duration of the Programme shall be two years (Two full Academic Years of Four Semester of six month each). Accordingly each year is divided in two semester- First and Third Semesters from July to December and Second and Fourth Semesters from January to June. The Examination for First and Third Semester shall ordinarily be held in the month of December and for Second and Fourth Semester in the month of May or on such dates as convenient to the University.

2. Intake: Total number of seats: *There shall be a maximum of seventy Eight (78) seats for each year or such number of seats as may be approved by the University. The reservation policy will be applicable as laid down by the Central Government.*

Course Fees: *The Fees and other charges for the Course and norms for refund of fees shall be as prescribed by the University from time to time.*

3. Eligibility for Admission to the Programme: No students shall be eligible for admission to Two Year Full time M.B.A Degree Programme unless he/she has completed Three Year Degree course University/Autonomous Institution.

4. Admission Procedure: Admission to Two year full time MBA Degree Programme shall be through entrance test conducted by the University or such by such agency as may be authorized by the University. The merit for admission shall be prepared on the basis of written test, Group Discussion and Personal Interview conducted by head/coordinator of the MBA programme.

5. Examination: Examination and evaluation shall be as per the university rules.

6. Course Numbering/coding: For two year full time MBA Degree course, the course structure shall be as per the following numbers and codes:

MBA-First Semester (All Papers are Compulsory-Total credits-18)

Paper Code	Subject/Paper	Credit	L	T	P
BM/SOM/C-101	Principles and Practices of Management	3	3	0	0
BM/SOM/C-102	Business Environment	3	3	0	0
BM/SOM/C-103	Entrepreneurship Development	3	3	0	0
BM/SOM/C-104	Financial Accounting	3	3	0	0
BM/SOM/C-105	Managerial Economics	3	3	0	0
BM/SOM/C-106	Management Information System	3	3	0	0

MBA-Second Semester (All Papers are Compulsory-Total credits-18)

Paper Code	Subject/Paper	Credit	L	T	P
BM/SOM/ C-201	Financial Management	3	3	0	0
BM/SOM/ C-202	Human Resource Management	3	3	0	0
BM/SOM/ C-203	Organizational Behaviour	3	3	0	0
BM/SOM/ C-204	Production and Operations Management	3	3	0	0
BM/SOM/ C-205	Marketing Management	3	3	0	0
BM/SOM/ C-206	Research Methodology	3	3	0	0
BM/SOM/ SS-207	*(Self study course) Professional Communication*	*3*	*3*	*0*	*0*

MBA-Third Semester(Total Credit-C-9 E-9)

Three (3) compulsory Papers and three (3) Optional/elective papers has to be selected for study in such way that two (2) papers from one Group known as Major specialization and One (1) Paper from another Group known as Minor Specialization.

Paper Code	Subject/Paper	Credit	L	T	P
BM/SOM/C- 301	Management Accounting	3	3	0	0
BM/SOM/ C-302	Project Management	3	2	1	0
BM/SOM/ C-303	Operations Research for Business Applications	3	2	1	0
BM/SOM/E-304	**Marketing Group**				
. M-1	1. Consumer Behaviour	3	2	1	0
M-2	2. Marketing Research	3	2	1	0
M-3	3. Marketing of Services	3	2	1	0
M-4	4. Industrial Marketing	3	2	1	0
M-5	5. Rural Marketing	3	2	1	0
BM/SOM/E-305	**H R M Group**				
. H-1	1. Labour Laws	3	2	1	0
H-2	2. Counseling Skills for Managers	3	2	1	0
H-3	3. Social Security &Labour Welfare	3	2	1	0
H-4	4. Industrial Psychology	3	2	1	0
H-5	5. Compensation Management	3	2	1	0
BM/SOM/C-306	**Finance Group**				
. F-1	2. Financial derivative and Risk Management	3	2	1	0
F-2	1. Security Analysis & Portfolio Management	3	2	1	0
F-3	3. Financial Institutions and Markets	3	2	1	0
F-4	4. Management Control System	3	2	1	0
F-5	5. Strategic Financial Management	3	2	1	0
BM/SOM/C-307	**International Business Group**				
. IB-1	1. International Trade Procedure & Documentation	3	2	1	0
IB-2	2. International Trade Theories and Policies	3	2	1	0
IB-3	3. International Business Environment	3	2	1	0
IB-4	4. International Marketing Management	3	2	1	0
IB-5	5. International Business Law and Taxation	3	2	1	0
BM/SOM/SS-308	*(Self study course) Business Ethics*	*3*	*3*	*0*	*0*

MBA-Fourth Semester(Total Credit-C-9 E-9)

Three (3) compulsory Papers and Three (3) Optional Papers to be selected for study in such way that Two (2) Papers from one Group known as Major specialization and One (1) Paper from another Group known as Minor Specialization.

Paper Code	Subject/Paper	Credit	L	T	P
BM/SOM/C-401	Industrial Training & Project Report	3	1	1	1
BM/SOM/C-402	Strategic Management	3	2	0	1
BM/SOM/E-403	**Marketing Group**				
. M-6	1. Advertising Management	3	2	1	0
M-7	2. Sales and Distribution Management	3	2	1	0
M-8	3. Product Management	3	2	1	0
BM/SOM/E-404	**HRM Group**				
. H-6	1.Industrial Relations	3	2	1	0
H-7	2.Organizational Development & Intervention Strategies	3	2	1	0

H-8	3. Human Resource Planning and Development	3	2	1	0
BM/SOM/E-403	**Finance Group**				
F-6	1. International Financial Management	3	2	1	0
F-7	2. Banking and Financial Services	3	2	1	0
F-8	3. Cost Accounting	3	2	1	0
BM/SOM/E-404	**International Business Group**				
. IB-6	1. Import Export Management	3	2	1	0
IB-7	2. Financing of Foreign Trade	3	2	1	0
IB-8	3. Global Logistics and Supply Chain Management	3	2	1	0
BM/SOM/C-405	Dissertation & Viva-Voce	3	0	0	3
BM/SOM/SS-406	(Self study course) Disaster Management	3	2	1	0

9. The Credit Based Course Structure of Two Year Full Time M.B.A Degree Programme is thus structured in the following manner:

Course with Credits	**Semester-I**	**Semester-II**	**Semester-III**	**Semester-IV**
Core	18	18	9	9
Elective	-	-	9	9
Self Study Course	-	3	3	3

Code number mentioned above the words denotes as – **BM**-Business Management **SOM**- School of Management, **C**- Core subject, **E**- Elective subject, **M**-Marketing Management Group, **H**-Human Resource Management Group, **F**-Financial Management Group, **IB**-International Business Group. Lectures, T-Tutorials, P-Practical, **The rest of provisions as per common Ordinances of University shall be Applicable.**

MBA- I semester(All Papers in First Semester are compulsory)

BM/SOM/C-101 –Principles and Practices of Management

(i) Nature, Scope and Significance of Management, Evolution and Development of Management Thought.Process and Functions of Management. Functional Areas of Management.

(ii) Nature, significance and scope of Planning, Types of Plans, Process and Techniques of Decision Making, MBO, MBE,Planning Strategies and Policies.

(iii) Nature and Significance of Organizing- Organizations Theories, Organization Structure, Departmentation, Line and Staff Relationship,Span of Management, Authority, Delegation and Decentralization and Group Functions, Staffing, Appraisal and Development of Managers, Formal, Informal and matrix Organizations.

(iv) Directing-Techniques of directing,Motivation-Concept,Theories of Motivation, Leadership Patterns and Styles.

(v) Concept and Significance of Communication, Process,Types and Techniques of Communication, Barriers of Communication.Overcoming barriers to Communication, Essentials of effective communication, Grapevine

(vi) Nature and Scope of Co-ordination, Principles, Techniques and Barriers to Co-ordination,Controlling-Elements, Process and Styles of Control, Techniques of Control, Challenges before Future Managers in 21st Century.

Suggested Readings

1. Drucker, F. Peter -Management-Tasks, Responsibilities & Practices
2. Koontz 'O' DonnelWeihrich -Elements of Management
3. Koontz 'O' Donnel C -Management-A Book of Reading
4.Drucker, F. Peter -The Practice of Management
5.Terry and Franklin -Principles of Management
6. Stoner and Freeman -Principles of Management

BM/SOM/C-102- Business Environment

(i) Concept, Nature and Significance of Economic, Socio-cultural, Political, Legal, Technological and Other factors affecting business Operations and Growth, Economic Systems – Capitalism, Socialism, Communism and Mixed –Economic System

(ii) Monetary Policy- Role of Reserve Bank of India, Monetary Policy Tools, Fiscal Policy and its importance in an economy, Exchange Rate and its determinants.

(iii) Indian Economy and Business before Economic Reforms of 1991, Need for Economic Reforms, New Economic Policy- Liberalization, Privatization, Globalization and its impact on Indian economy and business. India's Growth Story in the Post Reform Period.

(iv) Indian Financial System and its Evolution, Components of Financial System. Classification of Financial Markets- Money Market, Forex Market, Capital Market. Instruments of Capital Markets- Pure instruments, Hybrid instruments and Derivatives; Financial intermediaries and their types- Housing Finance Companies(HFCs), Merchant Banks, Venture Capital Companies, Nidhi Companies, Chit Fund Companies, Insurance Companies.

(v) FDI,FII and their role in Indian economy, Export Promotion schemes in India; WTO-objectives, functions; India and WTO; The Basel Accord, Basel III norms and India.

(vi) Business Ethics and Corporate Social Responsibility, Corporate Governance.

Suggested Readings

1. Francis Cherunilam: 'Business Environment', Himalaya Publishing House, New Delhi

2.MonikaKashyap&MahendraBabuKuruva: 'Economic Reforms in India Since 1991',SAGE Publications, New Delhi.,ISBN:9789352807222.

3. Misra, S.K. and Puri, V.K.: 'Economic Environment of Business', Himalaya Publishing House, New Delhi.

4..Misra, S.K. and Puri, V.K. : 'Indian Economy', Himalaya Publishing House, New Delhi.

5. Rudder Dutt and Sundharam K.P.M.: 'Indian Economy', S. Chand & Company Limited, New Delhi.

BM/SOM/C-103-ENTREPRENEURSHIP DEVELOPMENT

Objective:

The objectiveof the section is to develop conceptual understanding of the topic among the studentsand comprehend the environment of making of an Entrepreneur. Specific topics to be covered in the section are as follows:

Unit 1

Meaning, definition and concept of Enterprise, Entrepreneurship &Entrepreneurship Development, Evolution of Entrepreneurship,Theories of Entrepreneurship. Characteristics and Skills of Entrepreneurship, Concepts of Entrepreneurship, Entrepreneur v/s Intrapreneur, Entrepreneur Vs. Entrepreneurship, EntrepreneurVs. Manager, Role of Entrepreneurship in Economic Development, Factors affecting Entrepreneurship, Problems of Entrepreneurship

Unit II

Meaning and concept of Entrepreneurial Competency, Developing Entrepreneurial Competencies,Entrepreneurial Culture, Entrepreneurial Mobility, Factors affecting Entrepreneurial mobility, Types ofEntrepreneurial mobility. Entrepreneurial Motivation: Meaning and concept of Motivation, Motivationtheories, Entrepreneurship Development Program: Needs and Objectives of EDPs, Phases of EDPs, Evaluationof EDPs

Unit III

Role of Government in promoting Entrepreneurship, MSME policy in India,Agencies for Policy Formulationand Implementation:District Industries Centers (DIC), Small Industries Service Institute (SISI),Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & SmallBusiness Development (NIESBUD), National Entrepreneurship Development Board(NEDB),FinancialSupport System:Forms of Financial

support, Long term and Short term financial support, Sources of Financialsupport, Development Financial Institutions, Investment Institutions

Unit IV

Women Entrepreneurship: Meaning, Characteristic features, Problems of Women Entrepreneurship in India,Developing Women Entrepreneurship in India, Concept of Social Enterprise and Social Entrepreneurship,Social Entrepreneurs, Sustainability Issues in Social Entrepreneurship, Rural Entrepreneurship, FamilyBusiness Entrepreneurship,Concepts of Entrepreneurship Failure, Issues of Entrepreneurial failure, Fading ofEntrepreneurial success among once leading corporate groups, Entrepreneurial resurgence, Reasons ofEntrepreneurial Failure, Essentials to Avoid Unsuccessful Entrepreneurship.

Unit V

Forms of Business Ownership, Issues in selecting forms of ownership, Environmental Analysis, Identifyingproblems and opportunities, Defining Business Idea, Planning Business Process,
Project Management:Concept, Features, Classification of projects, Issues in Project Management, Project Identification, ProjectFormulation, Project Design and Network Analysis, Project Evaluation, Project Appraisal, Project ReportPreparation, Specimen of a Project Report

Suggested Readings:
1.Lall&Sahai:Entreprenurship(Excel Books)
2.KakkarD N-Enterpreneurship Development(Wiley Dreamtech)
3.A.K.Rai–Entrepreneurship Development, (Vikas Publishing)
4.Holt Entrepreneurship : New Venture Creation (Prentice-Hall)
5.Barringer M J-Entrepreneurship(Prentice-Hall,)
6.Nina Jacob,-Creativity in Organisations (Wheeler,)

BM/SOM/C-104- Financial Accounting

(i) Financial Accounting-Meaning, Objectives, Concepts and Conventions. Branches of Accounting, Internal and External Users of Accounting, Advantages and Limitations of Financial Accounting, Accounting Standards.

(ii) The Double Entry System- Its Meaning and Scope, The Journal, Cash Book, Ledger, Trial Balance, Trading Account, Profit and Loss Account, Balance Sheet, Entries and Adjustments of different heads in different Books and Accounts. Introduction of Company Accounts.

(iii) Analysis of Financial Statements- Ratios, Comparative and Common Size Statements, Cash Flow and Funds Flow Analysis, Management Audit and Financial Reporting.

(iv) Cost Accounting – Nature, Objectives, Significance of Cost Accounting, Classification of Cost, Costing for Material, Labour, and Overheads. Marginal Costing and cost volume profit Analysis- Its Significance, Uses and Limitations.

(v) Standard Costing- Its Meaning, Uses and Limitations, Determination of Standard Cost, Variance Analysis-Material, Labour and Overhead.

(vi) Responsibility Accounting- Its Meaning and Significance, Cost Profit and Investment Centers, Accounting for Price Level Changes- Concepts CPP and CCA Methods.

Suggested Readings

(1) Anthony, R N and Welsh, G A -Fundamentals of Management Accounting
(2) Khan and Jain -Management Accounting
(3) Horngren, C T -Cost Accounting
(4) Gupta, R L -Advanced Accountancy
(5) Shukla and Grewal -Advanced Accounts

BM/SOM/C-105- Managerial Economics

(i) Meaning, Definition, nature and scope of managerial economics; Goods, Utility, Value, Price, Wealth, Income, Equilibrium. Managerial Economist- Role and responsibilities.

(ii) **Demand**- Meaning, Types; Demand function, Law of Demand, Reasons for downward slope of demand curve, Demand function, concept of elasticity and elasticity of demand- Price elasticity of demand, Income elasticity of demand ,cross elasticity of demand ; Demand forecasting- Meaning, Types, Techniques.

(iii)**Concepts of Cost**-Cost Classification, Fixed and Variable, Total, Marginal and Average Cost, Opportunity Cost, Real Cost, Cost Out-put Relationship in Short Run and Long Run, Cost Analysis in the Process of Decision Making, Cost and Optimum Size of Plant.

(iv)**Production and cost Function**-Law of variable proportions and returns to scale, Economies of scale, concept of cost, cost function: Short run and long run- Total fixed and total variable cost- short run average and marginal cost curves. Theory of long run cost- Minimum efficient scale,long run average cost curve, Break Even Analysis.

(v)**Price determination under various market Structures** - Meaning of market, classification of market structures, Perfect and Imperfect competition, Monopolistic competition, pure oligopoly; Pricing and its determinants, Price determination under perfect competition, monopoly, imperfect competition and oligopoly.

(vi)**Basic Macro Economics**-Concept of National Income and methods of measurement: Economic growth- Meaning and determinants, phases of business cycle, Inflation-Meaning, Types and causes.

Suggested Readings

(1)H.L.Ahuja- Managerial Economics
(2) Nemmers, Erwin Esser -Managerial Economics Text &Analysis
(3) Alexander, K J W and Kemp, A J -The Economist in Business
(4) Norman, N Parish -Economic Analysis
(6) Adhikari M -Business Economics
(7) Baye -Managerial Economics &Business Strategies
(8) Varshney, R L and Maheshwary-Managerial Economics
(9) M.L.Jhingan and J.K.Stephen- -Managerial Economics
(10) Maheshwari- Managerial Economics
(11) R.L.Varshney andK.L.Maheshwari- Managerial Economics

BM/SOM/C-106-ManagementInformation System

Objective: This subject offers a fundamental framework for information systems application in organization. It also covers a wide spectrum of information technology aspects in order to prepare the students to undertake IT associated work with ease when they enter the industry. It identifies the various information systems solution for vertical and horizontal workflow of business operations.

Unit I: Concept of Computers

History, Generation of computers, Characteristics of computers, Functions of computer, Types of computers, Benefits & Drawbacks of computers, Meaning of Computer system, Computer Architecture, Computer Hardware – Input output devices, Computer Software – types, applications, Types of Computer networks.

Unit II: Foundation concepts

Foundations of information systems (IS) in business:Data & Information, Information as a Resource, System concepts – Components of an IS – IS resources – Fundamental roles of IS applications in business, SDLC.

Unit III: Kinds of Information Systems

TPS, OAS, MIS, DSS, GDSS, ES, ECS or ESS, Functional business systems – Sales & Marketing, Financial & Accounting, HR, Operational IS, cross-functional enterprise systems and applications – service sectors

Unit IV: Role of MIS

Strategic Advantage with MIS, Competitive Strategy Concept, The Value Chain and Strategic IS, Using IT for Strategic Advantage: BPR, Creating a Virtual Company, Improving Business Quality: Becoming an Agile Company, Building a Knowledge Creating Company

Unit V: e-Business

E-Business models – Customer relationship management (CRM) – Enterprise resource planning (ERP) and Supply chain management (SCM), E-Commerce systems – Essential e-Commerce processes – e payment processes – e-commerce application trends – Web store requirements

Unit VI: Management challenges

Rapid change in Technology, Quality Assurance –Ethical and Social Dimensions – IP Rights as related to IT Services / IT Products, Security threats, System vulnerability and hazards, Information security and access control, Communication and application control, Disaster recovery planning, IT risk management, Information privacy.

Suggested Readings:

1.Stair & Reynolds – Fundamentals of Information Systems (Thompson, 2nd Ed.)
2. D. P. Goyal - Management Information System (Mac Millan, 3rd Ed.)
3. Jawedkar W S - Management Information System (Tata McGraw Hill, 3rd Ed.)
4. Arora Ashok, Bhatia Akshaya – Management Information System (Excel, 1st Ed.)
5. Davis & Olson – Management Information System (TMH, 2nd Ed.)
6. IT for management - Ramesh, B.New Delhi: Tata McGraw Hills Publications, 2009.

MBA- II Semester

(All Papers in this Semester are compulsory)

BM/SOM/C-201-Financial Management

(i) Financial management and financial planning- Traditional and Modern concept of Finance Function, Nature, Scope and Importance, Financial Environment. Risk-return trade off, relationship of finance to economics and accounting. Forms of Business organisation.

(ii) Time Value of Money ,Risk and return of Portfolio, Measurement of Market Risk, Valuation of securities- Basic valuation model, bond valuation , equity valuation.

(iii) Basics of Capital Budgeting- Capital Budgeting process, cost and benefits, basic principles, investment criteria, Net Present Value, Benefit-Cost Ratio, Internal Rate of Return, Payback Period, Accounting rate of return. Leverage- Meaning, Significance and Types; Capital Structure and Cost of capital Theories of capital structure, Designing Optimal Capital Structure, EBIT and EPS Analysis,

(iv) Working Capital Management-Concept, Needs and Nature of Working Capital, Methods of Determining Working Capital, Requirement, Financing and Control of Working Capital.

(v) Dividend Policy and share valuation- Walter Model, Gordon Model, Miller and ModiGilani Position. Payout ratio, stability, dividend as a residual payment. Corporate dividend behavior, legal and procedural aspects, Bonus shares and stock splits, Share Buybacks.

(vi) Management of Earnings, Retained Earnings and Dividend Policies, Dividend Practice and Dividend Models; Management of Long term Funds, Sources of Long Term Finance, Financial Institutions and Term lending; Lease Financing, Mergers and Acquisitions. Take over, Strategic Financial Alliances.

Suggested Readings

(1) Khan, M Y -Financial management
(2) Prasnna Chandra -Financial Management
(3) Pandey, I M -Financial management
(4) Kuchal, S C -Financial Management and Corporate Finance
(5) Van Home -Financial management

BM/SOM/C-202- Human Resource Management

(i) Personnel Management-Concept, Nature, Scope and Importance of Human Factor; Evolution and Growth of Personnel Function in Management; Philosophy of Management of HRM; Present Status and Future of Human Resource Management in India. Personnel Department- Organization and Functions; Procurement- Job Analysis,

(ii) Human Resource Planning-Meaning and process, Manpower Planning: Recruitment, Selection, Placement, Induction. Methods of Manpower Search, Reality shock

(iii) Development-Need, Objectives and Methods of Training; Procedure of Training and its Efficacy. Development of Managers- Principles, Methods. Training and Promotion; Performance Appraisal, Methods of Performance appraisal,

(iv) Wage and Salary Administration; Wage Policy- Concept, Role and Importance; Job Evaluation; Fringe Benefits; Incentive Compensation- Prerequisites and Problems in Indian Context; Personnel Audit.

(v) Group Dynamics, Morale in Work Groups, Employee Turnover and its causes. Employee Productivity. Emerging issues and trend in HRM

Suggested Readings

(1) Flippo, E B -Principles of Personnel Management
(2) Yoder Dale -Personnel Management and Industrial Relations
(3) Strauses, G and Sayles L R -Personnel-The Human Problems in Mgt.
(4) Singh, Chhabra and Taneja -Personnel Management and Industrial Relations
(5) Aswathappa, A -Human Resources and Personnel Management
(6) Rao T.V. -Human Resources Management
(7) Cascio -Managing Human Resource

BM/SOM/C-203- Organizational Behavior

(i) Organisation-Concept, Types of Organization, Individual and Organizational Objectives, Organizational Behaviour model, Understanding Indian Social and Cultural Environment and Its Effect on Industrial Behaviour.

(ii) Individual Behaviour-Understanding Attitudes, Values Perception- Nature and Importance, Perceptual process, Perception vs. Sensation, Learning-Theories of Classical and Operant Conditioning, Reinforcement – Kinds and Administration.

(iii) Personality-Concept, Theories, Personality Development, Determinants of Personality, Personality and Organization Behaviour

(iv) Definitions and Characteristics of Group, Types, Stages of group development, Structural variables of group, Formal leadership, roles, norms, group status,

Group Cohesiveness, Group decision making-Process and techniques, Group Co-operation, Transactional Analysis, Organizational Conflicts.

(v) Organizational Changes and Organization Development, Causes of Organizational Changes, Process of Change, Resistance to change, Approaches to managing Organizational Change, Techniques of Organizational Development, Intervention- an Overview, Kinds of Applications.

Suggested Readings

(1) Korman, Abhrahim K -Organizational Behaviour
(2) Singh and Chhabra -Organization Theory and Behaviour
(3) Khanka S S -Organizational Behaviour
(4) Maslow A H -Motivation and Personality
(5) Stephen P Robbins -Organizational Behaviour
(6) Kao S R et el -Effective Organization and Social Value
(7) Luthans Fred -Organization Behaviour
(8) Newstrom -Organization Behaviour at Work

BM/SOM/C- 204- Production and Operations Management

Objective

This paper is offered as a General Management subject in MBA Programme. It develops an insight into the Strategy, planning, manufacturing and control aspects of Operations. This paper prepares the students for careers in the areas of Planning, Manufacturing and control management.

Unit I: Meaning, Production system concept, Transformation process, Difference between products and services, OM in the organizational chart, operations as service, Historical development of OM, Current issues in operations management, Operations strategy, competitive dimensions, Break even analysis, Capacity expansion decisions, Make or Buy decisions, Equipment Selection decisions, Production process selection decisions, Managerial uses of break even analysis, Limitations of Breakeven analysis.

Unit II: Forecasting as a planning tool, forecasting time horizon, short and long range forecasting, types of forecasting, quantitative forecasting models - Linear regression, Moving average, Weighted moving average, Monitoring and Controlling forecasting models, Line Balancing.

Unit III: Facilities location decisions, Facility location models, Facility layout planning: Layout and its objectives for manufacturing operations, warehouse operations, service operations, and office operations, Types of plant layouts –product layout, process layout, fixed position layout, cellular manufacturing layouts, hybrid layouts, Factors influencing layout changes. Capacity planning – PPC, MRP, MRP II, MPS.

Unit IV: Productivity, variables affecting labour productivity, work content and time, Work Study and related working conditions and human factors, Method Study, Data collection, recording, examining, and improving work, Material flow and material handling study, Worker flow study, Worker area study, Work Measurement, Work sampling study, Time study and setting standards

Unit V: Materials and profitability, Purchase functions, Procurement procedures including bid systems, Vendor selection and development, Vendor rating, Concepts of lead time. Inventory Management: Concept, types, Classification, selective inventory management, Inventory costs, Inventory models – EOQ, safetystocks, Re order point.

Unit VI: Quality assurance, Statistical Quality Control: Control charts, TQM: ISO-9000 series and its importance, JIT, Six sigma and its application, Maintenance Management: Meaning & its types.

Suggested Books

1. Operations Management - Norman Gaither, Greg Frazier, 9/e, Cengage learning, 2011.
2. Operations Management - Richard B. Chase, 11/e, TMH.
3. Operations Management-Terry Hill, Second edition, Palgrave Macmilan

4. Operations Management: Along the supply chain - Russel and Taylor, 6/e, Wiley India,2009.
5. Production and Operations management - Ajay K. Garg, Tata Mc-Graw Hill, 2012.

BM/SOM/C-205 – Marketing Management

(i) Concept, Nature, Significance of Marketing Management. Concepts of Marketing, Functions of Marketing, Strategic Marketing Planning, Marketing Mix.

(ii) Marketing Organization, Designing Appropriate Structure and Influencing Factors, Marketing Environment, Micro and Macro Environment

(iii) Market Segmentation, Basis for Market Segmentation and Purpose, Selection of Target Market and Positioning Strategies. Niche Market.

(iv) Consumer Behaviour, Nature and factors influencing Consumer Behaviour, Decision Making Process, Organizational Buying Behaviour,

(v) Product Management, Concept of Product, Classification of Products, Product Life Cycle, Marketing strategies at various stages of PLC, New Product Development, Product Positioning, Product Line and Product Line decisions, Product Mix, Branding Decisions, Packaging, Labeling.

(vi) Pricing-Factors Affecting Price Determination, Price Policies and Strategies, Pricing Methods. Promotional Mix-Elements of Promotional Mix, advertising, Personal Selling, Publicity and Public Relations, Sales Promotion. Direct marketing

(vii) Distribution Channels, Role and Type of Channels, Factors Influencing Channel Decisions. Forward and Backward integration, VMS, Rural Marketing

Suggested Readings

(1) Kotler, Philip -Marketing Management: Analysis Planning& Control
(2) Stanton W J -Fundamentals of Marketing
(3) Cunduff Still -Fundamentals of Marketing &GoianiCundiff
(4) Rusenberg, L J -Marketing
(5) Pillai R S N, Bhagwati -Modern Marketing Principles & Practices

BM/SOM/C-206- Research Methodology

(i) Nature, Meaning and Scope and significance of Research and Research Methodology. Problem Formulation and Statement of Research Objectives,

(ii) Organization Structure of Research, Research Process, Research Designs-Exploratory, Descriptive and Experimental Research, Research Designs. Sampling Design, Sampling Fundamentals, Methods of Data Collection Observational and Survey Methods, Questionnaire Design.

(iii) Measurement and Scaling Techniques, Motivational Research Techniques, Administration of Surveys, Field Work and Tabulation of Data, Processing and Analysis of Data, Selection of Appropriate Statistical Technique.

(iv) Introduction to Measurement of Central Tendency and Dispersion : Arithmetic, Geometric and Harmonic mean, Median, Mode, Mean Deviation, Standard Deviation, Skewness and kurtosis

(v) Advanced Techniques for Data Analysis, Analysis of Variance and Covariance, ANOVA, Discriminate Analysis, Factor Analysis, Conjoint Analysis, Multidimensional Scaling and clustering Methods, Correlation and Regression Analysis, Time Series Analysis, Measures of Trend and Seasonal Indices. Research Applications.

(vi) Sampling and Sampling Distributions: Probability and Non Probability Sampling Methods, Sampling and Non Sampling Errors, Sampling Theory, Sampling Distribution, Hypothesis Testing: T, A and Chi Square $(X)^2$ Tests.

Suggested Readings

(1) Kothari, S R -Research Methodology
(2) Levin, R I and Rubn David S -Statistics For Management
(3) Stephen KC -Applied Business Statistics
(4) Emory and Cooper -Business Research Method
(5) Hair -Marketing Research
(6) Salkind J -Exploring Research
(7) Fowler, Floyd J Jr. -Survey Methods
(8) Aakar -Marketing Research

BM/SOM/SS-207 Professional Communication (Self Study course)

(i) Business Communication-Meaning, Features and functions, Model of communication, Channels of communication-Formal vs. Informal, grapevine and its effective use.

(ii) Process of Communication. Barriers in Business Communication, Dimensions of communication, Communication and customer care

(iii) Business Correspondence-Essentials of effective correspondence, Planning the letter, Different types of letters, Sale letters, goodwill letters, notices, circulars and orders, Applications for employment, Modern Office Communication Techniques. Internet and its uses, E-commerce.

(iv) Oral Communication- Public Speaking, Body Language, Presentation and Interviews, Presentation of Reports, Sales Plans, Leading and Participation in Meetings and Conferences. Qualities of effective correspondence,

(v) Report Writings-Business Reports- Structure, Techniques and Styles of Report Writing, Proposal writing, Types of proposal,

Suggested Readings

(1) Sharma -Business Correspondence and Report Writing
(2) Monipally -The Craft of Business Communication
(3) Herta and Murthy -Effective Business Communication
(4) Lesikar and Pettit -Business Communication
(5) Bovee -Business Communication Today
(6) Treece M -Successful Business Communication
(7) Rue -Managerial Skills and Applications

MBA -III SEMESTER

There are both compulsory and elective papers in this Semester. Papers 301, 302 and 303,308 are compulsory for all students and for elective papers the students shall have to choose three papers- Two from Major specialization group and one from Minor specialization group mentioned below.

Compulsory Papers

BM/SOM/C-301-Management Accounting

(i) Management Accounting- Essentials, Scope, Objects, Limitations, Comparison of Management Accounting with Cost Accounting and Financial Accounting.

(ii) Concept of cost – Elements of Cost – Cost Accounting – Objectives – Cost Sheet (Problems) – classification of cost – Cost Unit and Cost Centre – Methods of Costing – Techniques of Costing..

(iii) Standard Costing and Variance Analysis: Meaning of Standard Cost and Standard Costing, Advantages, Limitations and Applications; Material, Labor, Overhead variances (problems). Marginal and absorption costing.

(iv) Budgets and Budgetary Control: Meaning, Types of Budgets, Steps in Budgetary Control, Fixed and Flexible Budgeting, Cash Budget (Problems).

(v) Cost-Volume-Profit Analysis: Contribution, Profit-Volume Ratio, Margin of safety, Break-even Point (problems), Composite Break-even Point.

Readings:

1. C.T. Horngren, Gary L. Sundem, Jeff O. Schatzberg, and Dave Burgstahler: Introduction to Management Accounting, Pearson
2. M.N. Arora: A Textbook of Cost and Management Accounting, Vikas Publishing House Pvt. Ltd.
3. M.Y. Khan, and P.K. Jain, Management Accounting: Text Problems and Cases, McGraw Hill Education (India) Pvt. Ltd.
4. S.N. Maheshwari, and S.N. Mittal, Cost Accounting: Theory and Problems, Shree Mahavir Book Depot (Publishers).

BM/SOM/C-302 Project Management

(i) Project Management- Nature, Scope, Process Elements, Significance and Emergence of Projects. Project Planning, Developing Project Models through Simulation.

(ii) Location of Project Site, Working Conditions Development, Plans of the Government and the Local Bodies, Factors Affecting Location Decisions. Analysis of Infrastructure, Labour, Raw material, Transport & Other Factors.

(iii) Selection of the Product or Service, Market Research, Product Appraisal, Product Design, Factors Affecting the Selection Decision, Choice of Technology, Choice of Process, Feasibility, Effects on Environment, Pollution Control, Govt and Local Bodies Regulations. Economic Analysis of the Projects

(iv) Project Financing, Sources of Finance, Raising Capital from Market, Financial Institutions, Raising Foreign Exchange, Government Regulations. Project Scheduling, Monitoring and Contract Management, Project Appraisal, Contract Project Review.

(v) Financial Feasibility Study, Analysis of Risk- concept, types, techniques of Risk Evaluation, Sensitivity Analysis and method for handling risk

(vi) Role of Government and Financial Institutions in Entrepreneurship Development. Sources of Finance and Institutionalize Finance to Entrepreneurs, Role of Technical Consultancy Organization in Developing Entrepreneurs.

(vii) Governmental Policies Governing Entrepreneurship, Problems of Entrepreneurship.

Suggested Readings

(1) Bhavesh M Patel -Project Management
(2) S S Khanka -Entrepreneurship Development
(3) Prasana Chandra -Project Management
(4) P C K Rao -Project Management and Control

BM/SOM/C- 303 Operations Research For Business Applications

(i) Introduction & Evolution of operation Research ,Growth of Operation Research in Different Sector, Characteristics of Operation Research , Some Special Function and their Applications.

(ii) Transportation Problem, Introduction and General structure of the Transportation Problem. Methods For Finding Initial Solution, Northwest Corner Method, Least Cost Method, Vogel's Approximation Method (VAM), Unbalanced Transportation Problem ,

(iii) Assignment Problem, Introduction Maximization in Assignment Problem, Unbalanced Assignment Problem.

(iv) Theory of Games, Basic Definition and Terminology ,Pure Strategy Games ,Principle of dominance ,Algebraic Method ,Graphical Method, Cramer Method ,Limitations and significance of Game theory .

(v) PERT and CPM, Introduction & Basic Concepts of the Network Analysis ,Critical Path Method, Estimate Critical path Analysis, Programme Evaluation & Review Technique, Distinction between PERT and CPM ,

(vi) Simulation-Introduction, Methodology for Simulation, Management Application, Stochastic Simulation and Problem Numbers. Markov Analysis and its application

Suggested Readings

(1). N.D. Vohra -Quantitative Techniques in Managerial Decisions
(2) V.K. Kapoor -Operation Research Technique For management
(3) Renders Stain -Quantitative Analysis for Management
(4) Hiller -Introduction to Operation Research

Major Four Specialization Groups-(2 papers from one of the Major Specialization Group and One paper from Minor specialization Group as mentioned below)

A- Marketing Management Group

BM/SOM/E- 304-M-1-Consumer Behaviour

(i) Introduction-Definition and Scope of Consumer Behaviour, Consumer Behaviour, and decision making, Types of Buying Behaviour, Consumer Research process.

(ii) Segmentation-Usage segmentation, Benefit Segmentation, Cultural, Sub-Cultural and Cross Cultural Influences, Social Class and Social Stratification,

(iii) Social Groups and Norms, Reference Groups, Organizations and Family Influences, Family Buying Behaviour

(iv) Personality- Theories of personality, Brand Personality, Self and self image, Attitude-Structural models, Attitude formation, Strategies of attitude Change.

(v) Consumer Perception-elements of perception, Dynamics of perception, Learning, Elements of consumer learning, Classical conditioning, Instrumental and observational learning, Attitudinal and Behavioural measures of Brand Loyalty

(vi) The Process of Consumer Decision Making-Opinion leadership, Measurement of opinion leadership, Diffusion of innovation, Diffusion process, Adopter categories, Models of Consumer Behaviour-Introduction and their need, Howard-Sheth Model, Engel-Blackwell-Kollat Model, Nicosia Model

(vii) Post purchase Behaviour, Consumer Complaint Behaviour, Brand loyalty, Complaint Behaviour.

(viii) Organizational Buying Behaviour-Influences on organizational buyer Behaviour, Organizational buyer's decision process.

Suggested Readings

(1) Zaltman and Wallendrof -Consumer Behaviour
(2) Engel, Blackwell Edition -Consumer Behaviour
(3) Mellout, Douglas W.Tr -Consumer Behaviour
(4) David L. Loudon and Della Bitta -Consumer Behaviour
(5) Schiffman and Kanuk -Consumer Behaviour

BM/SOM/E- 304-M-2_ Marketing Research

(i) Market Research – Introduction, Importance, Scope and Limitations of Market Research, Objectives, Types of Research. Planning and Designing Research.

(ii) Secondary and Primary Data Collection- Introduction to Secondary Data source and their Types, Methods of Data Collection, Data Preparation- Validation, Editing, Coding, Tabulation and Cross Tabulation of Data, Data Analysis and Interpretation, Hypothesis Testing, Univariate and Bivariate Data Analysis. Multivariate Data Analysis.

(iii) Sampling and Questionnaire Design and Construction-Introduction to Sampling, Sampling Process, Sampling Designs, Sample Size, Application of Sampling, Steps involved in Questionnaire Construction, Questionnaire Designs, Attitude Measurement, Types of Scales for Attitude Measurement.

(iv) Application of Marketing Research, Product Research, Utility of Market Research to Brand Positioning and Market Segmentation Analysis, Distribution Research, Advertising and sales Promotion Research, Sales Control Research, Financial Research and Strategic Planning.

(v) Presentation and Follow – Through – Role of the Report,Types of Reports, Contents of the reports, Personal Presentation of the Report, Follow-through.

(vi) Organization of Marketing Research Department, Marketing Research Agencies, Types and Functions of Marketing Research Agencies, Ethical Issues of Marketing Research.

Suggested Readings

(1) Agarwal - Marketing Research
(2) Boyd and West Fall - Marketing Research – Text and Cases
(3) D A Aaker and G S Dey Marketing Research
(4) Weiers - Marketing Research
(5) Malhotra - Marketing Research
(6) Luke and Rubin - Marketing Research
(7) Tull and Hawkins - Marketing Research

BM/SOM/E- 304-M-3-Marketing of Services

(i) The Nature of Services Marketing- Introduction, Definition and Characteristics of Services, Classification of Services, Evolution of Services marketing, Importance of Services Marketing in Indian Economy.

(ii) The Services Marketing Mix- Importance of 7 Ps in Services Marketing The Service Marketing- The People Component, Services and the Importance of the People Component, Using People to Differentiate Services, Internal Marketing, Employee Motivation and Implication for Service Delivery.

(iii) Physical Evidence and Services Process- Essential and Peripheral Physical Evidence,Nature of the Service Process, Customer Participation in Service Process, managing Evidence and Process.

(iv) Services Market Segmentation, Competitive Differentiation of Services, Positioning of Services. Consumer Behaviour for Services.

(v) Services Pricing Decisions- Approaches to Pricing Services-Cost Based, Competition Based, Demand Based. Factors Affecting Pricing.

(vi) Distribution of Services Decision-Distribution channels, Channel Design Decisions, Factors Affecting Channel Decisions.

(vii) Service Promotion Decisions- Importance of promotion in Services, Advertising, Personal Selling, Publicity and Sales Promotion.

(viii) Managing Services Quality- Dimensions of Service Quality,Tools for Achieving Service Quality, Consumer perception of Service Quality.

Suggested Readings

(1) Philip Kotler and Paul N Bloom -Marketing Professional Services
(2) Lovelock -Services Marketing
(3) Adrian Payne -The Essence of Services Marketing
(4) Rathmell J M -Marketing in Service Sector

BM/SOM/E- 304-M-4 Industrial Marketing

(i) Industrial Marketing Concept-Nature of Industrial Marketing, Industrial Marketing Environment, Industrial Marketing Environment, Industrial markets.

(ii) Demand for Industrial Goods, Demand and Product Characteristics, Derived Demand for Industrial Goods, Nature of Industrial Buying, Buyer Behaviour, Value Analysis and Vendor Selection.

(iii) Industrial Marketing Strategy-Product Strategy, Channel Distribution Strategy, Logistics, Pricing Decisions, Promotion Mix and strategy, Advertising, Personal Selling, Sales Promotion, Public Relations, Publicity.

(iv) Industrial Marketing Intelligence System, Information Needs system Design and Applications.

(v) Industrial Marketing Control- Strategic Goals, Performance Standards, Evaluation of Performance.

Suggested Readings

(1) E Rayon Coray -Industrial Marketing-Cases and Concepts
(2) Robert W Hass -Industrial Marketing Management
(3) Ralph and Gross -Industrial Marketing
(4) Websterm -Industrial Marketing
(5) V KasturiRangan -Business marketing Strategy

BM/SOM/E- 304-M-5- Rural Marketing

(i) Nature, Concept and Scope of Rural Marketing, The People, The Purchasing Power, Buying Pattern, Socio- Cultural, Economic and Other Environmental Factors Affecting Rural marketing.

(ii) Attitude and Behaviour Pattern of Rural Consumers, Overview of Rural Marketing. Marketing of Consumer Durables and Non Durable Goods and Services in Rural Markets with special Reference to Product Planning and Media Planning.

(iii) Planning of Distribution Channels, Organizing Personnel Selling in Rural Markets. Marketing of Agricultural Inputs with Special Reference to Fertilizers, Seeds, Agricultural Implements and Tractors.

(iv) Rural Marketing Behaviour in Space, Variation in Levels of Intersection, Variances of Distance Traveled Type and Role of Marketing Centers, Spatial Manifestations of Rural Marketing.

(v) Marketing Efficiency,Marketing Intelligence, Marketing Research and Information System.

(vi) Retailing in Rural Areas, Trade Channels, Rural Marketing in India, Its status and Present Position.Planning for Institutional Linkages, Monitoring and Evaluation of Rural marketing, Brand Awareness and Purchase Decisions.

Suggested Readings

(1) Raja Gopal -Organizing Rural Business Policy,Planning & Management

(2) Raja Gopal -Indian Rural marketing

(3) T P Gopalswamy -Rural Marketing-Environment,Problems And Strategies

(4) Ramachandram H and Shastri G S -Behaviour in Space-Rural Marketing in an Underdeveloped economy

B- Human Resource Management Group

BM/SOM/E- 305-H-1- Labour Laws

(i) Background of Labour Legislation in India

(ii) Factories Act, 1948

(iii) Minimum Wages Act 1947

(iv) Payment of Bouns Act 1965

(v) Industrial Employment (Standing Orders Act, 1946)

(vi) Payment of wages Act 1936

Suggested Readings

(1) Monappa -Industrial relations

(2) N D Kapoor -Handbook of Industrial law

(3) Dr. Tripathi and Dr. Gupta -Industrial relations and labour Laws

(4) Man Dot K C -Industrial and labour Laws

BM/SOM/E- 305-H-2- Counseling Skills for Managers

(i) Emergence and Growth of Counseling Services. Counseling as a discipline, Basic Principles for schools, for community agencies, Goals of counseling, Community and Mental Health agencies,

(ii) Individual Counseling- Theories of Counseling, Psychoanalytic Theory, Individual Psychology, Behavioural Analysis, Assessing Client's Problems, Counseling Process, Counseling skills, Solution, application and termination.

(iii) Counselor's Attitudes. Skills of Counseling. Counseling Strategies. Counseling Therapies-Insight Oriented Therapy, Behaviour Therapy, Reality Therapy, Transactional Analysis, Counseling Process, Counseling skills, Solution, application and termination, Special counseling populations.

(iv) Group Techniques for Counselors-Definitions, Group Guidance, Group counseling, T-Group, Sensitivity Group, Task Groups, Group counseling-Theoretical considerations, Values of group counseling, Selection of group members, Group Process

(v) Role of Counseling in Understanding of Low Productivity of Indian Workers. Need of Counseling Cell in the Organization, Counseling for career planning and decision making, Application of Counseling to Organizational Situations with a focus on Performance Counseling. Stress Management-Meaning of stress, Causes, Techniques of prevention of stress.

Suggested Readings

(1) Corner L S, Guide Hackney H -The Professional Counselor's

Process to Helping

(2) McLennan, Nigel -Counseling for Managers
(3) Moursund J -The Process of Counseling and Therapy
(4) Robert L.Gibson, M.H.Mitchell -Introduction to Counseling and Guidance
(5) Janase -Interpersonal Skills in Business
(6) Munra C A -Counseling-A Skills Approach
(7) Lussiar -Humans Relations in Organizations

BM/SOM/E 305-H-3-Social Security and Labour Welfare

(i) Social Security- Definition, Scope, Objective, Principles of Social Welfare. Abolition of Bonded and Child Labour, Government Policy for Social Security and Social Insurance, Welfare of special categories of Labour.
(ii) Workmen's Compensation Act, 1923
(iii) Employee's State insurance Act, 1848
(iv) Payment of Gratuity Act, 1972
(v) Maternity benefit Act,1961
(vi) Employees Provident Fund Act
(vii) International LabourOrganisation-in pursuit of Labour Welfare

Suggested Readings

(1) Mullick -Labour Laws
(2) Memoria, C B and Memoria, S -Industrial Labour, Social Security, and Industrial Peace in India
(3) Sinha, G P -Industrial Relations and Labour Legislation in India
(4) Zahiruddin -Labour Welfare Laws
(5) Saharay H K -Industrial and Labour Laws of India
(6) Srivastava S C -Industrial Relations and Labour Laws

BM/SOM/E 305-H-4 - Industrial Psychology

(i) Industrial Psychology- Introduction, Scope, and Historical development. Testing-Characteristics of Psychological Tests, Test Norms, Types of Tests, Tests VS Other Selection devices, Pro and Cons of Testing.
(ii) Interview and Other Selection devices- Interview, Interview Considerations, Applications and references and Recommendations.
(iii) Attitude Measurement and Motivation, Attitude and Social Phenomena Methods and Measuring Attitudes, Attitudes Surveys and their Application, The Attitudes of Employees VS Attitudes of Employers, Complexity of Motivation, Motivation and Frustration, Motivational Forces, Kinds of Incentives.
(iv) Job Satisfaction and Morale, Factors Measured in Job Satisfaction, Relative Importance of Different Aspects and Job Satisfaction, Job Satisfaction and Job Behaviour, Theories of Job Satisfaction, Morale and determinants of Morale, Methods of Enhancing Industrial Morale, Measurement of Morale. Job Analysis Methods, Evaluation of Job Evaluation, Psychological Contributions to Job Analysis and Evaluation, Clustering of Grouping Occupation.
(v) Work Environment and safety, Music in Industry the Arousal Hypothesis Noise, Illumination, Colour Vibration Miscellaneous Factors, Accident Prone principle, Accident Reduction, Predicting Accident, Fatigue, Unproductive Working Time, Rest Pauses, Absenteeism, the Ultimate Work Week.
(vi) Human Performance- Twice and Motion Study Metholodgy, Potential Factors of Time and Motion Studies, Resistance to Time and Motion Studies, Men in Motion, Need for Allowances in Time and Motion Study at Home, Human

Engineering, Principle of Human Performance, Perceptual Motor Skills, Information Processing Behaviour, Monitoring Behaviour.

Suggested Readings

(1) Keeth Davis - Human Behaviour at Work
(2) Chatterjee N R - Industrial Psychology
(3) Gilmer B V H and E L Dec Industrial Psychology
(4) P K Ghosh and M P Ghospade Industrial Psychology

BM/SOM/E 305-H-5- Compensation Management

(i) Types and characteristics of Labour Market and their effect on Employment and Compensation, Conceptual and Theoretical understanding of Economcis Theory related to Reward Management. Competitive Imperatives: Productivity, Quality, Service, Speed, Learning.

(ii) Planning for Improved Competitiveness, Diagnosis and Bench marking, Obtaining Commitment, Determination of Inter and Intra-Industry Compensation Differentials, Internal and External Equity in Compensation Systems. Understanding Tools Used in Designing, Improving and Implementing Compensation Packages.

(iii) Compensation Designs for Specific Type of Human Resources like Compensation of Chief Executives, Senior Managers, Research and Development Staff, and Other White color Executives.

(iv) Understanding Different Components of Compensation Packages lie Fringe Benefits, Incentives and Retirement Plans, Social Welfare packages, Producation and Productivity Bonus, Management of Compensation System.

(v) Compensation Practices of Multinational Corporations, Practices in Indian Companies, Strategic Compensation System, Statutory Provisions governing Differnet Components of Reward Systems, Working of Different Institutions Related of Reward System like Wage Boards, Pay Commissions etc.

Suggested Readings:

(1) Armstrong, Michel and Murlis, Reward Management: A hand book of salary Administration.
(2) Bergess, Lenard R. Wage and Salary Administration, London Charles Merrill.
(3) Suri G K - Wage Incentives
(4) Singh Chhabara and Taneja- Personnel Management and Industrial Relations.

C-Finance Group

BM/SOM/E306-F-1- Security Analysis and Portfolio Management

(i) Principles of Investment-Investment Objectives and Constraints, Fixed and Variable Return, Securities- Shares, Debentures, Government Securities, Derivatives, Commercial Papers, Different Modes of Investment and Investment Consideration.

(ii) Security Evaluation- Security Evaluation Model, Fundamental Analysis- Economic, Company and Industry Analysis, Technical Analysis and Random Walk Hypothesis, Efficient Market Hypothesis Forms and Tests.

(iii) The Risk- Return Framework, Types of Risk, Risk Evaluation, Hedging and Speculation Calculation of Return. Valuation of Fixed Income Investments and Equity shares.

(iv) Meaning and Importance of Stock Exchanges- Important Provisions Relating to Functioning of Stock Exchanges under Securities Regulations and Control Act. Latest Development in Securities Market, Control and SEBI Guidelines.

(v) Concept of Portfolio- Need, Types of Diversification, Elements of Portfolio Management, Determining the Expected Risk and Return on Portfolio, Sharpe

Pricing Theory, Portfolio Investment strategy, Risk Management Strategy, Determining Optional Portfolio, Performance Evaluation, Portfolio Revision Techniques, Bond,Equity Portfolio Management, Portfolio Insurance.

(vi) International Diversification, Risk in International Investment, International Investment Strategy, Return Forecasts. Portfolio Management services, SEBI Guidelines for Portfolio Managers.

Suggested Readings

(1) Apte, P G -International Financial Management
(2) Haugen Robert H -Modern Investment Theory
(3) Fisher, DM, Jordon, RJ -Security Analysis and Portfolio Management
(4) Sharpe William -Investments
(5) Bhalla, V K -Investment Management

BM/SOM/E306-F-2 – Financial Derivatives and Risk Management

(i) Introduction : Meaning and Significance of Derivatives in the Development of Securities Market; Types of Derivatives; L.C.Gupta Committee Report on Derivative Trading; Derivative Trading vs. Forward Trading. Global Financial Crisis- Role of Derivatives

(ii) Risk Management : Risk-Return Trade-Off; Systematic vs. Non-Systematic Risks; Components of Risks-Market Risk, Foreign Exchange Risk, Interest Rate Risk, Liquidity Risk and Purchasing Power Risk.

(iii) Futures Trading: Meaning of Futures Contracts and Role in Hedging Portfolio Risk;Short-term and Long-term Interest Rate Futures; Stock Index Futures; Determination of Bond Future Prices.

(iv) Options Trading: Meaning of Options; Call Options vs. Put Options; Writing of Options; Hedging with Options; Trading with Options; Arbitrage with Options; Black-Schole Option Pricing Model and Binomial-Option Pricing Model

(v) Swaps Trading : Meaning of Swaps and their Significance; Hedging Interest Rate Risks; Using Swaps to Reduce Interest Costs; Currency Swaps; Equity Swaps; Floating Rate Notes (FRNs); Swap Pricing.

References :

1. Chance, Don M : An Introduction to Derivatives, Dryden Press, International Edition.
2. Chew, Lilian : Managing Derivative Risk, John Wiley, New Jersey.
3. Das, Satyajit : Swap & Derivative Financing, Probus.
4. Hull , J., Options : Futures and other Derivatives, Prentice Hall, New Delhi.
5. Kolb, Robert W : Understanding Futures Markets, Prentice Hall Inc., New Delhi.
6. Kolb, Robert : Financial Derivatives, New York Institute of Finance, New York.
7. Marshall, John F and V.K. Bansal : Financial Engineering-A Complete Guide to Financial Innovation, PrencticeHc Inc., New Delhi.
8. Report of Prof. L.C. Gupta : Committee on Derivatives Trading.
9. Report of Prof. J.C. Verma : Committee Report on Derivatives Trading.

BM/SOM/E306- F-3- Financial Institutions and Markets

(i) Indian financial system – overview of financial markets in India – Capital markets – money market – government securities markets – foreign exchange market – derivative markets – financial sector reforms in India since 1991.

(ii) Stock exchange – An overview, Stock exchange trading, Stock exchange – Regulatory framework, Indian stock exchanges – A Profile, Insider trading, Listing of securities, Criteria for listing, Delisting, SEBI – Functions and Working, Restructuring of Indian stock exchanges – Major issues.

(iii) Overview of financial services – merchant banking – functions, regulation – leasing and hire purchasing, factoring, venture capital , mutual funds, credit rating agencies, depositories.

(iv) Government Securities (G-sec)Market in India- Meaning and Types of Government Securities, Reforms in Government Securities Market- Institutional Measures, Enabling Measures, Latest Developments in G-Sec Market in India

(v) Financial Institutions- SEBI, NSDL, NABARD, IDBI, SIDBI, IRDA, EXIM, ECGC.

Suggested Books:

1.Khan M.Y., 'Financial Services' Tata MC Graw Hill 1998.

2.MonikaKashyap&MahendraBabuKuruva: 'Economic Reforms in India Since 1991',SAGE Publications, New Delhi.,ISBN:9789352807222.

3. Varshney, P.N., INDIAN FINANCIAL SYSTEM, Sultan chand& Sons 2000.

BM/SOM/E306-F-4-Management Control System

(i) Management Control System, Conceptual frame Work, Objective and nature of Management, Anthony Dearden Model, Principles of Management Control.

(ii) Behavioral Problems in Control Process, Problems of Motivation, Goal Congruence and Co-ordination.

(iii) Structure of Management Control, Decentralization and Control of Subsidiaries.

(iv) Process of Management Control, Long Range Planning, Budgetary Control System, ROI System of Divisional Control, Transfer Pricing, Internal Controls and Formulation of Internal Control Scheme.

(v) MBO and Management Control,Standard Costing as a Tool of Control,Information System for Management reporting.

(vi) Management Control in Functional Area, Financial, Management Control of Projects, Services and Non Project organizations,Control in Government Departments and Administration.

Suggested Readings

(1) Anthony R A -Planning and Control System-A framework for analysis

(2) Anthony R A -Management Control System

(3) Gillespie C -Standard and Direct Costing

(4) Caplan E H -Management Accounting and Behavioural Science

BM/SOM/E-306-F-5-STRATEGIC FINANCIAL MANAGEMENT

Objectives:

1. To elaborate the key decision areas in financial management-investment, financing, dividend.
2. To explain the various techniques of evaluation of investment proposals.
3. To discuss the various factors to be considered in designing the target capital structure.

Unit I

Corporate Evaluation: Adjusted Book Value Approach, Stock and Debt Approach, Discounted Cash Flow (DCF) Approach, Cost of Capital Estimation, DCF Approach Growth Models, Free Cash Flow to Equity Valuation (FCFE), Guidelines for Corporate Evaluation

Unit II

Value Based Management: Methods and Key Premises of VBM, Alcar Approach, Stern Stewart Approach, BCG Approach-Total Shareholder Return, Total Business Return, Cash Flow ROI, Cash Value Added.

Unit III

Mergers and Acquisition: Reasons for mergers, Mechanics of a merger, Costs and Benefits of a Merger, Exchange ratio, Purchase of division/unit, Takeovers, Leveraged Buyouts, Acquisition Financing, Business Alliances, and Divestitures.

Unit IV

Corporate Governance: Divergence of Interest, Devices for containing Agency Costs, Corporate Governance in India, Legal Provisions and SEBI code, Reforming Corporate Governance, Executive Compensation, Employee Stock Option Plan (ESOP).

Unit V

Performance Measurement: Business Performance Measurement, Comprehensive Value Metrics Framework, Non-Financial Measures, Balanced Scorecard, Debt Analysis and Management: Rating of Debt Securities, Design of Debt Issues, Innovation in Debt Securities, Securitisation, Bond Covenants, Bond Refunding, Duration, Term Structure of Interest Rates.

Unit VI

Leasing and Hire Purchase: Types, Rationale, Mechanics, Operating Leases, Leasing as a Financing Decision, Hire Purchase Arrangement, Choice between Leasing and Hire Purchase, Project Finance.

Suggested Readings:

1. Prasanna Chandra, Financial Management, Tata McGraw Hill,2011
2. I M Pandey, Financial Management ,Vikas Publications -2013
3. Khan M. Y.& Jain P. K Financial Management, 6/e, TMH, 2011.
4. Rajiv Srivastava and Anil Misra, Financial Management, Second edition, Oxford University
Press,2011

D-International Business Group

BM/SOM/E-307-IB-1 International Trade Procedures Documentation

(i) Export Procedure: Starting an export firm – Selection of an export product, Market and Buyer – Registration procedure with Sales Tax, Central Exercise and various Boards and councils.

(ii) EXIM code number – Elements of export contract- Incoterms – Terms of payment and Letter of Credit**.** Export Documentation: Types of documents – Transport, Negotiation and Insurance documents.

(iii) Export Finance: Sources of Finance - Role of commercial bank, EXIM Bank, ECGC and others – Export promotion Schemes – Insurance for Export – Types – export credit insurance – Risk Management – Types of risks – mitigation methods.

(iv) Import Procedure and Documentation: Global sourcing – Types of global procurement – Tender – Negotiation – Contract and others – Customs regulations and import clearance formalities

(v) Types of import licenses- Export Promotion Capital Goods Scheme (EPCG) license- Duty exemption scheme – Duty Entitlement Pass Book Scheme (DEPBS)- Import formalities for 100% EOUs and SEZs - Import Risk Management.

Text Books:

1. P K Khurana "Export Management", Galgotia publishing company
2. Aseem Kumar "Export and Import Management", Excel Books,
3. David Stewart ,"International Supply chain Management", Cengage publications

BM/SOM/E-307-IB-2- International Trade Theories and Policies

1. Meaning, Definition, Nature, Scope, Importance of International Trade. The wave of Globalization and its impact on International Trade.
2. **International Trade Theories:**The Gains from Trade , The pattern of Trade, Balance of Payments, Exchange rate determination, International Policy Coordination, The International Capital Markets; International trade theories basics: Mercantilism, Adam Smith's Absolute advantage theory, Comparative cost advantage theory of David Ricardo
3. **International Trade Policy:**The Instruments of Trade Policy-Basic analysis of tariff- Supply, Demand and Trade in a single industry, Effects of Tariff, Costs and benefits of Tariff. Free Trade- Arguments for and against free trade. Case for and against protection- Basic theory of custom's union. Trade policies in developing countries. Macro economic policy and coordination under floating exchange rate – Optimum currency areas and European experience.
4. **International Negotiations and Trade Policy:** The advantages of negotiation, International Trade agreements- A brief History, The Uruguay round, Trade liberalization, From GATT to WTO, WTO and its role in international trade.
5. **Economics of Crises:** International Monetary System 1870-1973, Asian Financial Crisis of 1997, Global Financial Crisis of 2007, European sovereign debt crisis of 2010.

Suggested Readings:

1. Paul.R.Krugman& Maurice Obstfeld-International Economics-Theory and Policy
2. JagadishBhagwati- In Defence of Globalization
3. Joseph.E.Stiglitz- Globalization and its discontents
4. D.Sambandhan-The U.S.Dollar,Euro and World Money-Under Massive Heart attack

5.D.Sambandhan&M.B.Mohandas- Global Recession in Historical & Recent Perspective.

6. Economic Reforms in India Since 1991- Monika Kashyap&MahendraBabuKuruva, SAGE Publications, New Delhi

BM/SOM/E-307-IB-3-International Business Environment

(i) International Business and Its Environment, Theories of Export Behaviour, Theories of International Trade and Foreign Direct Investment.

(ii) Terms of Trade, Balance of Payments, Commercial Policy-Objectives, Instruments and Impact.

(iii) International Trading Framework GATT, WTO, UNCTAD, MFA, GSP, International Commodity Agreements, Bilateralism versus Multilateralism, Regional Economic Groupings including EC, EEA, NAFTA, ASEAN and CIS.

(iv) International Monetary System.

(v) Foreign Investment in India and Abroad, Technology Transfer, MNCs and International Business.

Suggested Readings

(1)	Peter H. Lindert	-	International Economics
(2)	Stanley Paldiwoda	-	International Marketing
(3)	Parvez A and Bahman E	-	International Business

BM/SOM/E-307-IB-4 -International Marketing Management

(i) Marketing Concept and Its Extension to International Marketing, International Marketing Tasks, Nature of International Marketing.

(ii) Selection of Foreign markets, The Concept of International Marketing Mix, Implementation of Marketing Strategies and seven Ps. Organization and Control for International Marketing.

(iii) Analysis of International Marketing Environmental Influences, Cultural and Social Dynamics, Economic Development and Geographical Conditions, Dynamics of Competitive Environment, Legal, Regulatory and Financial Influences.

(iv) International Market Segmentation, Market Entry and Operation Strategies-Export, Joint Ventures, Direct Investment, Strategic Alliances, Multinational Operations.

(v) International Product Policies, Strategic Considerations in making Product decisions, Alternative strategies in Multi-national Product Planning, Methodology in Making Product decisions for International markets.

(vi) International Pricing Decisions, Price Escalation, International Transfer Pricing, Factors Influencing the Pricing decisions for International markets,Export Pricing and Differential pricing.

(vii) International Distribution System and Logistics, International Marketing Channel Decisions, Importance and scope of Channel decisions, Nature of International Distribution Channels, Factors Influencing Channel decisions

Suggested Readings

(1)	Leighton	-	International marketing
(2)	Scravanavel P	-	International marketing
(3)	Kotler, Armstrong	-	Principles of Marketing
(4)	Keegan	-	Managing Global Marketing

(5) Franking R Root - International Marketing
(6) Foss and Caleore - International Marketing

BM/SOM/E-307-IB-5- International Business Law and Taxation

(i) Legal Frame Work of India's Foreign Trade, Indian Law of Contracts with specific reference to Foreign Trade, Sales of Goods Act with specific reference to Foreign Trade.
(ii) Import/Export Contracts for Products, Uniform Law on International Sale of Goods.
(iii) Project Export Contracts, Service Contracts with shipping, Air and Overland.
(iv) Joint Venture Agreements, Issues related to Methods of Payments and Overseas Distribution, Technology Imports.
(v) Law regarding Protection to Intellectual Property Rights, Patents, Trade Marks, Inventions, Marine Insurance, Foreign Investment Laws, International Taxation, Double Taxation Agreements.

Suggested readings

(1) Schmithoff C R -Export trade: The Law and Practice of International trade.
(2) J Daniel, Ernestaw O et el- International Business Environment and Operations
(3) Journal of World trade Law.

BM/SOM/SS- 308-Business Ethics

(i) Ethics- Meaning, ethical performance, ethics in business, source of ethics, types of ethics, models of ethics, factors influencing Business Ethics, Morality and ethics, Kohlberg's Theory or model, Functions of ethics

(ii)V**alues, norms, beliefs and standards**- Values, norms, beliefs. Morality, ethical codes

(iii)Normative Ethics in Management Theories of Ethics, ethical inquiry, reasons for payment, ethical reasoning, normative ethics, Teleological theory and Deontological theory, natural Law

(iv)Managing Ethics Ethical activities, Company codes, ethics training programmes, ethics committee , Laws enforcing ethical conduct.

(v)Ethical aspects in Marketing Marketing ethics and consumer rights, reasons for unethical practices, ethics and regulations in pricing, advertising critics, ethics in HRM , Privacy issues, secondary influences, psychological expectancy models, whistle blowing, discrimination, affirmative action, trade secrets and conflict of interests, ethical decision making.

Suggested Readings

1. C.S.V.Murthy-Business Ethics

MBA-IV SEMESTER

There are compulsory and elective papers in this semester, papers 401, 402, are compulsory and under elective papers the students shall have to choose Three papers from selected groups- Two from the Major specialization group and one from Minor Specialization Group.

BM/SOM/C-401-Industrial Training & Project Report

To give a first hand exposure to the students on management related problems and to enable them to develop problem solving skills with the help of problem solving techniques and by using primary and secondary information. Each student is required to undergo 45 days industrial training during the fourth semester. Students are required to prepare a project report in the guidance of their respective mentors/ project guides allotted to them by the department. Project report should be mandatorily submitted in the Department of Business Management, signed by the respective supervisors of the students .

BM/SOM/C-402- Strategic Management

(i) Introduction to Business Policy and Strategic Management, Nature, Meaning and Scope, Importance of Business Policy and Strategic Management.

(ii) Corporate Planning, Concept of Planning, Planning Process, Types of Planning, Strategic Planning, Strategic Decision Making, Mission, Objectives and Goals.

(iii) Corporate Strategy, Formulation of Strategy, Factors responsible for Shaping the Strategy, Different Types of Strategy, Environmental Analysis, Internal and External Environment of a Firm, Need for Environmental Analysis, Techniques for Environmental Analysis, ETOP

(iv) Corporate Appraisal and Its Significance, Assessment of Internal Capabilities, Company Situation Analysis, Strategy and Competitive Advantages, Matching Strategies, Functional Strategy and Operational Strategy.

(v) Implementing Strategy, Organization Structure, Culture, Commitment and Leadership, Business Unit Strategy, Portfolio Analysis, BCG and other Portfolio Models.

(vi) Strategic Alternatives, Stability, Expansion, Retrenchment, International strategy Variations, Diversification and Mergers, Strategic Alliances. Strategic Choice Process, Control and Evaluation Process.

(vii) Strategy in the Global Environment, Implementing Strategic Change- Politics, Power and Conflict.

Suggested Readings

(1) Thompson and Strickland -Strategic Management Concept and Cases
(2) Ansoff, H Igor -Corporate Strategy
(3) Charles W L Hill and G R Jones -Strategic Management Theory
(4) AzharKazmi -Business Policy
(5) Thomos L Wheelen and JD Huger -Strategic Management
(6) Hammel G and Prahalad C K -Competing for the Future

Major Specialization Groups-A,B,C,D,E,F (Two papers from one of the Major Specialization Group and one from Minor Specialization Group)

A-Marketing Management Group

BM/SOM/-403-M-6-Advertising Management

(i) Communication Process- Nature of Communication Process and Its Different Elements, Obstacles in Communication Process in Perception, Learning and Attitude Change.
(ii) Communication Process in Marketing- Importance and Applications of Communication Process in Marketing, Different Elements of Promotional Mix and Communication Process Relevant to them, Communication Process in Corporate Image Building, Advertising and Consumer Psychology.
(iii) Planning for Market Communication- Strategic Analysis for Market Communication, Communication Objective, Market Segmentation, Target Group and target Person, Brand Positioning.
(iv) Advertisement and Their Types- Importance of Advertising in Modern Marketing, Different Types of Advertising, Advertising Decision.
(v) Message and Copy, Message Strategy, Message design, Elements of Advertising Copy, Developing Effective Advertising Copy, Creative and Visualization in Advertising, Method of Creative development.
(vi) Media Planning- Comparative Study of Different Advertising Media, Media Choice, Media Scheduling, Budgeting for Advertising, Evaluation of Advertising Effectiveness, - Pre Testing and Post testing Techniques.
(vii) Regulation of Advertising- Advertising Department and its Organization, Advertising Agencies and their Organizations and Functions.

Suggested Readings

(1) Wright, Winters and Zeiglas -Advertising Management
(2) Dunn and Barban -Advertising-its Role in Modern Marketing
(3) Manendra Mohan -Advertising Management
(4) Aaker, Myers and Batra -Advertising Management
(5) Kenneth F Runyen -Advertising

BM/SOM/E-403-M-7-Sales and Distribution Management

(i) Basic Concepts- Selling Functions, Type of Selling and Emerging Dimensions, Direct Selling, Institutional Selling, Tele Marketing, Sampling, Follow the Customers and other Concepts.
(ii) Theories of Selling – Canned Approach, AIDA Model, Right Set of Circumstances Theory, Buying Formula Theories, Behavioural Equation Theory.
(iii) Process of Effecting Selling- Prospecting, Preapproach Presentation and Demonstration, Handling Objections, Closing the sale, Post sale Activities, Quality of Successful sales Person.
(iv) Sales management- Importance, Scope and Functions of Sales management, Organization for Sales, Sales planning-Market Potential Analysis, Sales

Forecasting, Fixing sales Objectives, Territory Allocation, Sales Quota, Participative Sales Planning and Behavioural Considerations.

(v) Sales Force Management- Sales Force Planning, Recruitment and Selection, Training and Development, Placement of sales Personnel, Compensation and Incentive to Sales Persons, Motivation and Leadership for Sales, Evaluation of Sales Performance.

(vi) Sales Control-M I S for Sales, Reports and Documents Used in sales Management, Budgetary Control in Sales, Sales Variance Analysis, Sales expenses Control.

(vii) Distribution Net Work- Various Distribution Channels and Their Comparative studies, Channel Design Decisions, Channel Management-Selection, Motivation, Evaluation, Control of Channel members, Channel Conflict Management.

(viii) Physical Distribution Management- Importance and Decision Areas, Logistic and Inner Distribution Management. An overview of Retail Marketing. Brief of Malls and Mall Management.

Suggested Readings

(1) Russel, BeachandBrukirk -Selling
(2) Still, Cundiff, and Govoni -Sales management
(3) K Patel -Sales
(4) Johnson, Kirtz and Schueing -Sales management
(5) Confierd -Salesmanship-Practice and Problems

BM/SOM/E403-M-8-Product Management

(i) Basic Concepts-Meaning and Various Concept of Product Value, Types of Product, Role of a Product Management, Product Market Strategies.

(ii) New Product Development- Various Stages, Product Idea-Generating Ideas, Creativity for Ideas, Creativity development Techniques, Screening Procedure, Concept development and Testing.

(iii) Strategic Product Development-Strategies Analysis- Analysis of Consumer Needs, Motives for Buying, Identifying Unsatisfied Consumer Needs, Analysis of Competitive Products and Brands, Business Analysis of New Product Concepts, Physical Development- Designing and testing the Prototype, Deciding Product Size, Shape, Colour, Packaging and Naming the Brand, Economic analysis.

(iv) Market Testing and Commercialization. Product Line management-Decision of Product Portfolio, Product Diversification, Dropping the Introducing the Product decisions, Problem Products, Product decisions.

(v) Product Life Cycle- Various Cycles and their Identification, Product Revamping, Elimination Decision.

(vi) Brand management- Concept of Brand, Brand value, Brand Building, Market Segmentation, Product Positioning and Mapping, Positioning Strategy.

Suggested readings

(1) M. Chaturvedi -New Product Development
(2) Mascarenhas -New Product development
(3) Urban and Hower -Design and Marketing of New product
(4) Booz, Allein and Hamilton -Management of New Product

B- HRM Group

BM/SOM/E-404-H-6-Industrial Relations

(i) Meaning, Scope and Importance of Industrial relations; Major Participants in IndustrialRelations; Role of State; Characteristics of Industrial System in India.

(ii) **Trade Union Movement in India-** Growth, Problems, Recent Trends and Future ofTrade Unionism in India.
(iii) Trade Unions in India- Concept, Objectives, Structure and Functions. Trade Unions Act, 1926. Major Problems and Issues. Employers Organizations in India.
(iv) Workers Participation in Management- Meaning and Objectives of WPM and FactorsInfluencing the WPM. Workers Participation in Management in India
(v) Industrial Disputes- Nature and Causes, Machinery Provided for Investigation, Prevention and Settlement of Industrial Disputes. Industrial Disputes Act, 1947.Review and Appraisal.
(vi) Collective Bargaining-Concept, Features, Types and Process. Pre-requisites for Success of Collective Bargaining.Status of Collective Bargaining in India.
(vii) Grievance Handling and Employee Discipline- Approaches, Procedure. National Commission on Labourand Its Recommendations on Various Aspects of IndustrialRelations in India.

Suggested Readings:

(1) Singh, B P, Chhabra, T N, Taneja,P L - Personnel Management& IR
(2) Abraham H Maslow - Motivation and Personality
(3) Agnihotri, V - Industrial Relations in India
(4) Prasad, Lallan - Personnel Management and IndustrialRelations.
(5) Davar, Rustam S - Personnel Management and IndustrialRelations.

BM/SOM/E404-H-7 Organizational Development and Intervention Strategies

(i) Organizational development-Definition, Values, Assumptions and benefits of Organizational Development.Theory and Management of Organizational Development-Foundations of Organizational Development,
(ii) Managing Organizational development Process, Action Research,Organizational Interventions-Team Interventions, Inter Group and third Party Peacemaking Interventions, Comprehensive Interventions.
(iii) Diagnosis and Intervention- Organizational Diagnosis- An Overview, Diagnosis Methods, Interventions in Organizational Change, Evaluation of Organizational Change Programme
(iv) Concept of Managing Change- The Process of Organizational Change, Factors Influencing Organizational Culture and Change, Managing Resistance to change, Effective Implementation of Change.
(v) Models of Organizational Change-Some Models of Change, Causes of Failure of Changes, Organizational Change and Process Consultation, Managers and the change, Internal and External agents of change.
(vi) Key Considerations and Issues-Ethical Standards in Organizational Development, The Future of Organizational development.

Suggested Readings

(1) Uma Sekren -Organizational Behaviour
(2) French and Bell -Organizational development
(3) Stephen Robbins -Organizational Behaviour
(4) Abad Ahmed at el -Development Effective Organizations
(5) Hussey -How to Make Organizational change

BM/SOM/E404-H-8- Human Resource Planning and Development

(i) Human Resource Planning - Role of Human Resource Planning in the context sof Human Resource Management, Definition, Objectives, Frame Work, Components of HRP, Organization Philosophy as Related to the Human resource Planning.

(ii) Manpower Forecasting- Necessity, Problems, Management of Cadre Structure in an Organization, Stock and Flows Model-Push and Pull Models, Markov Chain Models, Correlation Models, Benefits of Forecasting, Downsizing and Its Implications.

(iii) Job Analysis, Job Description and Job Specifications- Concept, Need and Importance, Methods of Job Analysis- Functional Job Analysis, Job Elements Method, Flieshman Job Analysis System, Positional Analysis, Job Description and Job specification.

(iv) Recruitment and Selection of Human resources-Recruitment, Selection, Vacancy Characteristics and Effects on Job Choice, Non Compensatory and Compensatory Decision Process in Job Choice, Factors Influencing Recruitment Efforts, Effects of Personnel Policies in recruitment Sources, Different Methods of Recruitment. Selection-Methods and standards, Types of Selection Methods, Steps in Selection Process.

(v) Performance Appraisal- Definition and Uses, Objectives, Appraisal Systems-Features and Limitations, Uses and Abuses Performance Appraisal Methods, Self Appraisal, Peer Appraisal, Frequency of Appraisal, Performance, Counseling and Feedback, Potential Appraisal, Monitoring and review of Appraisal System, Linkages with other Systems.

(vi) Employee development-Work roles of Employees Managers and Executives, Organization Characteristics Influencing Employee development, Approaches to Employee development, Current Issues in Employee development, Managing Work Force Diversity, Success Planning.

(vii) Career Management-Concept, Necessity, Career development Model, Career Planning Systems and Its Components, Career Counseling, Career Pathing Role of Employees Managers and Company in Career Planning, Career Plateauing, Dual Career Paths, Balancing Work and family, Coping with Job Loss, Retirement.

Suggested Readings

(1) David A, De Cenzo and Stephen P Robins-Personnel, Human resource Management
(2) Liyod L Byarsand Leslie W Rue- Human Resource Management,

C- Finance Group

BM/SOM/E -403 - F-6- International Financial Management

(i) Financial Management in a Global Perspective: Globalisation. India in the Global Economy. Challenges of International Financial Management. International Monetary System. An Overview of International Financial Markets. Exchange Rate Determination and Forecasting. Purchasing Power Parity. The Fishers' Effect. Interest Rate Parity.

(ii) The Foreign Exchange Market: Structure and the Participants, Types of Transactions, Mechanics of Currency Dealing, Exchange Rate Quotations, Arbitrage, Forward Rates, Evolution of Exchange control and the foreign Exchange Market in India, Exchange Rate Computations. Currency Derivatives: Currency Futures, Currency Options.

(iii) Foreign exchange Exposure and Risk: Economic Exposure, Transaction Exposure, Translation Exposure, Management of Exposures.

(iv) Short Term Investment Decisions- Domestic VS International Working Capital Management, International Cash Management, Cash Positioning, Cash Mobilization, Hedging Strategy, Intra Corporate Transfer of Funds, Transfer Pricing, Managing International Fund remittances, Problems of International

Cash management, International Receivables management, International Inventory management.

(v) International Financing Decisions, Euromoney and Euro Bond markets;Growth of Eurodollar Market, Instruments of International Financial Markets.

Suggested Readings

(1) Apte P G - International Financial management
(2) Keith Pilbeam - International Finance
(3) Levi M D - International Finance
(4) Singh P - Investment Management
(5) Paul.R.Krugman&MuriceObstedfield -International Economics
(6) Jeff Madura-International Financial Management
(7) Alan.C.Shapiro- Multi National Financial Management

BM/SOM/E-403-F-7- BANKING& FINANCIAL SERVICES

(i)Banking: Meaning and Definition, Evolution of Indian Banks, Types of banks, Performance of Banks.Commercial banking: Structure, Functions, Role ofcommercial banks in socio economic development, Credit creation and Deployment of Funds, Bank Clearing House: Clearing Procedure.Hi-tech Banking: Modern technology in Banking, Core banking, E Banking, ATM, EFTS,RTGS, Internet Banking, Mobile Banking.

(ii)Bank and Customer: Relationship between the Banker and the Customer, Types of accounts and Deposits, Forms of lending, Documents & Procedure forloan. ALM in banks: Components of Liabilities and Components of Assets, Significance, Purpose and objectives.Banking Instruments: Cheque, Bank draft, e-cheque, Travelers cheque, credit card, chequecards, and Debit card.Concepts of Universal Banking

(iii)International Banking: Exchange rates and Forex Business, BASEL, Correspondent banking and NRIAccounts, Letters of Credit, Foreign currency Loans, Facilities for Exporters and Importers,Role of ECGC, RBI and EXIM Bank.

(iv)Housing Finance: Types, Institutions and banks offering Housing Finance, Procedure and Interest rates, Income Tax Implication.Leasing: Concept, Steps in Leasing Transactions, Types of Lease, Legal frameworks, Advantages and disadvantages of Leasing,Matters onDepreciation and Tax, Problems in leasing, Factors influencing Buy or Borrow or LeaseDecision.Hire Purchasing: Concepts and features, Hire Purchase Agreement, Comparison of HirePurchase with Credit sale, Banks and Hire Purchase, Reversemortgage.

(v)Credit rating: Definition and meaning, Process of credit rating of financial instruments, Ratingmethodology, Rating agencies, Rating symbols of different companies. Securitization of debt:Meaning, Features, SPV, Types of securitisable assets, Benefits of Securitization, Issues in Securitization.Factoring& Forfeiting: Meaning, Functions, and Types.

(vi) Venture Capital: Concept, features, Origin in India and the current Indian Scenario.

Mutual Funds: Meaning, types of funds, organization of fund, NAV, Guidelines of Mutual Funds. Derivatives: Forwards, Futures, Options, Swap – Meaning, Features.

Suggested Readings:

1. Banking and Finance: Theory and Practice - Clifford Gomez, 1/e, PHI, 2011.
2. Bank Financial Management-Indian Institute of Banking and Finance, 1/e, Macmillan,
3. Financial Markets and Services – Gordon &Natarajan, , Himalaya publishing
4. Financial services- Khan M.Y, 6/e, McGraw Hill, 2011.
5. Banking Theory and Practice – Shekar&Shekar, Vikas, 20/e, 2011.

BM/SOM/E-403-F-8 Cost Accounting

(i) Introduction-Cost,Costing,CostAccounting,Relationship of Financial Accounting and Cost Accounting.

(ii) Classification of Cost, Different Concepts relating to Cost and Cost Accounting, Element of Cost, Material, Purchases, Store Route, Labour Remuneration and Incentives.

(iii) Unit or Out Put Costing-Meaning, Objectives and Importance and Methods of Determination of Unit Cost, Cost Sheet, Statement of Cost & Profit and Production Account. Job or Contract Costing- Meaning, Objectives and Importance, Preparation of Contract Account. Difference between Unit Costing and Job Costing.

(iv) Process Costing-Meaning, Objectives and Importance, Preparation of Process Account, Operating Costing-Meaning, Objectives and Importance, Calculation of Operating Cost.

(v) Standard Costing-Meaning, Objective and Importance, Types of Standards, Limitations of Standard Costing, Variance Analysis, Material, Labour and Overhead Variance. Marginal Costing-Meaning, Objectives and Importance, Limitations of Marginal Costing, Contribution, Break Even Analysis, P/V Ratio, Margin of Safety, Key Factor. Marginal Costing and Decision Making.

(vi) Budgetary Control-Meaning-Meaning and Characteristic of Budgetary Control, Advantages and Limitations of Budgetary Control Budget.

Suggested readings

(1) R R Gupta - Advance Accounting
(2) C T Horngren - Cost Accounting
(3) M N Arora - Cost Accounting
(4) J C Katyal - Cost Accounting
(5) Chalos - Managing Cost in today's Mfg. Env.

E- International Business Group

BM/SOM/E-404-IB-6 Import Export Management

(i) Import Management in a developing Economy, Objectives of Import Policy, Types of Licenses, Foreign Exchange Budgeting, Global Procurement, Conceptual Framework, Methods of Import Procurement, and Import Procurement Planning at Corporate Level, Identifying Sources of Supply, Supplier Identification, Selection and Evaluation.

(ii) Import Financing, Purchase Price Analysis, Canalization of Imports under Counter Trade, and Market Research for Import Procurement, Monitoring and Follow up of Import Contracts.

(iii) Buying of Technology, Import Procedure in India, and Customs Clearance of Imported Cargo, Customs Valuation of Imported Cargo, Import Documentation, Materials Management for Projects, Procurement under Worlds Bank Projects.

(iv) Export Management-Concept and Scope, Forms of Organizations, Export Marketing Environment, Export Planning, Organizing for Export, Organization Chart, Building a team, Executive Action, and Management Control.

(v) Barriers and Bottlenecks in Exports with specific reference to India.

Suggested Readings

(1) T A S Balgopal - Export Management
(2) B.S. Rathore - Export marketing
(3) P. Kumar and A K Ghosh - Export Management
(4) Ronald R - International Purchasing

BM/SOM/E-404-IB-7-Financing of Foreign Trade

(i) Financing of Imports and Exports, Methods and Procedures of Making Foreign Payments, Packing Credit, Letter of Credit, Deferred Payment Arrangement.

(ii) Turnkey Contracts, Joint Venture Abroad, Post Shipment Credit, Negotiation and Purchase of Export Bills, Scrutiny of Bills, Accounts Receivables-Domestic and International.

(iii) International Factoring, Forfeiting, Accounts Receivable Insurance, Investment in Foreign Countries- Evaluation, Role of EXIM Bank.

(iv) Foreign Exchange- Calculation of Foreign Exchange Rate, Forward exchange Market, Forward Contracts, Forecasting of Exchange rate, Forward Contracts Extension and cancellation of Forward Contracts, Option forwards and Swaps, Exchange Control in India.

(v) International Financial market-Internal and International Foreign exchange Market, Euro market, International debt market, International capital market, International banking, International Lending Agencies-IMF,IDA,IFC,ADB, CDFC.

Suggested Readings

(1) B K Chaudhury - Finance of Foreign Trade and Foreign Exchange

(2) Pigott and Scott - International Financial management

BM/SOM/E-404-IB-8 Global Logistics and Supply Chain Management

(i) Logistics Management: Concepts – Importance – Elements of the logistic System – Marketing and logistic mix – Logistics and marketing interface – Value-chain and production efficiency.

(ii) Shipping Industry: Types of ships – Shipping systems: linear, Tramp, conference, chartering, Baltic freight exchange – Shipping intermediaries: agent , forwarder, brokers and others – containerization – types of containers – ICDs – CFS – CONCOR.

(iii) Air Transport: Air transport – Air freight – IATA – Cargo handling – Designing the International Information system – system modules – Distribution and Transportation.

(iv) Supply chain: Definition – scope and importance of supply chain – supply chain drivers and metrics - efficient and responsive supply chain - Designing supply chain network: Distribution network – Factor influencing distribution - Transportation decision in supply chain management

(v) Forecasting and planning in supply chain management – Pricing in supply chain management- Role of IT in supply chain management - co-ordination in supply chain management.

Text Books

1. Chopra S and P Meindl “Supply chain management: Strategy, planning and operations”

2. David P, “International Logistics” Biztantra, New Delhi

3. T.A.S.BalaGopal, Export Management

BM/SOM/C405- Dissertation & Viva- Voce

At the end of the Semester, each Student will have to appear for Viva-Voce exam wherein his knowledge and skill acquired during the course and the Project work done shall be examined. The Viva Voce shall be conducted jointly by the Internal and External Expert.

BM/SOM/SS 406 Disaster Management (Self Study Course)

(i) Principle of Disaster Management-Component of Disaster Management, Organizational Structure of Disaster management, Natural Disaster, Man Made Disaster, Hazards, Risks and Vulnerabilities. Assessment of Disaster, Vulnerability of a location and vulnerable groups.

(ii) Disaster Management Plans, Disaster Management Schemes, Natural Disaster and Mitigation Efforts, Risk Assessment and Disaster Response, Insurance and Risk Management, Role of Financial Institutions in Mitigation Efforts, Group Dynamics, Team Building, Motivation with specific reference to Disaster Management.

(iii) Psychological and Social Dimensions in Disaster, Trauma and Stress Management with reference to Disaster, Role of Leadership and Emotional Intelligence in Disaster Management.

(iv) Post Disaster Relief and Logistic Management, Emergency Support Functions and their Coordination Mechanism, Relief Resources and Materials Management, Relief Campus Management, Voluntary Agencies- Their Role and Participation in Disaster Management, Disaster Rehabilitation Planning and Management.

(v) Disaster Management information System, Role of Remote Sensing, Government Departments and other Agencies concerned with Disaster Management, New Initiatives in Disaster Management with latest Threats to Environment and Safety of the Society.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – CHEMISTRY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lecturer-ship

CHEMICAL SCIENCES

Inorganic Chemistry

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory).
3. Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.
4. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.
5. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.
6. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
7. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis.
8. Cages and metal clusters.
9. Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.
10. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.
11. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.
12. Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Physical Chemistry:

1. Basic principles of quantum mechanics: Postulates; operator algebra; exactly-solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling.

2. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.

3. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.

4. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems.

5. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.

6. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

7. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

8. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.

9. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.

10. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

11. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.

12. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

13. Polymer chemistry: Molar masses; kinetics of polymerization.

14. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

Organic Chemistry

1. IUPAC nomenclature of organic molecules including regio- and stereoisomers.

2. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.

3. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.

4. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes.

5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.

6. Common named reactions and rearrangements – applications in organic synthesis.

7. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations.

8. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.

9. Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction – substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic.

10. Pericyclic reactions – electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.

11. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).

12. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.

13. Structure determination of organic compounds by IR, UV-Vis, ^{1}H & ^{13}C NMR and Mass spectroscopic techniques.

Interdisciplinary topics

1. Chemistry in nanoscience and technology.
2. Catalysis and green chemistry.
3. Medicinal chemistry.
4. Supramolecular chemistry.
5. Environmental chemistry.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – COMMERCE

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

DEPARTMENT OF COMMERCE

Revised Syllabus

(1st January, 2019)

For

Master of Commerce (M. Com.)

Examinations: 2017-18 and Onwards

H.N.B. GARHWAL UNIVERSITY

SRINAGAR GARHWAL

(A Central University)

SYLLABUS OF TWO YEARS FULL TIME MASTER OF COMMERCE (M. Com) DEGREE PROGRAMME (SEMESTER WISE)

1. There shall be a full-time Master's Degree programme viz Master of Commerce (M.Com). The duration of the course shall be two years (i.e. two academic sessions). Each year shall be divided into two semesters (July – December & January – June). There shall be about 90 teaching days, across 16 weeks, in a semester. The examination shall be held in around December and May for the First / Third and Second/Fourth semesters, respectively, or as decided by the University.

2. A candidate for admission to M.Com Ist Semester must have passed B.Com. Examination of any recognized Indian or Foreign University with minimum 45% marks in aggregate, or B.A. with Economics or Mathematics, or B.Sc. with Mathematics or Economics with minimum 50% in aggregate, from a recognized Indian or Foreign University. Those appearing for their final examinations of Bachelor Degree programme may also apply, provided, they can produce their result at the time of admission.

3. A candidate who has passed the previous examination for the degree of Master of Commerce of any other recognized University (following the Semester system) may also be admitted to the final examination provided that he has offered, for his previous examination, a course of an equivalent standard, with almost similar syllabus as is required for the previous examination of this University and has attended a regular course of study of one academic year.

4. A candidate who does not possess a commerce background in the qualifying class (i.e. graduation BA/B.Sc. shall be required to pass the qualifying course in Book- Keeping and Accountancy, by securing at least 18 marks out of 50. He shall not be awarded the M.Com. degree unless he/she qualifies this course. However, the marks secured in the qualifying examination shall not be added to his aggregate marks.

5. There shall be a maximum of 100 seats for the M.Com. programme for Srinagar Campus and 60 seats for Tehri Campus. Reservation as per the Central Government Rules shall be applicable.

6. The candidates seeking admission to the course shall have to appear at a written test, a group discussion and an interview if and when conducted by the University. The written test shall generally carry questions related to comprehension (English language), Reasoning, General Awareness, Business and Finance Aptitude and Mathematics (Intermediate level).

7. Only those qualifying at the written test in the order of merit shall be called for interview and group discussion, which shall carry a maximum of 25 (Twenty five) marks each. The number of candidates called shall generally be equal to three times the number of seats available or as decided by the University.

8. The relative merit list for admission shall be prepared on the basis of all the three components as follows:
i) Written Test/ graduation marks (75%), ii) Group Discussion (10%), iii) Interview (15%).

   The criterion for inviting students for the Group Discussion and Interview shall be the performance in written test, or a candidate's previous academic record at Graduation level or both as decided by the University. While the final selection shall be on the basis of performance at the Interview and Group Discussion as well as the marks obtained at the written test.

9. Those qualifying in the final merit (after interview / group discussion) shall be eligible for admission. If some seats fall vacant, those in the subsequent order of merit (waiting list upto a cut off point to be decided by the department) shall be eligible for admission.

10. The examination of the course shall consist of six papers in each of the semesters including, e-Commerce or project report and seminar & viva-voce. Only seminars shall be evaluated internally, rest of the courses, including the project and the viva voce, shall be evaluated externally.

i. The maximum marks for each paper shall be 100 of which 40 marks shall be awarded on the basis of internal assessment in each paper excluding Project Report and seminar & Viva-Voce (for which details have been provided ahead) and 60 marks kept aside for the end semester examinations. There shall be a maximum of 10 marks for attendance, 10 marks for assignments, 10 marks for midterm tests, and 10 marks for surprise test (overall 40 marks) under internal assessment.

The Scheme of Courses along with their credits in the Programme shall be as follows (2017-18 and onwards):

Semester I		
M.Com.101	Corporate Financial Accounting	**3 Credits**
M.Com.102	Management Principles and Practice	**3 Credits**
M.Com.103	Business Environment	**3 Credits**
M.Com.104	Managerial Economics	**3 Credits**
M.Com.105	Computer Applications in Business	**3 Credits**
M.Com.106	Business Communication	**3 Credits**

Semester-II		
M.Com.201	Financial Management	**3 Credits**
M.Com.202	Marketing Management	**3 Credits**
M.Com.203	Human Resource Management	**3 Credits**
M.Com.204	Research Methods & Statistics	**3 Credits**
M.Com.205	Management Accounting	**3 Credits**
M.Com.206	Legal Aspects of Business	**3 Credits**
M.Com.207	Organizational Design, Development and Change **(Self Study Course)**	**3 Credits**

Semester-III		
Core Papers	**Core Papers**	
M.Com. 301	International Business	**3 Credits**
M.Com. 302	Management of Financial Services	**3 Credits**
M.Com. 303	Income Tax Laws and Practice	**3 Credits**
Elective Group: The students have to opt one whole group as a major course and one paper from another group as a minor course.		
Group A: Finance:		
M.Com.304	Financial Markets and Institutions	**3 Credits**
M.Com.305	Security Analysis and Portfolio Management	**3 Credits**
Group B: Marketing		
M.Com.306	Consumer Behaviour	**3 Credits**
M.Com.307	Marketing Communication	**3 Credits**

Semester –IV		
M.Com.401	Project Planning and Evaluation	**3 Credits**
M.Com.402*	E-Commerce Or Project Report	**3 Credits**
M.Com.403**	Seminar and Viva Voce **(40+60)**	**3 Credits**
Elective Group: The students have to opt one whole group as a major course and one paper from another group as a minor course. Group selected by the student as major group in 3rd semester cannot be changed in the 4th semester.		
Group A: Finance		
M.Com.404	Risk Management and Insurance	**3 Credits**
M.Com.405	International Financial Management	**3 Credits**
Group B: Marketing		
M.Com.406	Marketing of Services	**3 Credits**
M.Com.407	International Marketing	**3 Credits**
M.Com.408	Entrepreneurship Development **(Self Study Course)**	**3 Credits**

Note: The detailed course outlines for each course, mentioned above is explained, as follows.

Note: * Students have to opt for either E-commerce as a paper or Project Report. Only those students can opt project Report, who has secured 75% marks in aggregate up to second semester. Project Report (periodical presentation 20 marks, Viva-voce 20 marks and project Evaluation 60 marks)

Note: ** M.Com.403- Seminar and Viva Voce (Seminar 40 marks and Viva-Voce 60 marks)

Detailed Syllabus for M. Com.

Semester-I

M.Com. 101: Corporate Financial Accounting:

Course Objective: The objective of paper is to help students understand accounting with relation to the corporate world and to introduce the recent accounting concepts and conventions. Students are requested to follow Revised Schedule VI for presenting Balance sheet wherever needed.

Course Outline:

Unit 1: Preparation of Final Accounts of Companies: Preparation of Final Account with adjustments as per revised schedule VI.

Unit II: Valuation of Goodwill and Share: Valuation of goodwill and shares with all the available methodology.

Unit III: Corporate Accounting: Issue and redemption of debentures.

Unit IV: Holding Companies: Preparation of Consolidated Profit & Loss Accounts and Balance-sheet.

Unit V: Accounting for Amalgamation of Companies as per A.S.-14: Accounts of amalgamation, absorption and reconstruction of companies

Note: Question paper will contain 50% Numerical questions and 50% Theoretical questions.

Suggested Reading:

1. M.C. Shukla & T.S. Grewal: Advanced Accounts, S. Chand & Co. (Pvt.) Ltd. New Delhi.
2. S.M. Shukla & S.P. Gupta: Corporate Accounting, Sahitya Bhawan Publications Agra.
3. R.L. Gupta & M. Radha Swamy: Ad. Accounting, Sutan Chand & Sons, Delhi
4. S.M.Maheshwari: Fiannacial Accounting,
5. G.R. Mounga: Corporate Accounting, Mayur Publication, New Delhi

M.Com. 102: Management Principles and Practice:

Course objective: The objective of this course is to provide an understanding of the tasks and functions of management and to acquaint the participants with the developments of the concept, theories and practices in the field of management.

Course Outline:

Unit I: Management: Nature and Significance of Management, Classical, Neo-Classical and Modern Theories of Management. Contingency and System Approach to Management, Functions of Management.

Unit II: Planning: Meaning and Process, Goals, Objectives, Plans and Programmes. Premises of Planning – Forecasting, Process of Decision Making. Rationality and Bounded Rationality. Risk and Uncertainty in Decision Making.

Unit III: Organization: Theory, Structure, Departmentation, Vertical and Horizontal Growth in Organization, Line and Staff Functions and Conflicts, Span of Management, Authority, Accountability, Delegation, Centralization and Decentralization, Formal and informal organization Group Functions in Organization: Formation and Role of Groups in organization.

Unit IV: Staffing: Nature and Purpose of Staffing: Selection, Performance Appraisal, Organizational Development.

Leading: Motivation – Meaning and Theories of Motivation, Motivation in Practice Leadership – Types and Traits of a Leader, Leadership Styles. Communication: Forms, Process, Barriers and Effective Communication.

Unit V: Controlling: Meaning and Process of Controlling. Techniques of Controlling. Management of Change: Adaptability to Change, Resistance to Change. Emerging Challenges for the Managers.

Suggested Reading:

1. Stoner, James A.F., Management, Pearson (Textbook)
2. Robbins, Stephen P. and Coulter, Mary, Management, Prentice Hall
3. Koontz, Harold and Weihrich, Heinz, Essentials of Management, McGraw-Hill
4. Bateman, Thomas S. and Snell, Scott A., Management, McGraw-Hill
5. Hill, Charles W.L. and McShane , Steven L., Principles of Management, McGraw Hill
6. Pareek, Udai, Understanding Organizational Behaviour, OUP, New Delhi (Textbook)
7. Thakur and Burton, Management, McGraw-Hill

M.Com.103: Business Environment:

Course Objective: The objective of this course is to develop the ability to understand and scan business environment in order to analyse the opportunities and take decisions under uncertain conditions.

Course Outline:

Unit I: Theoretical Framework of Business Environment: Concept, significance and nature of business environment; Elements of environment micro and macro; Techniques of environmental scanning and monitoring.

Unit II: Economic Environment of Business: Significance and elements of economic environment; Economic system and business environment; Economic planning in India; Government policies, industrial policy, fiscal policy, monetary policy, EXIM policy.

Unit III: New Economic Policy: Privatization, Liberalization and Globalization and their Implications for Indian Business, MNCs.

Unit IV: Political and Legal Environment of Business: Critical elements of political environment; Government and business; Competition Act 2002, FEMA and Consumer Protection Act.

Unit V Technological Environment: Factors Influencing Technological Environment. Role and Impact of Technology on Business. Transfer of technology-Channels, Methods and limitations.

Suggested Reading:

1. Adhikary, M.: Economic Environment of Business Sultan Chand & sons New Delhi.
2. Ashwathappa, K.: Legal Environment of Business Himalaya Publication New Delhi.
3. Cherunilam, Francis: Business Environment Himalaya Publishing House New Delhi.
4. Rajvaid: Business Environment.
5. I.C. Dhingra, Indian Economy: Environmental and Policy, Sultan Chand & sons New Delhi.
6. S.K. Mishra and V.K. Puri: Economic Environment of Business.

M.Com.104: Managerial Economics:

Course Objective: To develop managerial perspective on economic fundamentals as an aid to decision making under given environmental constraints.

Course Outline:

Unit 1: Introduction: Nature and Scope of managerial economics and its relationship with other disciplines; Its role and significance in decision making; Basic concepts; Positive Vs Normative analysis.

Unit II: Market Forces: Demand and Supply:

a) Demand Analysis: Theory of demand; Objectives of demand analysis and determinants of demand; Theory of consumer behaviour; Elasticity of demand and its measurement methods; Importance in decision-making.

b) Supply Analysis: Objectives of supply analysis; Determinants of supply.

Unit III: Production Function and Cost Analysis: Theory of production and cost analysis; Production function and its managerial uses; Laws of production and analysis; Empirical estimates of production and cost; Short-run and long-run average cost curves and their analysis; Economies and diseconomies of scale.

Unit IV: Organisation of the Firm: Pricing decision; Pricing under different market structure; Perfect and imperfect (monopoly, monopolistic and oligopoly markets); Pricing strategies; Collusive and non-collusive oligopoly; Baumol's marries; and O. Williamsons' models.

Suggested Reading:

1. Baumal, Shalliam J. Economic theory and operations analysis, Prentice hall, Landon.
2. Baya, Michail R. Managerial economics and business strategy, Mc Graw hill New York.
3. Chopra O.P. Managerial economic, Tata Mc Graw hill Delhi.
4. Dean, Joel. Managerial economic, prentice hall Delhi.
5. Crag W. Peterson, W.Cris Lewis, and Sudhir K. jain, managerial Economics, Prentice-Hall of India/ Pearson, New Delhi, 2004.
6. H.L Ahuja, Managerial Econimics, S. Chand, 2004.
7. DN Dwivedi, Managerial Economics, 4th ed., Vikas Publishing House, New Delhi, 2006.
8. Paul Samuelson and Nordhaus, Economics, 19th ed. Tata McGraw-Hill, New Delhi, 2005.

M.Com.105: <u>Computer Applications in Business:</u>

Course objective: The main objective of the course is to familiarize the students with the fundamental aspects of computers and their application in Commerce.

Course Outline:

Unit I: Introduction to Computer: Evaluation of Computer, Functional part of computer, Input Devices, Output Devices, Central Processing Unit, Memory (Primary and Secondary), Introduction to Software (System Software, Application Software)

Unit II:

a) **Operating Systems:** Type of Operating Systems, Functions of Operating Systems, Features of a good operating system, Introduction to WINDOWS.
b) **Application Softwares:** Type of Application software, Introduction to Word Processing (MS word), Introduction to Presentation Software (MS Power Point).
c) **Introduction to Spreadsheets** (MS Excel), Introduction to Database (MS Access).

Unit III: Introduction to SPSS: Descriptive Analysis

Unit IV: Introduction to Computer Networks: Need for Networking, Type of Networks, Networks Topologies, Transmission Media, Networking Components (BRIDGE, GATEWAY, ROUTER, REPEATER, HUB, SWITCH), Introduction to Internet (WWW, HTTP, FTP, TCP/IP).

Unit V: The Internet Environment: Surfing & Searching, Protocols, World Wide Web, Elementary Idea of E-Commerce & Its Types, future of information technology.

Suggested Readings:

1. Pandey, U.S. & Kumar, Varinder. *Computer Applications in Business* (ed.2017), Kitab Mahal, New Delhi
2. Rajaram, V. *Introduction to Information Technology,* PHI.
3. Eliason, A.L. *On-line Business Computer-Applications*. Chicago: Science Research Associates.
4. Frye, Curtis D. *Step by Step Microsoft Excel 2010*. PHI
5. Leon, A, and Leon, M. *Fundamentals of Information Technology*. Leon, Vikas (4) Software Manuals
6. Sinha, Pradeep K. and Sinha, Preeti. *Foundation of Computing*. BPB Publications.
7. Basandra, Suresh K. *Management Information System*. New Delhi-Allahabad: Wheeler Publication.
8. Kumar, Muneesh. *Business Information System*. Vikas Publishing House.
9. Saxena, Sanjay. *A First Course in Computers*. Vikas Publiashing House.
10. Fizegerald & Dennis. *Business Data Communication and Networking*. Wiley

M.Com.106: Business Communication:

Course Objective: The objective of this course is to introduce students to the principles, processes and skills of communication, equip them with skills to critically analyze oral, written and multi-modal texts based on purpose, audience, message, organization and style.

Course Outline:

Unit I: Introduction: Nature of communication; Myths about communication; Communication process and stages in communication cycle; Barriers to effective communication; Formal and informal communication; Communication channels; Choosing the means of communication, like letters, memos, reports, fax, e-mail, presentation, telephone and multimedia; Improving the communication; Verbal and non-verbal communication; Organisational culture; Communication and ethics.

Unit II: Communication for Managers: Importance of communication to managers; Internal and external audiences in the organization; Planning and creating business managers; Analysing the problem and defining the purpose; Analysing business communication situations; Adapting the message to the audience.

Unit III: Written Communication: Planning, writing and revising business document; Designing documents; Slides and screens; Polishing the writing; Editing for grammar and punctuation; Choosing the right word; Revising sentences and paragraphs, letters, memos, e-mails and web writing, informative and positive message, negative messages, persuasive messages; Reports: Types, characteristics of business reports, purpose of reports; Planning and techniques of writing a report.

Unit IV: Recruitment and Employment Correspondence: Researching job; Job application letter; Curriculum vitae/ resumes; Employment; Interview; References; Offers of employment; Job description; Letter of acceptance; Letter of resignation.

Unit V: Interpersonal Communication: Listening, working and writing in teams; Planning, conducting and recording; Meetings; making effective oral presentation; Overcoming stage fright; Telephonic communication; Conversation and discussion; Public speaking; Seminar presentation; Conference; Group discussion.

Suggested Readings:

1. Raman and Singh, Business Communication, Oxford University Press, 2006, !2th impression
2. Business Communication Today, Bovee, Thill and Chaturvedi, Pearson Education, Ninth Edition
3. Deborah Britt Roebuck. Improving Business Communication Skills.
4. Lesikar and Flatley. Basic Business Communication. 11th Ed. New Delhi: Tata
5. McGraw-Hill Publishers 2008.
6. Locker, K.O., and Kaczmarek, S.K., Business Communication: Building Critical Skill, 2nd ed., Tata McGraw-Hill,2002.
7. Bovee, C.L., et al., Business Communication Today, Pearson Education, 200.

Semester II

M.Com.201: Financial Management:

Course objective: To develop adequate level of knowledge of broad areas of financial decisions and also to introduce to the students the basic analytical techniques and methods of Financial Management of Organizations.

Course Outlines:

Unit I: Financial Management: Nature, Objectives and Scope, Modern concept of finance, Financial Decision- Types of Financial Decisions, Role of Finance Manager, Risk Return Framework for Financial Decision Making, Time value of money.

Unit II:

a) **Cost of capital:** Concept of value, present value, basic valuation models.
b) **Capital Structure:** Concept, Financial Leverage and its Impact on the Valuation of firm, Theories of Capital Structure- net income approach, operating income approach, miller – Modigliani approach, Determinants of Capital Structure.

Unit III: Investment Decisions: Nature and Kinds of Capital Budgeting, Techniques of Evaluating Capital Budgeting Decisions, Capital Budgeting Under Risk and Uncertainty, Analysis of Real Life Capital Budgeting Decisions- Some Case Studies.

Unit IV:

a) Dividend Decisions: Dividend and its form, Theories of Dividend Policy and their Impact on the Value of a Firm, Determinants of Dividend Policy.
b) **Working Capital Management:** Meaning and Concepts of Working Capital. Estimating Working Capital Requirements. Management of Cash Receivables and Inventory.

Unit V: Corporate Restructuring: Merger and Acquisitions-Types, Sources of Takeover Gains, Valuation and Financing of Acquisitions, Analysis of some Case Studies**.** The Empirical Evidences on Theories and the Case Studies Relevant for above Topics are Required be Discussed**.**

Note: Question paper will contain 50% Numerical questions and 50% Theoretical questions.

Suggested Readings:

1. Van Horne James C.: Financial Management and Policy, Prentice Hall of India 12th Ed,208.

2. Prashna Chandra: Financial Management. McGraw Hill.

3. Pandey, I.M: Financial Management. 9th Ed. Vikas Publishing.
4. Khan and Jain: Financial Management. McGraw Hill.
5. Ross S.A., R.W: Westerfield and J. Jaffe, Corporate Finance, 7th Ed. McGraw Hill.
6. Brealey R.A. and S.C. Myers: Principles of Corporate Finance, McGraw Hill, 6th Ed.
7. V.Saran, Financial Management, PHI.

M.Com.202: Marketing Management:

Course Objective: The objective of this course is to facilitate understanding of the conceptual framework of marketing and its applications in decision making under various environmental constraints.

Course Outlines:

Unit I:

a) **Marketing Concept:** marketing management; Nature and scope; Evolution of marketing; Selling vs marketing; CRM; Emerging role of marketing; Marketing mix.
b) **Marketing Environment:** Concept; Need for study; Major elements and their impact on marketing decisions.

Unit II:

a) **Consumer Behaviour:** Consumer vs. organizational/industrial buyer; Their characteristics; Importance of understanding consumer behaviour; Determinants of consumer behaviour; Theories of consumer behaviour; Various buying roles in family; Types of buying behaviour; Consumer decision-making process in buying.
b) **Market Segmentation:** Nature and importance of segmentation; Pre-requisites for effective segmentation; Bases of segmenting consumer markets; Market selection strategies; Positioning.

Unit III: Product Decisions: Concept of product; Classification of products; Product line and produt mix; Branding, packaging and labeling; Customer services; Development of new product; Product life cycle; The new product (Consumer); Adoption process.

Unit IV:

a) **Price Decisions:** Pricing as a marketing variable-its role and importance; Price vs. non-price competition; Factors influencing price determination; Price setting in practice; Price policies and strategies.
b) **Distribution Channels and Physical Distribution Decisions:** Why are marketing intermediaries used? Marketing channel functions; Selecting channels distribution; Determining the intensity of distribution; Channel management decisions- selection, motivation and evaluation of individual middlemen; Manufacturer- distribution relationship; Retailing and wholesaling; Logistics of distribution.

Unit V:

a) **Promotion Decisions:** Nature; Objectives and importance of promotion; Communication process; Promotion mix and methods; Advertising; Personal selling; Public Relations and Sales promotion.
b) **Legal, Ethical and Social Aspects of Marketing:** Consumerism; Consumer protection measure in India; Recent Developments in consumer protection in India.

Suggested Reading:

1. Kotler Philip and Gray Armstrong: Principles of marketing, Prentice hall New Delhi.
2. Kotler Philip: Marketing Management-Analysis, Planning, Implementation and Control, Prentice hall New Delhi.
3. Ramaswami, V.S and Namakumari, S: Marketing Management Mac Millan India New Delhi.
4. Stanton, Shallian J. and Charles Futrell: Fundamentals of Marketing Mc Graw hill New York.
5. Rajan Saxena, Marketing Management, 3rd ed, Tata MCGraw Hill, New Delhi, 2009

M.Com.203: Human Resource Management:

Course Objective: To enable students to understand procedures, processes and techniques applied in the management of Human Resource in an organization.

Course Outlines:

Unit I: Introduction to Human Resource Management: Evolution of HRM , Objectives and functions of HRM , Role and responsibilities of HR Manager , Relevance of HRM , Systems approach to HRM

Unit II: Acquisition of Human Resource Management: Human Resource Planning: Purpose and process , Recruitment and selection: Sources of recruitment, stages in selection process , Placement, goals analysis: Job description and job specification.

Unit III: Developing Human Resources: Training and Development: Training needs, training methods, application of computers in training, developing effective training programmes, Concept of HRD, Management development programmes.

Unit IV:

1. **Performance Appraisal:** Concept and objective of performance appraisal , Process of performance appraisal , Criteria for performance appraisal , Benefits of performance appraisal , Limitations and constraints , 360 degree performance appraisal , Promotion-degree, transfer air separation: Promotion, purpose, principles and types; Transfer: Reasons, principles and types; Separation: Lay-off, resignation, dismissal, retrenchment, voluntary**,** retirement scheme.
2. **Motivating Human Resources:** Motivation at work, major motivation theory: An overview, Participative management, Compensation Management, Incentives: Concepts, types of incentives; Incentives schemes in Indian industries; Fringe benefits, Discipline and employees' grievance redressal.

Unit V:

a) **Individual Behaviour:** Attitude, perception, learning, values.
b) **Group Processes:** Group dynamics, power, policies, organizational culture and climate. Forms of groups.

Suggested Readings:

1. Dessier, Gary and Biju Varkkey, Human Resource Management, 11th ed., Pearson Education, New Delhi, 2009.
2. Gomez-Mejia, et al., Managing Human Resources, 3rd ed. Pearson Education.
3. Ivancevich, Human Resource Management, Tata McGraw-Hill.
4. David S. Decenzo and Stephen P. Robbins, Personal/ Human Resource Management, 3rd ed., Prentice Hall of India, New Delhi, 2006
5. Biswajeet Pattanayak, Managing Human Resources, 3rd ed., Prentice Hall of India, New Delhi.
6. K. Aswathappa, Human Resource and Personnel Management, Tata McGraw-Hill.
7. RS Dwivedi, Managing Human Resources in Indian Enterprises, Galgotia Publishing Co., New Delhi, Latest ed.

M.Com.204: Research Methods & Statistics

Course Objective: The objective of this course is to help students design and carry out research, as well as, the application of statistical tools and techniques for decision making.

Course Outline:

Unit I: (a) Business research: purpose, steps, objectives, preliminary research.

(b) Research design: preparing a blue print, establishing hypotheses, process. Sources of data.

Unit II: Developing research instruments: questionnaires and scales- types, preparation, standardisation.

Unit III: (a) Sampling methods & techniques: Probability and non- probability methods, random, non random techniques, stratification, focus group.

(b) Probability: Progressions and elements of set theories. Calculation of simple and compound Probabilities.

Unit IV: (a) Analysis of Time Series: Meaning and components, Measurement of Trend.

(b) Linear regression: equations, coefficients, introduction to multiple regression analyses.

Unit V: Testing Hypotheses: Test of significance Application of 'T' and 'F' Tests. Analysis of variance (ANOVA). Coefficient of Association and contingency, X^2 Test

Note: Question paper will contain 50% Numerical questions and 50% Theoretical questions.

Suggested Reading:

1. Wiliam G Zikmud ,Business Research Methods, Cengage Learning 2008
2. Uma Sekaran, Research Methods for Business Wiley India 2007.
3. Paneerselvam, Research Methodology, Prentice Hall of India 2009.
4. Aaker, D. A., Kumar, V., & Day, G. S. (2008). Marketing research. John Wiley & Sons.
5. Boyd, H. W., Westfall, R. L., & Stasch, S. F. (1977). Marketing research: text and cases. McGraw-Hill/Irwin.
6. Dash, M., & Malhotra, N. K. (2016). Marketing Research an Applied Orientation. Indian Institute of Management Lucknow.
7. Donald R.Cooper, Pamela S.Schindler, Business Research Methods, Tata McGraw Hill Publishing 2009.
8. Bhardwaj, R. S. (2009). Business statistics. Excel Books India.
9. Gupta, S. P., & Gupta, M. P. (1979). Business statistics. S. Chand, New Delhi.
10. Hooda, R. P. (1994). Statistics for business and economics. Vikas Publishing House.Business

M.Com.205: Management Accounting

Course objective: The objective of this course is to impart knowledge of various accounting tools and techniques useful for business decision making.

Course Outline:

Unit I: (a) Management Accounting: Concept, Importance, Nature and Functions, Financial vs Management Accounting, Cost vs Management Accounting, Role of Management Accountant.

(b)Basic Concepts of Costing: Basic Cost Terms and Concepts, Type and Elements of Cost, Cost Allocation- Absorption Costing, Marginal Costing, Activity Based Costing.

Unit II: Financial Statement Analysis: Trend Analysis, Ratio Analysis, Preparation and Analysis of Fund Flow Statement and Cash Flow Statement (Revised AS).

Unit III: (a) Use of Marginal Costing in Decision Making.

(b) Cost Volume Profit (CVP) Analysis: Contribution Margin, Break-Even Analysis, Profit Volume (P/V) Analysis, Multiple Product Analysis, Optimal Use of Limited Resources.

Unit IV: Budget and Budgetary Control: Preparation of Different Types of Budgets, Fixed Versus Flexible Budgets.

Unit V: (a) Standard Costing: Concept, Advantage, Types of Standards, Variance Analysis-Material, Labour, Overheads, Managerial Use of Variances.

(b) Responsibility Accounting: Concept of Responsibility Accounting, Responsibility Central-Cost Centre, Revenue Centre, Profit Centre, Investment Centre.

Note: Question paper will contain 50% Numerical questions and 50% Theoretical questions.

Suggested Reading:

1. Horngreen : Management Accounting. PHI
2.Homgreen Charies T., and Gary L. Sundem and Shalliam O. Stration, Introduction to Management Accounting, Prentice Hall of In dia, 2006.
3. Dury Colin, Management and Cost Accounting, Thomson Learning, 2001.
4. Jawahar Lal, Advanced Management Accounting, Text Problems and Cases, S. Chand & Co., New Delhi, 2009.
5. S.N. Maheswari: Management Accounting.

M.Com.206: Legal Aspects of Business:

Course Objective: The objective of this course is to help students become familiar with the relevant provisions of various laws influencing business.

Unit I: Company Act; Selected Aspects: Nature, kinds of companies, formulation of company; Company management, powers, functions and duties and liabilities of directors, managerial compensation, oppression and mismanagement.

Company Meetings; Types of meetings, resolutions, winding up.

Unit II: The Consumer Protection Act, 1986: Basic Concepts: Complaint, complainant, consumer, rights of consumer, consumer forums, their role, powers and functions, procedure for consumer grievance redressel, major decided cases.

Unit III: The Competition Act, 2002: Basic concepts, powers of central government under the competition act, major provisions of the competition act: Role and working of competition commission of India.

Unit IV: Information Technology Act, major provisions.

Unit V: Right to Information Act (RTI) .major provisions

Suggested Reading:

1. Avtar Singh, Principles of Mercantile Law, 7th ed., Eastern Book Company, Lucknow
2. M.C. Kuchhal, Business Law, 6th ed., Vikas publishing House, New Delhi
3. Ravindra Kumar, Legal Aspects of Business, Cengage learning, New Delhi, 2009
4. Avtar Singh, Consumer Protection Law, Eastern Book Co., Lucknow, 2006
5. M.C. Kuchhal, Indian Company Law, Shree Mahabir Book Depot, Delhi, 2008

M. Com 207: Organizational Design, Development & Change (Self Study Course):

Course Objective: The objective of this course is to help the students become familiar with the different aspects of organizational design, development & change.

Unit I: Understanding Organisations: Approaches to Understanding Organisations, Types of Organisations.

Unit II: Organisational Design: Principles of Organisational Designs, Forms of Organisational Design.

Unit III: Work Organisation: Analysing & Organising Work, New Forms of Organisation, Emerging Issues of Work Organisation and Quality of Working Life.

Unit IV: Organisation Analysis: Organisational Diagnosis, Tools and Techniques, Questionnaire as a Diagnostic Tool, Interview as a Diagnostic Tool, Workshops, Task Forces and Other Methods.

Unit V: Organisational Development and Change: Organisational Development, Alternative Interventions, Skills of Change Agents, Follow up and Consolidations, Institution Building.

Suggested Readings

1. Kavita Singh – Organisation Change and Development
2. M.N. Mishra – Organisational Behaviour through Indian Philosophy
3. Pattanayak & Ravishanker – Organisational Development Skills for Competitive Edge

Semester III

M.Com.301: International Business

Course Objective: The objective of this course is to acquaint students with the theoretical framework of international business and the impact of its environmental dynamics on the international business operations of a firm.

Course Outline:

Unit I: International Business: Meaning, Concept, Importance and Scope of international business, Environment analysis; Geographical, Socio-cultural, Political and legal. Theoretical Foundations of International Business: Theories of International trade, Gains from international trade; Balance of payments analysis.

Unit II: International Economic Environment: International economic institutions and agreement; WTO, IMF, IFC, World Bank.

Unit III: (a) Regional Economic Co- Operation: Forms of regional groupings; Integration efforts among countries in Europe, North America, and Asia.

(b) International Financial Environment: International financial system and institution; Foreign exchange markets and risk management; Foreign investments types and flows; Foreign investment in Indian perspective.

Unit IV: (a) Organisational Structure for International Business Operations: Key issues involved in making international production, finance and human resource decisions; International business negotiations.

(b) Developments and Issues in International business: Outsourcing and its potentials for India; strategic alliances, mergers and acquisitions; Role of IT in international business; international business and ecological considerations.

Unit V: (a) Foreign trade promotion measures and organizations in India; special economic zones (SEZs) and 100% export oriented units (EOUs); measures for promoting foreign investments into and from Indian; Indian joint ventures and acquisitions abroad.

(b) Financing of foreign trade and payments terms.

Suggested Reading:

1. Adhikari Manab: Global Business Management Mac Millan New Delhi.
2. Black and Sundaram: International Business Environment prentice hall New Delhi.
3. Sodersten, B.O: International Economics Mac Milllan Landon.
4. Tayeb, Monis H: The Global Business Environment-An Introduction sage publication New Delhi
5. Charles, W.L. Hill and Arun K. Jain, International Business, Tata McGraw- Hill, New Delhi, 2008
6. Johnson, Derbe, and Colin Turner, Inrernational Business- Themes and Issues in the Modern Global Economy, London: Roultedge, 2003
7. Cherunilam, Francis, International Business: Text and Cases, Prentice-Hall of IndiaLtd., 2004
8. Justin, Paul, International Business, Prentice- Hall of India Ltd., 2003

M.Com.302: Management of Financial Services:

Course objective: The objective of the course is to help the students understand the role of financial services in project management and also equip them with skills required to handle the problems of financial markets and services.

Course Outline:

Unit I: Financial Services: Meaning and Concepts, Need for Financial Services, Various Types of Financial Services, Fund Based and Non Fund Based, Characteristics and Role of Financial Intermediaries.

Unit II: (a) Depository Institutions and Financial Services: Commercial Banks and their Changing Role, Functioning of banks, Financial Services and Banking System.

(b) Non Depository Institutions: Finance Companies and Mutual Funds and Pension Funds- A Financial Services and their Role.

Unit III : Merchant Banking and Venture Capital: The Concept of Merchant banking Services of Merchant Bankers, Merchant Banking in India- Rules and Regulations Management of Capital Issues, Fixed Deposits and Debenture Issues, Venture Capital- The Concept and Characteristics, Growth of Venture Capital Services in India.

Unit IV: (a) Leasing: Concept, Types, Legal and Tax Aspects, Hire- Purchase, Lease Structuring.

(b) Factoring: Concept and Characteristics, Types of Factoring, Factoring in India, Factoring and Bill Rediscounting.

(c) Forfeiting: Meaning and Mechanism of Forfeiting.

Unit V: Credit Rating Services: Concept and Types, Function of Credit Rating Agencies, Credit Rating Agencies in India.

Suggested Reading:

1. Bhole L.M.: Financial Institutions and Markets, 4th ed., McGraw Hill Co. New Delhi, 2008
2. Anthony Saunders, Financial Markets and Institutions, 4th ed., McGraw Hill Publishing Comapany, New Delhi.
3. Khan M.Y: Financial Services, 4th ed., McGraw Hill, New Delhi, 2008
4. K Sasidharan, Fiancial services and System (2008), McGraw Hill Publishing Company, New Delhi.
5. Clifford Gomez, Financial Markets, Institutions and Financial Services, Prentice Hall of India, 2008.
6. Anthony Saunders, Financial Institutions Management- A Risk management Approach, 6th ed., McGraw Hill Publishing Comapany New Delhi
7. M.Y. Khan Indian Financial System, 6th ed., McGraw Hill Publishing Company, New Delhi, 2008.
8. Sharma, management of Financial Institutions: With Emphasis on Bank and Risk Management, Prentice Hall of India, New Delhi

M.Com.303: Income Tax Laws and Practice:

Course Objective: The purpose of this course is to enable the student to understand the tax liabilities under the Acts, as well as, be able to file returns.

Course Outline:

Unit I: Introduction: Basic concepts, Residential Status, Exempted Income.

Unit II: Various heads of Income and Computation of Income under different heads of Income

Unit III: Deduction from gross total income, Rules of set off and carry forward of loses, clubbing of income, tax authorities, various types of Assessment.

Unit IV: Assessment and computation of Income of Individuals, Firms and Company.

Unit V: Appeal and Revision, Payment of Advance Tax, Deduction at source and Tax Planning.

Note: Question paper will contain 50% Numerical questions and 50% Theoretical questions.

Suggested Readings:

1. Ahuja Girish: Direct Tax Laws and Practice
2. Singhania: Direct Tax Laws and Practice
3. Mehrotra, H.C: Direct Tax Laws and Practice
4. Aggarwal, B.K: Direct Tax Laws and Practice

Elective Group:

The students have to opt one whole group as a major course and one paper from another group as a minor course

Group A: Finance:

M.Com.304: Financial Markets and Institutions:

Course objective: The main objective of the course is to provide a sound information and knowledge of broad framework of Financial Systems and its constituents.

Course Outline:

Unit I: (a) Financial Markets: Nature, Functions and Efficiency, Financial System and Economic Development, Flow of Funds in Indian Economy, An Overview of Indian Financial System.
(b) Money Market: Organization, Instruments, Functioning and its Regulations and Recent Developments, RBI.
(c) Capital Market: Structure of Capital Market in India-Primary and Secondary Markets, NSC, OTCEI, SEBI and its Role as Regulator.

Unit II: Financial Institutions: Functions and working of IDBI, IFCI, ICICI, NABARD, SIDBI and SFCs.

Unit III: Management of Banking and Other Institutions:

(a) Depository Institutions: Commercial Banks and Industrial Finance, Bank Credit, Performance of Indian Banking, Regulatory Aspect of Banking.
(b) Non Depository Institutions: Mutual Funds, Measuring Performance of Mutual Funds, Functioning and Regulatory Aspects, Working and Regulatory Framework of UTI, LIC and GIC.

Unit IV: Financial Instruments: Equity Shares, New Issue Market and Secondary Market-The Allocative and Operational Efficiency, Preference Shares, Private Placement-Channels, Debentures and Other Fixed Income Securities, Engineered Financial and Monetary Instruments.

Unit V: Foreign Capital: Foreign Capital as a Source of Finance, Place of Foreign Capital in the Overall Framework of Indian Financial System, The Regulatory Framework and NRI Investments.

Suggested Reading:

1. Kohn Meir Financial Institutions and Markets, Oxford University Press 2nd Edition 2007.
2. Madura Jeff: Financial Markets and Institutions, South Western Cengage Learning, 8th Edition 2008.
3. Mishkin, Fredrick S. and Stanley G. Eakins: Financial Markets Institutions, Pearson Education Ltd., 6th Edition.
4. Reserve Bank of India: Report on Currency & Finance.
5. Bhole L.M.: Financial Institutions and Markets, 4th ed., McGraw Hill Co. New Delhi, 2008
6. Khan M.Y: Financial Services, 4th ed., McGraw Hill, New Delhi, 2008
7. M.Y. Khan Indian Financial System, 6th ed., McGraw Hill Publishing Company, New Delhi, 2008.

M.Com.305: Security Analysis and Portfolio Management:

Course Objective: Security Analysis & Portfolio Management, as an academic discipline, is constantly changing and stimulating. The man objective of the paper is to explain the investment decision making and investment process. It focuses on the investment analysis.

Course Outline:

Unit I: Securities and Risk and Return: Meaning, nature and types of securities, concept of portfolio management, Measurement of return, meaning of risk, types of risk-systematic and unsystematic risk, Basic valuation models (with numerical).

Unit II: Fundamental Analysis: Economic Company and industry analysis. Technical analysis and random walk hypothesis, efficient market hypothesis.

Unit III: Valuation of Shares, Debentures and Preference Shares

Unit IV: Concepts of portfolio diversification and its effects, Theories of Portfolio: Capital asset pricing model, arbitrary pricing model.

Unit V: Portfolio Performance Evaluation and Revision

Note: Question paper will contain 50% Numerical questions and 50% Theoretical questions.

Suggested Readings:

1.Fisher & Jordon: Security Analysis and Portfolio Management
2. Jack clark Francis: Management of Investments Mc Graw hill.
3. Markowitz: Portfolio Selection yale University Press, yale.
4. Boltem: Security analysis and Portfolio Management.
5. Jones Tuttle, Healton: Essentials of Modern Investments.
6. Prasannachandra, International management Tat McGraw Hill New Delhi.
7. Avdhani, V.A, Investment and Security Market in India, Himalaya Publishing house, 3rd Edition.

Group B: Marketing:

M.Com.306: Consumer Behaviour:

Course Objective: The course helps students to develop basic understanding of the concepts and theories of consumer behaviour and their applications in marketing decision making.

Course Outline:

Unit I: Introduction: Defining consumer behaviour; reasons for studying behaviour, applying consumer behaviour knowledge; scope of consumer behaviour; market segmentation; bases of segmentation, criteria for effective targeting of market segments.

Unit II: Consumer as an Individual: Consumer motivation; consumer involvement, personality and self concept; perception consumer learning and memory; information processing, attitudes and changing attitudes

Unit III: Consumer in Social and cultural settings: Reference groups and family influences; Social class, cultural; sub cultural and cross cultural influences on consumer behaviour; personal influences and diffusion of innovations; impact of media and globalization.

Unit IV: Consumer Decision Process: Problem recognition; search and evaluating; purchasing processes; post purchase behaviour; consumer behaviour models; consumerism; organizational buying behaviour.

Unit V: Consumer Satisfaction: Measurement of consumer satisfaction and dis-satisfaction, repeat buying, brand switching and loyalty, opinion leadership, complaining behaviour.

Suggested Readings:

1. Schiffman and Kanuk: Consumer Behaviour
2. Engle, Blackwell and Minriad: Consumer Behaviour
3. Zaltman and Wallendorf: Consumer Behaviour
4. Mellot, Douglas W. Tr. : Consumer Behaviour
5. Loudon and Della Bitta: Consumer Behaviour
6. Benneton: Consumer Behaviour

M.Com.307: Marketing Communication

Course Objective: The course enables the students to gain understanding of the concepts, strategies and issues involved in marketing communication.

Course Outline:

Section A: Advertising

Unit 1: Communication process: Nature of communication process and its different elements, obstacles in communication process. Communication process, communication process in marketing: Importance and applications of communication process in marketing, different elements of promotional mix and communication process relevant to them, communication process in corporate image building.

Unit II: Advertisement: Importance of advertising in modern marketing, Different types of advertising, role of advertising in the national economy, setting of advertising objectives, advertising budget, factors affecting the advertising expenditure in a company, advertising department and its organization, advertising agencies, their organization and functions.

Unit III: Message and copy: Message strategy and design, elements of advertising copy, developing effective advertising copy, creativity and visualizing in advertising, media planning**:** Comparative study of different advertising media, Media selection, media scheduling.

Section B: Sales Management

Unit IV: Introduction: Nature and importance of personal selling, personal selling versus advertising, types of sales persons, selling as a career, process of effective selling.

Unit V: Management of the sales force: recruitment and selection; Training and development; direction, motivation, compensation, performance appraisal, sales planning and control; Market analysis, sales budget, sales territory, sales quota.

Suggested Readings:

1. Wright, Wintersand zeigers: Advertising Management
2. Dunnand Barban- Advertisng: Its role in modern marketing advertising
3. Chunnawala & Sethia: Advertising management
4. Still, Cundiff & Govoni: Sales Management
5. Subroto Sengupta: Cases in advertising and communication
6. Spiro: Management of sales force.

Semester IV

M.Com.401: Project Planning and Evaluation

Course objective: To provide adequate knowledge to the students for formulating and handling the project.

Course Outline:

Unit I: Project Management: Nature, Scope, Process, Elements, Significance and Emerging Issues. Identification of Investment Opportunities and their Feasibility. Market and Demand Analysis.

Unit II: Technical Analysis: Choice of Technology, Analysis of Materials and Inputs, Plant Locations and Layout Pollution Control and Government Regulations. **Financial Analysis:** Fund flow analysis and sources of funds.,

Unit III: Project Appraisal: Cash Flow estimate under different financing pattern (LTF, TF) capital expenditure decisions (using capital budgeting techniques),

Unit IV: Risk Analysis: Different techniques, project evaluation under special circumstances, CAPM model,

Unit V: Net Work Techniques for Project Management: PERT / CPM Techniques. Time-Cost Trade-off. Resource Leveling. Social cost benefit analysis; SCBA approach, UNIDO approach, shadow pricing

Note: Question paper will contain 50% Numerical questions and 50% Theoretical questions.

Suggested Reading:

1. Prasanna Chandra: Project: Preparation, Appraisal, Budgeting and Implementation.
2. P.K. Matto: Project Formulation in Developing Countries
3. Dass Gupta & Sen : Guideline for Project Evaluation
4. D.K. Jain : Project Planning and Appraisal in Planned Economy

M.Com.402: E-Commerce

Course Objective: The aim is to help students develop insight on how electronic commerce affects the strategic intent and operations, function of the firm, how electronic commerce can be used to create a strategic competitive advantage for an enterprise, and explain some of the best practices in E-commerce that are currently available.

Course Outline:

Unit I: Introduction to e-Commerce: e-Commerce Infrastructure, Business Models and e-Commerce Strategy

Unit II: Supply Chain Management and e-Commerce

Unit III: Marketing Strategies and e-Commerce

Unit IV: Mobile Commerce and e-Commerce Security and Controls

Unit V: Global, Social, Legal and Ethical Issues in e-Commerce

Suggested Readings:

1. Turban, E., King, D., McKay, J., Marshall, P., Lee, J., & Viehland, D. (2008). *Electronic commerce: A managerial perspective 2008* Pearson
2. Kenneth C. Laudon and Carlo Guercio Traver, *E-Commerce*, Pearson Education.
3. David Whiteley, *E-commerce: Strategy, Technology and Applications*, McGraw Hill Education
4. Bharat Bhaskar, *Electronic Commerce: Framework, Technology and Application, 4th Ed.,* McGraw Hill Education
5. PT Joseph, *E-Commerce: An Indian Perspective*, PHI Learning
6. KK Bajaj and Debjani Nag, *E-commerce*, McGraw Hill Education
7. TN Chhabra, *E-Commerce*, Dhanpat Rai & Co.
8. Sushila Madan, *E-Commerce*, Taxmann
9. TN Chhabra, Hem Chand Jain, and Aruna Jain, *An Introduction to HTML*, Dhanpat Rai & Co.

or

M.Com 402 Project Report:

Only those students can opt project Report, who has secured 75% marks in aggregate up to second semester.

Course Objective: The Project report writing trains a student to communicate information in an effective and convincing way, thus, contributing to the organizational planning and decision making.

The Project Report would commence at the beginning of the IV semester. To carry out the study, students can associate themselves with any business organization or can do the study independently.

The student would choose a topic of his/her choice, conduct an investigative research into the nature, reasons, causes, effect of the problem on different aspects of business and carry out a detailed research based on the current literature and collected data and compile a comprehensive report on the topic. The essential aspect shall be to analyse the existing knowledge and data to present new findings or propose a new model.

Note: *The detailed instructions are provided in the appendix given below:*

Appendix

(Project Report activity and format)

The following activity schedule has been developed to facilitate the process.

IMPORTANT DATES		
ACTIVITY	**LAST DATE (TENTATIVE)**	**MAX CREDITS**
Topic finalization with mentor	30 Jan	-
Synopsis submission to mentor	15th March	-
Approval by Mentor	31st March	
Preliminary Report submission	30 April	-
Viva-voce for Report I (by internal panel)	5th and 6th May (tentative dates)	
Final report submission	31st May	-
Viva-voce (by external panel)	8th, 9th and 10th of June	
	Total	**3 Credits**

1. Following are the steps: **Preliminary Report:** This task shall be performed just before embarking on the data collection exercise. It should contain the following in detail:

   - Problem background and significance of the study
   - Literature review and theoretical background
   - Objectives
   - Hypotheses
   - Research design and sampling design
   - Theoretical Model (if any)
   - Data collection tools & Data analysis tools to be used
   - Bibliography and references

   Soft-copy should be submitted for evaluation and 'progress review viva-voce'.

2. **Final Report Submission:** This part would involve data collection, tabulation, data analysis, findings, suggestions, limitations, conclusion, and scope for further studies. Students should Use appropriate data analysis tools and software.

   Every report must be hard bounded with Black Leatherette cover duly embossed in Golden in BOLD letters with the Project Title, Student's name & roll no., class, batch and year and must be submitted to the Department. Copy of Synopsis should also be submitted.

   Following should be the chapterization scheme of the report. The list of chapters is indicative in nature and can be modified by the Faculty guide if required.

Indicative chapters for Final Research Report

- Introduction (background and significance)
- Literature review & theoretical background
- Objectives
- Hypothesis
- Research design and sampling design & theoretical model
- Data analysis
- Findings
- Suggestion & limitations
- Conclusion
- Appendix, bibliography & reference, questionnaires, scales

Plagiarism/ Cheating/ Unfair Means in Projects/ Assignments

Plagiarism is when you steal the thoughts or writing of others and offer them as your own. Everyone repeats someone else's ideas at some point in their academic career but when doing so, it is important to acknowledge it. You can avoid plagiarism by quoting within inverted commas and acknowledging the source. But mostly the reference must be in your own words.

<u>Final Submission of the Project</u>: Hard copy and Soft copy of the Project Report along with the Synopsis shall be submitted to the University for evaluation.

M.Com.403: <u>Seminar and Viva Voce</u>

(a) Seminar (40 marks)

Course Objective: To help develop the art of public speaking among the students as well as, face interviews.

The students shall be expected to give several presentations during the semester with the final one on the day of the examination. The viva voce shall give them an opportunity to experience an interview. Regular quizzing sessions shall be held with the students throughout the semester under this course.

(b) Viva Voce (60 marks)

Course Objective: The objective is to help them gain the experience of a final interview before they go out seeking jobs in industry and also develop confidence in a face to face interaction in a formal setting.

At the end of the semester, a viva voce shall be conducted with an external and internal examiner wherein the students shall be expected to answer questions related to both their project report and the courses studied in the IVth semester, as well as, previous semesters.

Elective Group:

The students have to opt one whole group as a major course and one paper from another group as a minor course. Group selected by the student as major group in the 3rd semester cannot be changed in the 4th semester.

Group A: Finance:

M.Com.404: Risk Management and Insurance

Course objective: To develop an understanding among students about identifying, analyzing and managing various types of risk, principles of insurance and its usefulness in business.

Course Outline:

Unit I: Introduction: Concept of risk; objective of risk management; need for a risk management; types of risk; Identification and measurement of risk; risk evaluation and prediction

Unit II: Risk Aversion and Risk Management: Risk aversion and demand for insurance by individual; business risk management and demand for insurance; Application of statistical techniques in risk avoidance; disaster risk management; Insurability of risk contractual provisions and legal doctrines; premium loading; moral hazards; deductibles and claim processing costs; risk retention and transfer; legal aspects of insurance contract; principle of indemnity; estoppels.

Unit III: Types of Insurance: Fire and motor insurance; health insurance; social insurance; home-owners insurance; life insurance and annuities; term insurance; endowment insurance; whole life insurance; life insurance pricing; employees benefits group; medical coverage; retirement plans; marine insurance; ships and goods policy; marine risk institute cargo clauses reinsurance

Unit IV: Assessment and control: control of malpractices; negligence, loss assessment and loss control; exclusion of perils, actuaries, computation of insurance premium.

Unit V: Globalization of Insurance Sector: Globalization of insurance sector; regulation of risk reduction by IRDA; reinsurance; coinsurance assignment

Suggested Reading:

1. Scott Harrington and Gregory Niehaus, Risk Management and Insurance, 2nd ed., Tata McGraw- Hill, 2004.
2. Dorfman, Risk Management and Insurance, PHI
3. Gupta, PK, Insurance and Risk Management, Himalaya Publishing House, 2004
4. Mishra, MN, Principles and Practices of Insurance, S. Chand and Co., 2004
5. Panda, GS, Principles and Practices of Insurance, Kalyani Pub. 2004
6. Jeevanandam, C, Risk Management, Sultan Chand and Sons, 2005

M.Com.405: International Financial Management

Course objective: The objective of the course is to acquaint the students with Financial Management problems of multinational corporations and prepare them to tackle these problems.

Course Outline:

Unit I: (a) Financial Management in Global Perspective: Development in the International Monetary System, Gold Standard, Britain Woods System of Exchange Rate, Exchange Rate Regime, IMF and International Liquidity, System of Exchanging Currencies.

(b) Exchange Rate Determination: Determination of Exchange Rate in Spot and Forward Market, PPP Theory, IRP Theory, Monetary Theories of Exchange Rate determination, Overshooting Models.

Unit II: Foreign Exchange Market: Spot and Forward, Participants in Foreign Exchange Market-Arbitraging, Hedging and Speculation, Covered Interest Rate Arbitrage, Borrowing and Investing Markets.

Unit III: Risk Exposures and Their Management: Translation, Transaction and Operating Exposures: Their Measurement and Management.

Unit IV: Financial Swaps: Types and Uses, cash management by MNCs

Unit V: (a) International Financial Markets: International Equity Issues and Long Term Borrowings. GDRs, ADRs and Euro Bonds. International Development Banks, Foreign Currency Financing by Indian Financial Institutions.

(b) Short Term Financial Management: Management of Cash, Inventory and Accounts Receivable in Global Context, Inter–Company Fund Flow Mechanism, Short Term Financing. Financing of International Trade.

Suggested Reading:

1. Levi, Maurice: International Finance, Routledge, 2009
2. Eiteman, David K: Arthur Stonehill and Michael H. Moffett, Multinational Business Finance, Pearson, 2008
3. Shapiro AC: Multinational Financial Management: PHI
4. Apte : International Financial Management: PHI
5. Seth, A.K.: International Financial Management.
6. Vij, madhu: International Financial Management, Excel Publications, 2006

Group B: Marketing

M.Com.406: Marketing of Services

Course objective: To enable students to understand the conceptual aspects of service marketing.

Course Outline:

Unit I: Introduction to Services Marketing: Services as a marketing concept; factors for the growth of service sector; characteristics of services; dimensions of services; classification of services; managing customer expectations: level of expectations; zone of tolerance; segmentation, targeting and positioning of service.

Unit II: Services Marketing Mix: Product: service package, core and supplementary services; Product levels, service levels and delivery; price: pricing concepts and issues in pricing, pricing policy, pricing approaches, price and customer values; Promotion: Internal and external communication, issues in services promotion; place: Service distribution, channel options, service distribution strategy.

Unit III: Service Design: Essentials of a service system; components of services; designing the service package; front office interface; back office interface; operations system; service delivery system; customer satisfaction and conflicts; service recovery system; service quality; concept of service quality, measuring service quality; SERVQUAL system; concept of CRM: CRM objectives, technology impact on services, concept of e-CRM.

Unit IV: Globalization of services: Stages of globalization; international marketing services; emerging trends; principal driving forces in global marketing of services; key decisions in global marketing; services strategy and organizing for global marketing.

Unit V: Marketing of Financial and Hospitality Services: Application of the component of marketing of services in marketing of financial, tourism, travel and transport services.

Suggested Reading:

1. Zeithaml, Gremler, Bitner, and Ajay Pandit, Services Marketing, Tata McGraw- Hill, 4th ed., 2008.
2. Lovelock, Services Marketing: People, Technology and Strategy, Pearson Education, 5th ed., 2007.
3. Baron S and Harris K, Services Marketing: Text and Cases, Palgrave, 2003
4. Rajendra Nargundkar, Services Marketing: Text and Cases, Tata McGraw- Hill, 2nd ed., 2007.
5. Harsh V Verma, Services Marketing: Text and Cases, Pearson Education, 2008.
6. Rama Mohana Rao, Services Marketing, Pearson Education
7. Govind Apte, Services Marketing, Oxford Univ. Press

M.Com.407: International Marketing

Course objective: To enable the students to understand the concept, implications and procedures of international marketing and to be able to apply those in management of international business.

Course Outline:

Unit I: Introduction to International Marketing: Meaning, nature and scope of international marketing; international marketing distinguished from domestic marketing. Exporting, international trade and international business; international marketing management process- an overview.

Unit II: International marketing Environment: Geographic, demographic, economic, political, legal, socio cultural environments- their nature and effects on international marketing operations, tariff and non-tariff barriers; WTO, UNCTAD, generalized system of preferences (GSP), regional economic groupings-European Union (EU), NAFTA, ASEAN, etc., facilities and incentives schemes for exporters.

Unit III: International Product/ Market Selection and Entry Modes: Selection products, selection market, various modes of entry into international markets and their evaluation, export licensing/franchising contracting, joint venture, setting up wholly owned subsidiary.

Unit IV: International Product Planning and Pricing: Product in international context, standardization vs. adoption decision, other considerations; packaging, branding after sales services, ISO 9001:2000 quality system standard, factors influencing price, pricing methods, decisions and pricing process, price quotations and related considerations.

Unit V: International Distribution and Promotion: Types and functions of foreign distribution channels, selection of middlemen, distribution logistics- transportation and warehousing decisions, International advertising- standardization vs. adaptation, selection of media, selection of agency, measuring advertising effectiveness.

Suggested Reading:

1. Vern Terpestra, Internation Marketing, Southwest Publication, 2005
2. Varshney RL and B. Bhattacharya, International Marketing- Indian Perspective, Sultan chand publication 2006.
3. Fayerweather, J, International Marketing Management, Sage Publication, 2006
4. Cateroa, R, Phylip, International Marketing, Tata Mc Graw Hill, 2006
5. Jain Subash, International Marketing Management, Southwest Publication, 2005

M.Com.408: Entrepreneurship Development: (Self Study Course)

Course objective: This course aims at providing entrepreneurial skills to the students by giving an overview of who entrepreneurs are and what competences are needed to become an entrepreneur.

Course Outline:

Unit I: Entrepreneurship: Definition and Structure, Entrepreneurial Culture, Theories of Entrepreneurship, Classification and Types of Entrepreneurship. Factor Effecting Entrepreneurial Growth, Entrepreneurial Competencies, Women Entrepreneurship.

Unit II: Entrepreneurial Development: Entrepreneurial Environment, Process of Entrepreneurial Development, Entrepreneurial Development Programme, Role of Government and Specialized Institutions in Entrepreneurship Development.

Unit III: Issues Related to Entrepreneurship in Uttarakhand.

Unit IV: Entrepreneurship Development and Government: Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants etc.

Unit V: Project Financing: Estimation of Financial Requirements, Capital Structure and Source of Financing, Various Financing Schemes of Financial Institutions. Foreign Currency Financing.

Suggested Readings:

1. Prasanna Chandra: Project Preparation, Appraisal and Implementation, 5th ed., Tata McGraw Hill, 2002
2. Holt, D. H. (1992). *Entrepreneurship: New venture creation*. Prentice Hall.
3. S.S. Khanka: Entrepreneurial Development
4. Vasant Desai: Entrepreneurial Development
5. Madhurima Lall & Shikha Sahai: Entrepreneurship
6. Clifford Gray: Project Management, Richard D. Irwin, 2005

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – COMPUTER SCIENCE & APPLICATIONS

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

SYLLABUS

FOR

M.Sc. (Computer Science) Programme

H. N. B. GARHWAL UNIVERSITY
SRINAGAR (GARHWAL)

H.N.B. GARHWAL UNIVERSITY

(A Central University)

Regulations, Curricula, Syllabus and Scheme of Examinations (Credit and Semester System)

M.Sc. (Computer Science)

(With effect from session 2015-2016)

1. **Duration** of the M.Sc. (Computer Science) program shall be 2 years, divided into 4 semesters. Each semester should have 15 – 18 weeks.
2. Eligibility for admission: Bachelors Degree in Science from any University recognized by UGC.

All other ordinances related to examination and result declaration will be as per the ordinances framed by University for PG Courses.

H. N. B. Garhwal University Srinagar Garhwal
M. Sc. (Computer Science)

Programme Structure

SEMESTER - I

SET/CSE/MCS/C101 : Computer Fundamental & Programming in 'C'

SET/CSE/MCS/C102 : Combinatorics & Graph Theory

SET/CSE/MCS/C103 : Relational Data Base Management System

SET/CSE/MCS/C104 : Digital Electronics & Computer System Architecture

SET/CSE/MCS/C105 : Operating System with Case Study of UNIX/LINUX

SET/CSE/MCS/CP11: Programming & Problem Solving in 'C'

SET/CSE/MCS/CP12 : Shell Programming

SEMESTER - II

SET/CSE/MCS/C201 : Data Structures

SET/CSE/MCS/C202 : Object Oriented Programming in C++

SET/CSE/MCS/C203: Theory of Computation

SET/CSE/MCS/C204: Software Engineering

SET/CSE/MCS/C205: Data Communication and Computer Networks

SET/CSE/MCS/CP21 : Data Structures Using 'C'

SET/CSE/MCS/CP22 : Data Communication and Computer Networks

SET/CSE/MCS/SS21: Self Study*

SEMESTER - III

SET/CSE/MCS/C301: Network Security and Cryptography

SET/CSE/MCS/C302: Design and Analysis of Algorithm

SET/CSE/MCS/C303: Mobile and Wireless Computing

SET/CSE/MCS/E1: Elective I

SET/CSE/MCS/E2: Elective II

SET/CSE/MCS/EP31: Elective I

SET/CSE/MCS/EP32: Elective II

SET/CSE/MCS/SS31: Self Study*

SEMESTER - IV

SET/CSE/MCS/E3: Elective III

SET/CSE/MCS/PR41: Project

SET/CSE/MCS/SS41: Self Study*

FIRST SEMESTER:

S.No	Course No.	Subject	Evaluation – Scheme								Credit
			Period			Sessional			Examination		
			L	T	P	TA	CT	TOT	ESE	Sub. Total	
Theory											
1.	SET/CSE/MCS/C101	Computer Fundamental & Programming in 'C'	3	-	-	10	30	40	60	100	3
2.	SET/CSE/MCS/C102	Combinatorics & Graph Theory	3	-	-	10	30	40	60	100	3
3.	SET/CSE/MCS/C103	Relational Database Management System	3	-	-	10	30	40	60	100	3
4.	SET/CSE/MCS/C104	Digital Electronics & Computer System Architecture	2	-	-	10	30	40	60	100	2
5.	SET/CSE/MCS/C105	Operating System with Case Study of UNIX/LINUX	3	-	-	10	30	40	60	100	3
Practical											
1.	SET/CSE/MCS/CP11	Programming & Problem Solving in 'C'	-	-	3	40	-	40	60	100	2
2.	SET/CSE/MCS/CP12	Shell Programming	-	-	3	40	-	40	60	100	2
		Total	**14**	**-**	**6**	**130**	**150**	**280**	**420**	**700**	**18**

SECOND SEMESTER:

S.No	Course No.	Subject	Evaluation – Scheme								Credit
			Period			Sessional			Examination		
			L	T	P	TA	CT	TOT	ESE	Sub. Total	
Theory											
1.	SET/CSE/MCS/C201	Data Structures	3	-	-	10	30	40	60	100	3
2.	SET/CSE/MCS/C202	Object Oriented Programming in C++	3	-	-	10	30	40	60	100	3
3.	SET/CSE/MCS/C203	Theory of Computation	3	-	-	10	30	40	60	100	3
4.	SET/CSE/MCS/C204	Software Engineering	2	-	-	10	30	40	60	100	2
5.	SET/CSE/MCS/C205	Data Communication and Computer Networks	3	-	-	10	30	40	60	100	3
Practical											
1.	SET/CSE/MCS/CP21	Data Structures Using 'C'	-	-	3	40	-	40	60	100	2
2.	SET/CSE/MCS/CP22	Object Oriented Programming in C++	-	-	3	40	-	40	60	100	2
		Total	**14**	**-**	**6**	**130**	**150**	**280**	**420**	**700**	**18**
1.	SET/CSE/MCS/SS21	Self Study	2	1	-	-	-	-	-	-	3

TA : Teacher Assessment
CT : Class Test

ESE : End Semester Examination
SUB TOT. : Subject Total
TOT. : Total

THIRD SEMESTER:

S.No	Course No.	Subject	Evaluation – Scheme								Credit
			Period			Sessional			Examination		
			L	T	P	TA	CT	TOT	ESE	Sub. Total	
Theory											
1.	SET/CSE/MCS/C301	Network Security and Cryptography	2	-	-	10	30	40	60	100	2
2.	SET/CSE/MCS/C302	Design and Analysis of Algorithm	3	-	-	10	30	40	60	100	3
3.	SET/CSE/MCS/C303	Mobile and Wireless Computing	3	-	-	10	30	40	60	100	3
4.	SET/CSE/MCS/E1	Elective I	3	-	-	10	30	40	60	100	3
5.	SET/CSE/MCS/E2	Elective II	3	-	-	10	30	40	60	100	3
Practical											
1.	SET/CSE/MCS/EP31	Elective I	-	-	3	40	-	40	60	100	2
2.	SET/CSE/MCS/EP32	Elective II	-	-	3	40	-	40	60	100	2
		Total	**14**	**-**	**6**	**130**	**150**	**280**	**420**	**700**	**18**
1.	SET/CSE/MCS/SS31	Self Study	2	1	-	-	-	-	-	-	3

FOURTH SEMESTER:

S.No	Course No.	Subject	Evaluation – Scheme								Credit
			Period			Sessional			Examination		
			L	T	P	TA	CT	TOT	ESE	Sub. Total	
Theory											
1.	SET/CSE/MCS/E3	Elective III	3	-	-	10	20	30	70	100	3
2.	SET/CSE/MCS/E4	Elective IV	3	-	-	10	20	30	70	100	3
Practical											
1.	SET/CSE/MCS/EP41	Elective III	-	-	3	30	-	30	70	100	2
2.	SET/CSE/MCS/PR41	Project	-	2	12	-	-	-	400	400	10
		Total	**6**	**2**	**15**	**50**	**40**	**90**	**610**	**700**	**18**
1.	SET/CSE/MCS/SS41	Self Study	2	1	-	-	-	-	-	-	3

TA : Teacher Assessment
CT : Class Test
ESE : End Semester Examination
SUB TOT. : Subject Total
TOT. : Total

Elective I
(Choose any one)

E1.1 Computer Graphics

E1.2 Computer Organisation

E1.3 C#

Elective II

(Choose any one)

E2.1 ASP.NET

E2.2 Compiler Designing

E2.3 Human- Computer Interaction

Elective III

(Choose any one)

E3.1 Image Processing

E3.2 Unified Modeling Language

E3.3 Multimedia Technology and Applications

Elective IV

(Choose any one)\

E4.1 Artificial Intelligence

E4.2 Wireless Networks

E4.3 Data Mining & Data Warehousing

E4.4 Genetic Algorithms and Machine Learning

***Self Study**
(Choose any one for semester II, III& IV)

Speech Recognization
Biometrics
Robotics
Pattern Recognistaion Techniques
Cloud Computing
E-Governance
Fuzzy logic & Neural Networks
Ethical Hacking

SET/CSE/MCS/C101: Computer Fundamental & Programming in 'C'

Introduction to Computers: Computer hardware Components, Disk Storage, memory, keyboard, mouse, printers, monitors, CD etc., and their functions, Comparison Based analysis of various hardware components.
Basic Operating System Concepts: MS-DOS, WINDOWS, Functional knowledge of these operating systems. Introduction to Basic Commands of DOS, Managing File and Directories in various operating Systems, Introduction to internet, Basic terms related with Internet, TCP/IP.

Programming in C: History, Introduction to C Programming Languages, Structure of C programs, compilation and execution of C programms. Debugging Techniques, Data Types and Sizes, Declaration of variables, Modifiers, Identifiers and keywords, Symbolic constants, Storage classes (automatic, external, register and static), Enumerations, command line parameters, Macros, The C Preprocessor
Operators: Unary operators, Arithmetic & logical operators, Bit wise operators, Assignment operators and expressions, Conditional expressions, precedence and order of evaluation. Control Statements: if-else, switch, break, continue, the comma operator, go to statement. Loops: for, while, do-while.

Functions: built-in and user-defined, function declaration, definition and function call, parameter passing: call by value, call by reference, recursive functions, multifile programs. Arrays: Linear arrays, multidimensional arrays, Passing arrays to functions, Arrays and strings.

Structure and Union: Definition and differences, self-referential structure. And address of (&) operator, pointer to pointer, Dynamic Momory Allocation, calloc and malloc functions, array of pointers, function of pointers, structures and pointers.

References:

1. V. Rajaraman, "Fundamentals of Computers", PHI
2. Pater Norton's "Introduction to Computer", TMH
3. Hahn, "The Internet complete reference", TMH
4. Peter Nortton's, "DOS Guide", Prentice Hall of India
5. Gottfried, "Programming in C, Schaum's Series Tata McGraw Hill

SET/CSE/MCS/C102 : Combinatorics & Graph Theory

Rules of sum and products, Permutation, Combination, Permutation groups and application, Probability, Remsey Theory, Discrete numeric function and generating function, combinatorial problems, Difference equation.
Recurrence Relation: Introduction, Linear recurrence relation with constant coefficient, Homogeneous solution, Particular solution, Total solution, Solution by the method of generating function.

Graphs, sub-graphs, some basic properties, Walks, Path & circuits, Connected graphs, Disconnected graphs and component, Eular and Hamiltonian graphs, Various operation on graphs, Tree and fundamental circuits, Distance diameters, Radius and pendent vertices, Rooted and binary trees, Counting trees, Spanning trees, Finding all spanning trees of a graph and a weighted graph.

Cut-sets and cut vertices, some basic properties, All cut sets in a graph, Fundamental circuit and cut sets, Connectivity and seperatability, Network flows, Planner graphs, Combinatorial and geometric dual, Kuratowski to graph detection of planarity, Geometric dual, Some more criterion of planarity, Thickness and Crossings, Vector space of a graph and vectors, basis vectors, cut set vector, circuit vector, circuit and cut set verses sub spaces, orthogonal vector and sub space. Indicidence matrix & adjacency matrix of graphs.

Coloring and covering partitioning of graph, Chromatic number, Chromatic partitioning, Chromatic polynomials, Matching, covering, Four color problem, Directed graph, Types of directed graphs, Directed paths and connectedness, Euler digraph, Tree and directed edges, Fundamental circuit in digraph, Matrices A,B,C of digraph adjacency matrix of digraph, Enumeration and its types, counting of labeled and unlabeled trees, Polya's theorem, Graph enumeration with polyas theorem, Graph theoretic algorithm.

References:

1. Deo Narsing, :Graph Theory with applications to engineering and computer science", PHI
2. Tremblay and Manohar, :Discrete mathematical structures with applications to computer Science:, TMH
3. Joshi K.D., "Fundamental of discrete mathematics:, New Age International
4. John Truss, "Discrete mathematics of computer scientist"
5. C.L. Liu, "Discrete mathematics"

SET/CSE/MCS/C103: Relational Data Base Management System

Introduction to database systems-Operational Data, File Management Vs Data Management, characteristics of Database approach, An Architecture for a Database System, Advantages and Disadvantages of DBMS, Data associations - Entities, Attributes and Associations, Relationship among Entities, Representation of Associations and Relationship, Data Model Classification, Entity Relationship Model,Relational Data Model, Network Data Model, Hierarchical Data Model .Objects – Relational Model Objects, Relationship, Composite Objects, Procedures, Types and Inheritance.

Relational data structure-A Review of Set Theory, Relations, Domains and Attributes, Tuples, Keys. Integrity Rules Extensions And Intensions, Base Tables, Indexes Relational Algebra and Operations, Retrieval Operations, Relational Calculus and Domain Calculus.

Relational database design-Universal Relation, Anomalies in a Database, Normalization Theory, Functional Dependencies. Closure of a Set of F.D Covers, Non Redundant and Minimum Cover, Canonical Cover, First, Second and Third Normal Forms, Relations with more than one Candidate Key, Good and Bad Decompositions, Boyce Codd Normal Form, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Query processing-Query Processing Stages, Query Interpretation, Equivalence of Expression, Query Execution Statistics. Query Execution Plan, Query Estimation, Query Evaluation, View Processing, Integrity & Security, Need for Integrity and Security Integrity Constraints.
The distributed databases -Motivation for Distributed Database . Distributed Database concepts, Types of Distribution Architecture of Distributed Databases, The Design of Distributed Databases, Distributed Query Processing, Recovery In Distributed Systems, Commit Protocols for Distributed Databases, Multi Database System.

References:

1. Date C.J. "An Introduction to Database System". Addision Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts" McGraw Hill
3. Database Management System: V. K. Jain, Wiley dreamtech
4. Elmasri, Navathe, "Fundamentals of Database Systems" Addision Wesley
5. Paul Beynon Davis, "Database Systems" Palgrave Macmillan
6. Bipin C. Desai, "An introduction to Database Systems", Galgotia Pub.
7. Begining SQL: Paul Wilton, Wiley dreamtech

SET/CSE/MCS/C104 : Digital Electronics & Computer System Architecture

Representation of information & Basic Building Blocks: Introduction to Computer, Computer hardware generation, Number System: Binary, Octal, Hexadecimal, Character Codes (BCD), ASCII, EBCDIC and their conversion. Logic gates, Boolean Algebra, K-map simplification, Half Adder, Full Adder, Subtractor, Decoder, Encoders, Multiplexer, Demultiplexer, Carry look ahead adder, Combinational logic Design, Flip-Flops, Registers, Counters (Synchronous and asynchronous), ALU, Micro-operation. ALU-chip, Faster Algorithm and Implementation (multiplication & Division).

Basic Organization: Operational flow chart (Fetch, Execute, Instruction Cycle), Organization of Central Processing Unit, Hardwired & micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing modes, Instruction formats, data transfer & Manipulation, I/O Organization, Bus Architecture, Programming Registers.

Memory Organization: Memory hierarchy, Main memory (RAM/ROM) chips), Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory Management Hardware, hit/miss ratio, magnetic disk and its performance, magnetic Tape etc.

I/O Organization: Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.

References:

1. Willam Stalling, "Computer Organization & Architecture" Pearson Education Asia
2. Mano Morris, "Computer System Architecture" PHI
3. Zaky & Hamacher, "Computer Organization: McGraw Hill
4. B. Ram, "Computer Fundamental Architecture & Organization" New Age
5. Tannenbaum, "Structured Computer Organization" PHI.

SET/CSE/MCS/C105 : Operating System with Case Study of UNIX/LINUX

Introduction: Definition, Design Goals, Evolution; Concept of User, job and Resources; Batch processing, Multi-programming, Time sharing; Structure and Functions of Operating System.Process Management: Process states, State Transitions, Process Control Structure, Context Switching, Process Scheduling, Threads.

Memory Management: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Combined Systems, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing, Working Set Model, Paging.

Concurrent Processes: Process Interaction, Shared Data and Critical Section, Mutual Exclusion, Busy form of waiting, Lock and unlock primitives, Synchronization, Classical Problems of Synchronization, Semaphores, Monitors, Conditional Critical Regions, System Deadlock, Wait for Graph, Deadlock Handling Techniques: Prevention, Avoidance, Detection and Recovery.

File and Secondary Storage Management: File Attributes, File Types, File Access Methods, Directory Structure, File System Organization and Mounting, Allocation Methods, Free Space management; Disk Structure, Logical and Physical View, Disk Head Scheduling, Formatting, Swap Management. Protection & Security.
Case Study of UNIX/LINUX

References:

1. Silberschatz and Galvin, Operating System Concepts 6/ed, Addison Wesley.
2. William Stalling, Operating Systems: Internals and Design Principles 5/ed, PHI.
3. Tanenbaum, Modern operating Systems, PHI.
4. J Bach, The Design of UNIX Operating System, Pearson Education.
5. Vijay Mukhi, The C Odessy, BPB.
6. Peterson and Silberschatz, Operating System Concepts, Addison Wesley.
7. P. B. Hansen, Operating System Principles, PHI.
8. K. Christian, The UNIX Operating System, John Wiley.
9. A. N. Haberman, Introduction to Operating System Design, Galgotia.

SET/CSE/MCS/C201 : Data Structures

Introduction to data structures, Abstract data types

Stacks - Introduction to stack & primitive operation on stack, Stack as an abstract data type, Stack's applications - Infix, post fix & Prefix expressions, Recursion, Multiple stacks Queues -Introduction to queues, Primitive Operations on the Queues, Queue as an abstract data type, Circular queue, Dequeue, Priority queue.

Linked List - Introduction to the Linked List, Operation on Linked List, Linked List representation of stack and Queue,Header nodes.

Types of Linked List - Doubly Linked List, Circular Linked List

Application of Linked List.

Trees -Basic Terminology of Trees, Binary Trees, Tree Representations as Array & Linked List Binary tree representation, Traversal of binary trees - In order, Preorder & post order, Application of Binary tree, Threaded binary tree

Balanced tree, AVL tree, B-tree, B+ & B* trees, Conversion of General Tree to Binary Tree, Counting Binary Trees, 2-3 Trees, algorithm for manipulating 2-3 Trees.

Searching - Sequential Searching, Binary search and their Comparison.

Sorting - External & Internal sorting, Insertion sort, Selection sort, Quick sort, Bubble sort, Heap sort, Merge sort, Comparison of sorting methods Algorithms of sorting and searching in Linked list and Arrays.

Tables - Hash table,Collision resolution Techniques.

Graphs - Introduction to graphs, Basic Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Warshall's algorithem for path matrix and shortest path

Graph Traversals-Depth first & Breadth first search.

References:

1. Lipshutz, Data Structure, McGraw Hill.
2. Standish, Data Structure, Addison-Wesley.
3. B. Salzberg, File Structures, Prentice-Hall, 1988.
4. A.L. Tharp, File Organization and Processing, John Wiley and Sons, 1988.
5. A. M. Tennenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, PHI, 1991.
6. S. Lipschutz, Data Structure, Schaum Series.
7. D. E. Knuth, Fundamental Algorithms, Narosa Publication.

SET/CSE/MCS/C 202: Object Oriented Programming using C++

OOAD and OOP, Object Oriented Programming paradigm and design; General Concepts: Object, Class, Data Abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing; Benefits of OOP, Object-oriented Languages.

Object oriented Programming using C++: Data Types, Operators, Classes and Objects, Constructors and Destructors, Operator Overloading, Type Conversions, Inheritance, Pointers, Virtual Functions, Polymorphism,

Stream I/O in C++, File Processing, Templates, Standard Template Library, Program defined exceptions, Events; Introduction to Class Wizard, Application Wizard and MFC.

Use of OOAD and OOP concepts in different areas: - Object-oriented Software Engineering, Object-oriented OS.

References:

1. B. Stroustrup, The C++ Programming Language, Addison-Wesley.
2. E. Balagurusamy, Object oriented Programming with C++, 2/ed, TMH.
3. G. Booch, Object Oriented Analysis and Design, Addison-Wesley.
4. Rumbagh et. Al., Object Oriented Modeling, PHI.
5. R. S. Pressman, Software Engineering – A Practitioner's Approach, McGraw Hill.

SET/CSE/MCS/C 203 : Theory of Computation

A brief review of Finite Automata, Regular expressions, Regular languages, Deterministic and non-deterministic computations. Pumping Lemma for Regular languages,

Context free languages, Pushdown automaton, Pumping Lemma for Context free languages, Grammar types and Chomsky Hierarchy.

Turing Machines (TM), Variations of TM's, Universal Turing Machines (UTM),

Church-Turing Thesis, Relation of Languages to Automata. Turing computable functions, Halting problem, Solvability, Undecidability and Computability.

References:

1. J.E.Hopcraft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education
2. Cohen, "Introduction to Computer Theory", John Wiley.
3. M. Sipser, Introduction to Theory of Computation, PWS Publishing Corporation, 1997.
4. J.E. Hopcroft, J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Addison-Wisley, 1979.
5. T.C. Martin, Theory of Computation, Tata McGraw-Hill
6. H.R. Lewis, C.H. Papadimitrou, Elements of the Theory of Computation, PHI.

SET/CSE/MCS/C 204 : Software Engineering

Software **:** software characteristics, components & applications, software engineering - a layered technology, software process models - linear sequential model, prototype & rad model., evolutionary software process model – incremental model and spiral model.

Software project management **:** project management concepts – people problem and process

S/w process and project metrics : metrics in the process and project domains . Software measurement –size oriented, function oriented metrics, extended function

Software project planning: objectives, scope, project estimation, decomposition techniques, empirical estimation models.

Analysis concept and principles : requirement analysis, communication techniques, analysis principles, software prototyping, specifications.

Analysis modeling: elements of the analysis modeling, data modeling . Functional modeling and information flow, behavioral modeling, data dictionary.

Design concepts and principles: design process, design concepts, design principles, effective modular design .

Design methods : architectural design process, transform mapping and transaction mapping,interface design, - internal and external design, human omputer interface design, interface design guidelines, procedural design,

S/w quality assurance : quality concepts, matrix for software quality, quality movement, s/w q a, s/w review, formal technical reviews, formal approaches to sqa, s/w reliability, iso 9000quality standards

S/w testing models : s/w testing fundamentals, test case design, white and black box testing, basic path testing, control structure

S/w testing strategies : strategic approach to s/w testing, unit testing, integration testing, validation testing, system testing, debugging

S/w reuse : reuse process,building reuse components, classified and retrieving components, economics of s/w reuse

Computer aided s/w engineering: introducing of case, building block for case, taxonomy of case tools, integrating case environment, integrating architecture, case repository

References:

1. Software Engineering By R.S.Pressman
2. An Integrated Approach To Software Engineering By Pankaj Jalote

SET/CSE/MCS/C 205 : Data Communication and Computer Networks

Introduction to Computer Networking: Use, advantage, structure of the communications network topologies the telephone network, analog to digital communication.

Communication Between Analog Computers & Terminals Layered Protocols, Network & The OSI Models, Traffic control and accountability wide area and local area networks, connection oriented and connectionless networks, classification of communication protocols polling/selection systems, non-priority system priority system, rotation for layered protocols foals of layered protocols, network design problems, communication between layers, A parametric illustration, introduction to standards organizations and the ISO standard.

Polling/Selection, Satellite and Local area Networks: Binary synchronous control, other BSC system, conversion using satellite communication SPUS, and the Tele-port primary attribute of a LAN, IEEE LAN standards, LAN topology and protocols.

Switching and routing in Network: Telephone switching system, message switching, packet switching, packet switching support to circuit switching networks.

The X.25 & Digital Networks: Layers of x.25, features of x.25 flow control principles, other packet type, x.25 logical channel states time out and time limits, packet formats, flow control and windows x.25 facilities, other standards layer the pad, communication networks communication between layers, advantage of digital networks, Digital's switching, voice transmission by packet.

Personal Computer Network: Personal computer communications, characteristics, using the personal computers as server linking the personal computer to mainframe computers, semaphores of vendor offerings. File transfer on personal computers, personal computer and local area networks. Personal computer networks and the OSI models.

TCP/IP: TCP/IP and internetworking, example of TCP/IP operations, related protocols ports and sockets. The IP address structure, major features of IP, IP datagram, Major IP services. IP source routing, value of the transport layer, TCP, Major features of TCP, passive and active operation, the transmission control block (TCB), route discovery protocols, examples of route discovery protocols, application layer protocols.

References:

1. Tannanhaum, A.S. : Computer Network, PHI – 1995.
2. Martin J.: Computer Network and Distributed processing, 1985.
3. Black : Computer Network; Protocols, Standards and Interface PHI – 1995.
4. Black : Data Network; Concepts, Theory and Practices, PHI
5. Starlings, William : Local Networks; and Introduction Mack Publishing Co.
6. Comer; Internetworking : Principles, Protocols Architecture, PHI with TCP/IP
7. Crichlow : Introduction to Distributed and Parallel Comp.
8. Ahuja : Design and Analysis of Computer Communication Network, McGraw Hill Co.

9. Chorafas: Designing and Implementing Networks, McGraw Hill Co.

SET/CSE/MCS/C 301 : Network Security and Cryptography

Introduction of Cryptography: Introduction To security: Attacks, Services and Mechanisms, Security, Attacks, Security Services, Conventional Encryption: Classical Techniques, Conventional Encryption Model, and steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operations.

Conventional Encryption Algorithms: Triples DES, Blowfish, International Data Encryption Algorithm, RCS, CAST-128, CR2 Placement and Encryption Function, Key Distribution, Random Number Generation, Placement of Encryption Function.

Public Key Encryption: Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, Key, Key Management, Fermat's and Euler's Theorm, Primality, Chinese Remainder Theorem.

Hash Functions: Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function and MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures: Digital Signature, Authentication Protocol, Digital Signature Standard (DDS) Proof of Digital Signature Algorithm.

Network and System Security: Authentication Applications: Kerberos X-509, Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction (Set), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

References:

1. 1.William Stallings, "Cryptography and Network Security: Principles and Practice"' Prentice hall, New Jersey
2. Johannes A. Buchmann, "Introduction to Cryptography" Springer-Verlag
3. Atul Kahate, "Cryptography and Network Security" TMH
4. Network Security Bible : Eric Cole, Wiley dreamtech India Pvt. Ltd.
5. 5.Practical Cryptography "Bruce Schneier" Wiley dreamtech India Pvt. Ltd.

SET/CSE/MCS/C 302: Design and Analysis of Algorithm

Elementary Data Structures, Basic Computational Models.

Simple Algorithms. Analyzing Algorithms, Asymptotic Notation.

Design Methods : General Consideration, Algorithm design paradigms and representative problems: Divide and Conquer (Binary search, Merge Sort, Quick Sort, Arithmetic with Large integers, etc.), Greedy Method (Minimal Spanning Tree, Shortest Paths, Knapsack, etc.), Dynamic Programming (Chained Matrix Multiplication, Optimal Storage on Tapes, Shortest Paths, Optimal Search Trees, etc.), Backtracking (8-queens problem, Graph Colouring, Hamiltonian Cycles, etc.), Branch and Bound (0/1 Knapsack problem, Travelling Salesperson, etc.),

Approximation (Graph Colouring, Task Scheduling, Bin Packing, etc.), Probabilistic Algorithms (Numerical Integration, Primality Testing, etc.).

Graph Algorithms: BFS, DFS and its applications.

Polynomial Evaluation and Interpolation, Fast Fourier transforms.

Intractable Problems : Basic Concepts, Nondeterministic Algorithms, NP Completeness, Cook's Theorem, Examples of NP-Hard and NP-Complete problems. Problem Reduction.

Lower Bound Techniques: Comparison tree, Reduction, Adversary argument.

References:

1. A.Aho, J. Hopcroft and J.Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley.
2. E. Horowitz and S. Sahani, Fundamentals of Computer Algorithms, Galgotia, New Delhi.
3. S.E.Goodman and S.T.Hedetniemi, Introduction to the Design and Analysis of Algorithms, McGraw Hill.
4. G.Brassard and P.Bratley, Algorithmics, PHI.
5. S.K.Basu, Design Methods and Analysis of Algorithms, PHI, 2005.

SET/CSE/MCS/C 303: Mobile & Wireless Computing

Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.

General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard,
Mobile IP.
Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

Reference :

1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing
6. House, 2001.
7. "Wireless Web Development", Ray Rischpater, Springer Publishing,
8. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
9. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers,

E1.1 Computer Graphics

Introduction to computer graphics & graphics systems

Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

2D transformation & viewing Basic transformations: translation , rotation, scaling ; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation , clipping operations , point clipping , line clipping, clipping circles , polygons & ellipse.

3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Curves Curve representation, surfaces , designs , Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Hidden surfaces Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry.

Color & shading models Light & color model; interpolative shading model; Texture;

Text Books:

1. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics
4. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
5. Sanhker, Multimedia –A Practical Approach, Jaico
6. Buford J. K. – "Multimedia Systems" – Pearson Education
7. Andleigh & Thakrar, Multimedia, PHI
8. Mukherjee Arup, Introduction to Computer Graphics, Vikas
9. Hill,Computer Graphics using open GL, Pearson Education

E1.2 Computer Organisation

Introduction: Function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer. Representation of Instructions: Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

Processing Unit: Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit.

Memory Subsystem: Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address translation, Hardware support for memory management.

Input/Output Subsystem: Access of I/O devices, I/O ports, I/O control mechanisms -Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces- Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infiniband, I/O peripherals - Input devices, Output devices, Secondary storage devices.

References

1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGraw- Hill, 2002.
2. W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India, 2002.
3. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design - The Hardware/Software Interface", Morgan Kaufmann,1998.
4. J .P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1998.

E1.3 C#

MS.NET Framework Introduction

The .NET Framework - an Overview , Framework Components , Framework Versions

Types of Applications which can be developed using MS.NET , MS.NET Base Class Library , MS.NET Namespaces , MSIL / Metadata and PE files.

The Common Language Runtime (CLR) ,Managed Code , MS.NET Memory Management / Garbage Collection , Common Type System (CTS) , Common Language Specification (CLS)

Language Basics

Datatypes & Variables Declaration , Implicit and Explicit Casting , Checked and Unchecked Blocks – Overflow Checks , Casting between other datatypes Operator Overloading, Partial Class, Attributes, Reflection, Configuration

Boxing and Unboxing , Enum and Constant , Operators , Control Statements , Working with Arrays,

Working with Methods , Pass by value and by reference and out parameters

Exception Handling

What is Exception , Rules for Handling Exception , Exception classes and its important properties,

Understanding & using try, catch keywords , Throwing exceptions

Importance of finally block , "using" Statement , Writing Custom Exception Classes.

Working With Collections and Generics

Importance of IList and IDictionary., Using ArrayList and Hashtable. , Understanding IEnumerable and IEnumerator. Sorting Items in the collection using IComparable.

Typesafety issue with ArrayList and Hashtable classes. Writing custom generic classes.

Working with Generic Collection Classes.

WinForms

Introduction, Controls, Menus and Context Menus, MenuStrip, ToolbarStrip.

Graphics and GDI , SDI and MDI Applications , Dialogbox (Modal and Modeless)

Form Inheritance, Developing Custom, Composite and Extended Controls

Other Misc topics., Working with Resource Files , Working with Settings

Data Access using ADO.NET – DataSet

Dataset, Advantages of DataSet, DataSet Object Model, Fetching data using Fill methods of Data Adapter and filling data into Dataset to create a DataTable, Showing DataTable in DataGridView

E2.1 ASP.NET

Introduction to ASP

Introduction to ASP. Types of Path. Examples using Response object of ASP. Working with FORM tag. Important Points about the FORM submission. Problem with ASP.

Validation Controls

BaseValidator, ValidationSummary, RequiredFieldValidator, CompareValidator RangeValidator, RegularExpressionValidator, CausesValidation Property of Button Grouping Controls for Validation

Applying Themes and Styles to Controls

Working with CSS ,Using Themes to Customize a Site , Named Skins within a Theme Server-side Styles using Themes , Contents of a Theme and Skin, Themes and Profiles

ASP.NET Architecture

What is AppDomain, Life cycle of a WebForm when requested by a client., How does a control manages its state, EnableViewState property, Event Handling in WebForms , Writing / Using Custom Classes in WebApplication

Page Navigation Options

Response.Redirect, Server.Transfer, CrossPagePostBack property of Button a. Accessing controls of PreviousPage b. Accessing Properties of PreviousPage c. PreviousPageType page directive

Creating a Layout Using Master Pages

Why Master Pages. , Significance of ContentPlaceHolder Tag in MasterPage and Content Tag in WebForm. How a control of MasterPage can be accessed / programmed in WebForm. a. Master.FindControl b. Public property in MasterPage and <%@MasterType directive in WebForm. Load and LoadComplete events of the Page and MasterPage classes. Understanding ClientID and UniqueID properties.

E2.2 Compiler Designing

Compiler Structure: Compilers and Translators, Various Phases of Compiler, Pass Structure of Compiler, Bootstrapping of Compiler.

Programming Language: High level languages, lexical and syntactic structure of a language, Data elements, Data Structure, Operations, Assignments, Program unit, Data Environments, Parameter Transmission. Lexical Analysis: The role of Lexical Analyzer, A Simple approach to the design of Lexical Analyzer, Regular Expressions, Transition Diagrams, Finite state Machines, Implementation of Lexical Analyzer, Lexical Analyzer Generator: LEX, Capabilities of Lexical Analyzer.

The Syntactic Specification of Programming Languages: CFG, Derivation and Parse tree, Ambiguity, Capabilities of EFG.

Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive descent Parsers, Predictive Parser, Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers (SLR, Canonical LR, LALR) Syntax Analyzer Generator: YACC

Intermediate Code Generation: Different Intermediate forms: Three address code, Quadruples & Triples, Syntax Directed Translation mechanism and attributed definition. Translation of Declaration, Assignment, Control flow, Boolean expression, Array References in arithmetic expressions, procedure calls, case statements, postifix translation.

Run Time Memory Management: Static and Dynamic storage allocation, stack based memory allocation schemes, Symbol Table management.

Error Detection and Recovery: Lexical phase errors. Syntactic phase errors, semantic errors.

Code Optimization and Code Generation: Local optimization, Peephole optimization, Basic blocks and flow Graphs, DAG, Data flow analyzer, Machine Model, Order of evaluation, Register allocation and code selection.

References:

1. Alfred V Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa
2. A.V. Aho, R. Sethi and J.D.Ullman, "Compiler Principle, Tech & tools" AW
3. H.C. Holub "Compiler Design in C", Printice Hall Inc.
4. Apple, "Modern Computer Implementation in C: Basic Design" Cambridge Press
5. Modern Compiler Design: Dick Grune, Wiley dreamtech India Pvt. Ltd.
6. Starting Out with Modern Compiler " David Gaddis Wiley dreamtech India Pvt. Ltd.

E2.3 Human- Computer Interaction

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design,
The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.
Screen Designing:- Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls.
Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

Software tools – Specification methods, interface – Building Tools.
Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

References:

1. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen , Pearson Education.

E3.1 Image Processing

Introduction: Digital Image Processing, The origins of Digital Image Processing, Examples of Digital Image Processing application, Fundamental steps in Digital Image processing, Components of Image Processing system Fundamentals: Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels, Linear and Nonlinear Operations.

Image Enhancement in the spatial domain: Background, Some basic gray level transformation, Introduction of Histogram processing, Enhancement using Arithmetic/Logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Image Enhancement in the Frequency Domain: Introduction.

Image Restoration: Model of the Image Degradation/Restoration process, Noise Models, Restoration in the presence of noise only spatial filtering, Inverse filtering, Minimum Mean Square Error (Wiener) filtering, Geometric mean filter, Geometric Transformations, Image Compression: Fundamentals, Lossy Compression, Lossless Compression, Image Compression models, Error-free Compression : Variable length coding, LZW coding, Bit plane coding, Run length coding, Introduction to JPEG.

Morphology: Dilation, Erosion, Opening and Closing, Hit-and Miss transform, Morphological Algorithms : Boundry Extraction, Region filling, Extraction of connected components, Convex Hull, Image Segmentation: Definition, characteristics of segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region based segmentation. Introduction to Representation & Description, Introduction to Object Recoginition.

References:

1. Digital Image Processing: Rafael C. Gonzalez and Richard E.Woods. Addision Wesley.
2. Fundamentals of Digital Image Processing. Anil K. Jain, PHI.
3. Digital Image Processing and Analysis : B. Chanda & D. Dutta Majumber, PHI.
4. Image Processing in C : Dwayne Phillips, BPB.

E3.2 Unified Modeling Language

Introduction: The Evolution of Technology, Structured Analysis and Design, Object-Oriented Technologies, Comparison between the main technologies.

The Unified Process and Features: Unified Process, Static Structure: Process Representation, Dynamic Structure: iterative development, an architecture-centric process, A use-case-driven process, Use case models, Notations and Terminology.

Process Components (Workflows): Business Modeling Workflow, Requirement Workflow, Analysis and Design Workflow, Deployment workflow.

Understanding Object –Oriented Technologies, Current status of Object Technologies, The static object model- Class, Collaborations and Object Diagrams, Generalization, Composition, Aggregation, Multiplicity & Association with concept and examples.

Use Case Analysis: Discussion on use cases, terminology, notations and analysis, what they are and aren't, Use case- an example, Use case- formal Scenario template.

Static chart Diagram: Composite states, nested states, Events, Simple transitions.

UML Activity and sequence diagrams: Usage and Syntax, Guarded Transitions, Synchronization Bars, Swim lanes Purpose, Proper Usage of Activity diagram. Transition time sequence diagram: Objective and Modeling guidelines, Objective Interaction, Sequence diagram- UML notation, Object and Stereotypes.

References:

1. UML distilled by Martin Fouler- Pearson Education.
2. Object –Oriented Modeling by James Raumbaugh, PHI.
3. UML a nutshell by Dan Pillone, O'Reilly Publication.
4. The elements of UML by Scott Amber, Cambridge University Press.
5. Designing Object-Oriented Software by Rebecca Wirf Brock, PHI.

E3.3 Multimedia Technology and Applications

Evolution of Multimedia and its objects, Scope of multimedia in business & work, production and planning of Multimedia applications. Multimedia hardware, Memory of Storage Devices, Communication Devices, Multimedia Software, Presentation and object generation tools, Video, sound, Image capturing Authoring Tools, Card & Page Based Authoring Tools.

Production and Planning of Multimedia building blocks, Text, sound (MIDI), Digital Audio, Audio File Formats, MIDI under Windows environment, Audio & Video Capture.
Macromedia products, Basic drawing techniques, Advance animation techniques, Creating Multi layer combining interactivity and multiple scenes, Creating transparency effects using text in Flash, Flash animation.

Digital Audio Concepts, Sampling variables, Loss Less compression, of sound, Lossy compression & Silence compression.

Multimedia monitor bitmaps, Vector drawing , Lossy graphic compression, Image file formatic animations, Image standards, JPEG compression, Zig Zag coding. Video representation, colors, video compression, MPEG standards, MHEG standard, recent development in multimedia. Multimedia Application Planning, Costing, Proposal preparation, and Financing-Case study of a typical industry.

References:

1. Andreas Halzinger, "Multimedia Basics" Vol-I to VOL-III Firewall Media
2. Tay Vaughan, "Multimedia Making It work" Tata McGraw Hill
3. Buford, "Multimedia Systems" Addison Wesley
4. Agarwal and Tiwari, "Multimedia Systems" Excel
5. Rosch, "Multimedia Bible" Sams Publishing
6. Digital Multimedia "Nigel Chapman" Wiley dreamtech India Pvt. Ltd.
7. Sleinreitz, "Multimedia Bible" Sams Publishing
8. Ken Milburn, John Ckroteau, "Flash 4 Web special Effects, Animation & Design Handbook" Dreamtech Press
9. John. Villamil-Casanova & Louis Molina, "Multimedia-Production, Planning & Delivery" PHI
10. Flash MX 2004 Bible: Robert , Wiley dreamtech India Pvt. Ltd.

E4.1 Artificial Intelligence

Introduction: Definition and meaning of artificial intelligence, A.I. techniques, pattern recognition, Level of, speech recognition representation in A.I. properties of internal representation.

Production System: Different types of tracing, strategies, graph search strategies, Heuristic graph, search procedure, AND/OR graph, relationship between decomposional and compatible systems, searching Gate Tree, min-max search game playing, actual game playing.

Introduction to Predicate Calculus: Predicates and Arguments, connectives, Simplifications of strategies, extracting answers from Resolution Refutation. Control strategies.

Rule Based Deduction Systems: Forward and backward deduction system, resoling with AND/OR graph, computation, deduction and program synthesis, central knowledge for rules based deduct systems.

Managing Plans of Action: Plan interpreter, planning decisions, execution monitoring and re-planning domain of application robot motion planning and game playing.

Structural Object Representation: Semantic networks semantic market matching deductive operations on structured objects.

Architectural for A.I. Systems: Knowledge, acquisitions representation IMAGES PROCESSING, Natural language processing.

References:

1. Introduction to artificial Intelligence Eugene Charnik Drew MC mott
2. Artificial Intelligence Elaine Rice.
3. Principal of Artificial Intelligence, Nelson, Springer-Verlag.
4. Artificial Intelligence Application Programming: Tim Jones, Wiley dreamtech

E4.2 Wireless Networks

Introduction to Wireless Networks

Elements of a wireless communication system – signal and noise - the radio – frequency spectrum –Analog modulation schemes -Amplitude modulation –frequency and phase modulation – sampling – pulse code modulation – delta modulation – data compression.

Digital Modulation and Radio Propagation

Digital communication- sampling –pulse code modulation – delta modulation - Frequency shift keying – Phase shift keying – Multiplexing and Multiple access – spread spectrum systems - radio propagation.

Principles of Cellular Communication And Multiple Access Techniques

Cellular terminology - Cell structure and Cluster – Frequency reuse concept – Cluster size and system capacity – method of locating co channel cells – frequency reuse distance – frequency division multiple access – time division multiple access – space division multiple access – code division multiple access.

GSM and CDMA Digital Cellular Standards

GSM network architecture –GSM signaling protocol architecture – Identifiers in GSM – GSM channels – GSM handoff procedures – Edge technology – wireless local loop – DECT system – GPRS

Emerging Wireless Technologies

IEEE 802.11 system architecture – mobile ad hoc networks – Mobile IP and mobility management – Mobile TCP - wireless sensor networks – RFID technology – Blue tooth – Wi –Fi standards – Wimax standards. – Femtocell network – Push -to –talk technology for SMS.

References:

1. Roy Blake, *"Wireless communication technology"* CENGAGE Learning , sixth Indian reprint 2010. (Chapter 1,2,3,4,7,14)
2. Singal T.L. , *"Wireless communication"* Tata Mc Graw Hill Education private limited , 2011.**(** chapter 4,8,11,13,14)
3. Dharma Prakash Agrawal , Qing –An Zeng , *" Introduction to wireless and mobile systems"* CENGAGE Learning, first edition 2012.(chapter 16)

E4.3 Data Mining & Data Warehousing

Fundamentals : Data Mining, Data Processing And Data Warehouses

Data Mining – History – Strategies – Techniques – Applications – Challenges – Future- Types of Data – Data Warehouses – Data Processing - Quality Measure – OLAP – Sampling.

Data Types, Input And Output Of Data Mining Algorithms – Different Types of features – Concept Learning – Output of Data Mining Algorithms.

Preprocessing In Data Mining – Steps – Discretization – Feature Extraction, Selection and construction – Missing Data and Techniques for dealing it.

Model Evaluation Techniques: Accuracy Estimation- ROC-Lift Charts- Cost –Bagging and Boosting-Model Ranking Approach.

Association Rule Mining: Concepts, Relevance, Functions of Association rule Mining – Apriori Algorithm-Strengths and Weaknesses of ARM- Applications

Clustering And Estimation

Clustering Task: Introduction- Distance Measure – Types – KNN for clustering – validation - Strengths and Weaknesses of Algorithms – Applications.

Estimation Task: Scatter Plots and Correlation – Linear regression Models – Logistic regression – Regression Analysis - Strengths and Weaknesses of Estimation- Applications.

Introduction to Data Warehouse – Data warehouse delivery method – system process – typical process flow within a Data ware house – query management process – process

architecture.

Design Aspects

Design aspects – Designing dimension tables – Designing star flake schema – Multi dimensional schema – partitioning strategy aggregations – Data marting- Meta data – System Data warehouse process manager.

Hardware Hardware and operational design – server hardware, network hardware – parallel technology – Security input on design of Hardware – backup and recovery –

Service level Agreement – Operating the data warehouse.

References:

1. Shawkat Ali A B M, Saleh A. Wasimi, *"Data Mining: Methods and Techniques*", Third Indian Reprint, Cengage Learning, 2010.
2. Sam Anahory & Dennis Murray, "*Data Warehousing in the real world*",Pearson Education Ltd., 2011
3. Prabhu C.S.R. , "Data Ware housing: Concepts, Techniques, Products and *Applications*", Prentice Hall of India, 2011,

E4.4 Genetic Algorithm and Machine Learning

Introduction To Genetic Algorithm And Machine Learning

Robustness of Traditional Optimization and Search methods – Goals of optimization-GA versus Traditional methods – Simple GA; Machine learningexplanation-machine learning Vs artificial intelligence-supervised and unsupervised machine learning-examples of machine learning.

Mathematical Foundations Of Genetic Algorithm

The fundamental theorem - Schema processing at work. – The 2-armed & karmed

Bandit problem. –The building Block Hypothesis. – Minimal deceptive problem.

GA Operators

Data structures – Reproduction- Roulette-wheel Selection – Boltzmann Selection – Tournament Selection-Rank Selection – Steady –state selection –Crossover &mutation – Mapping objective functions to fitness forum. – Fitness scaling.

Applications Of GA

The rise of GA – GA application of Historical Interaction. – Dejung & Function optimization – Current applications of GA - Advanced operators & techniques in genetic search: Dominance, Diploidy & abeyance.

Applications Of Genetics-Based Machine Learning

The Rise of GBML – Learning classifier system--Development of CS-1, the first classifier system. – Smitch's Poker player –GBML for sub problems of learning-- Other Early GBML efforts –Current Applications.

References:

1. David E. Gold Berg, *"Genetic Algorithms in Search, Optimization & Machine Learning"*, Pearson Education, 2013.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – DEFENCE STRATEGIC & GEO POLITICAL STUDIES

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Department of Defence, Strategic &
Gro-Political Studies
(School of Earth Science)
H.N.B. Garhwal University Srinagar (Garhwal)
(A Central University)

Syllabus Pre-Ph.D Entrance

1-National Security

- National Power – Concept, definitions, type, Elements and Importance.
- National Interest – Concept, definition, Elements and Importance.
- Geo-Strategic location of India and areas of Strategic importance.
- Internal and External threats with special reference to India's Security.
- India's Strategy to Counter security threats, Various military operations.
- Development of India's Defence and Nuclear policy.
- India's Border dispute.
- Defence cooperation with strategic partnership of India with other countries.

2-Indian Military History

- Comparative study of Indo-Greek art of war with special reference to the Battle of Hydaspes (326 B.C.), Mauryan military system as describes by Kautilya and Megasthenes.
- Rajput Military system and the art of war with special reference to the Second battle of Tarain (1192 A.D.), Mughal military system and the art of war with special reference to the first Battle of Panipat (1526 A.D.),
- Maratha military system and the art of war with special reference to the Irregular art of war of Shivaji and the third Battle of Panipat (1761 A.D.),
- Sikh military system and military reforms of Maharaja Ranjeet Singh with special reference to the Battle of Sobraon (1846 A.D.),
- Presidency armies and Military reforms under the British Crown.

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Head & Convener
Deptt. of Defence Strategic
& Geo Political Studies
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Srinagar Garhwal - 246174

3-Strategic Thoughts

- Kautilya Philosophy of war, Sun Tzu Art of War.
- Linkages between war and politics - Machiavelli's, Jomini and Clausewitz's .
- Concept of Land, Sea and Air power – J.F.C. Fuller, B.H Liddle Hart, A.T. Mahan, Douhet's.
- Concept of Revolutionary warfare – Mao Tse- Tung.

4-Modern Warfare

- War – meaning, Definition and Historical Evolution.
- Typology of warfare.
- Contemporary Strategic Environment in the world Example. Russia-Ukraine, Israel-Hamas and Syria etc.

5-International Law (Security Aspects)

- Nature, Definition and Sources of International Law.
- Concept of state and its type.
- Definition of Neutrality, its Characteristics, Rights and duties of Neutral State.
- Block and Contraband.
- Law of war – Land warfare, Air warfare and Sea warfare, Nuclear warfare.
- War crimes.

6-Role of India in International Relations and Conflict resolutions

- Defence Mechanism of India.
- Higher Defence Organization of India, Ministry of Defence, Cabinet Committee of Security, NCC, NSAB, CDS.
- Organization and Headquarters, Army, Air Force, and Navy.
- Second Line of Defence (BSF, CG, CISF, RR, ITBP, SSB, CRPF),
- Defence Intelligence Agency (DIA)

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SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – DRAWING & PAINTING

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Course Detail for Pre-Ph.D. Entrance Exam.
Drawing & Painting

Fundamentals of Visual Art :- Meaning and Definition of Art, Classification of Art, Types of Painting. Visual Elements of Painting : Line, shape and Form, Colour, Tone and Value, , Space ,Texture .Principles of Composition :Introduction of Composition Proportion, Movement & Rhythm, Dominance, Harmony, Unity, Contrast, Balance, Perspective.

Media and Technique :- Introduction to media and techniques, Monochromatic Drawing media & tech.: pencil, charcoal, ink, colored chalk etc. Painting media & tech.: water color, tempera, gouache, oil color, acrylic, batik, tie and die. Brief introduction of Print Making & tech. : Relief Prints, Intaglio prints, paleographic prints. Mural, video art, computer art, mix media, collage, documented art.

History of Indian painting:-

Introduction of art, Painting in Pre-historic India, Indus Valley, Jogimara, Ajanta, Bagh,Badami, Sittanvasal, Ellora,Elephenta,Tanjavur, Pal school Jain school,Deccani school (Ahemadnagar, Bijapur,Golconda) Mughal Painting under Akbar, Jahangir,Shahjahan, Aurangzeb. Prominent Mughal Artists. Rajasthani school (Mewar, Malwa, Bundi, Kishangarh, Nathdwara) Pahari school (Basohli, Guler, Kangra,Mandi, Garhwal) Kalighat Painting, Company Painting, Raja Ravi Verma and his follower, Renaissance period.

Mural Tradition in India:- Himanchal, Jammu & Kashmir. Uttarakhand, Ajanta, Bagh, Sittanvasal, Badami, Ellora, Jogimara, Singiria, Varannasi, Rajasthan, Andhra, Kerla, Karnataka, Tmilnadu etc.

Philosophy of art :-

Relationship of mythology and Art in India. Sources and evolution of aesthetic concepts in India. Rasa theory of Bharat Muni, Abhinava Gupta, Sadharanikaran, Dhwani (suggestiveness of work of Art: richness of Ambivalence and association) Alankar (Artistic embellishment) Auchitya (Propriety in works of Art) Riti (Style in Art) Guna and Dosha (Merits and Demerits of Art work) Shadang theory. Concept of Art and Beauty with reference to thinkers like Plato, Aristotle, Plotinus and Augustine, Aquinas, Leonardo- de -Vinci, Lessing, Diderot, Baumgarten. Kant, Hegel, Tolstoy, Croce, Roger Fry, Clive Bell, Bullough, Bradely, Susanne Langer, Freud, Sartre etc. communist Philosophy of Art, Study of relationship between Aesthetics and actual works of Art.

History of European painting.:-

Primitive cave painting. Egyptian painting. Greek painting. Roman painting. Early Christian Art. Byzantine Art. Romanesque painting. Gothic painting. Renaissance painting. Lives and works of 16th century great masters Leonardo Da Vinci, Michael Angelo, Raphael, Titian and others. Mannerism. Baroque. Rococo painting. Lives and works of 17th & 18th century great masters. Rembrandt, Rubbens, Vermeer, Vlazquez and others. 18th century painting of England and France. Francisco Goya. Neo-Classism. Romantism. Realism. Pre- Raphelism

History of modern painting of Europe;-

Brief introduction of early 19th century painting, (Neo-classicism, Romanticism, Realism. Pre- Raphaelites) Impressionism. Post-Impressionism, Symbolism, Fauvism. Cubism, Expressionism, Surrealism, Abstract Art.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – ELECTRONIC AND COMMUNICATION ENGINEERING

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Department of Electronics and Communication Engineering
H. N. B. Garhwal University (A Central University)
Srinagar Garhwal, Uttarakhand

Syllabus for subject-specific component of entrance examination for admission in Doctor of Philosophy (Ph. D.) programme in Electronics and Communication Engineering

Section 1: Networks, Signals and Systems Circuit analysis

Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform. Linear 2-port network parameters, wye-delta transformation. Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications. Discrete-time signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay.

Section 2: Electronic Devices

Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors. Carrier transport: diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations. P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.

Section 3: Analog Circuits

Diode circuits: clipping, clamping and rectifiers. BJT and MOSFET amplifiers: biasing, ac coupling, small signal analysis, frequency response. Current mirrors and differential amplifiers. Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

Section 4: Digital Circuits

Number representations: binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders. Sequential circuits: latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay. Data converters: sample and hold circuits, ADCs and DACs. Semiconductor memories: ROM, SRAM, DRAM. Computer organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

Section 5: Control Systems

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

Section 6: Communications

Random processes: auto correlation and power spectral density, properties of white noise, filtering of random signals through LTI systems. Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers. Information theory: entropy, mutual information and channel capacity theorem. Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER. Fundamentals of error correction, Hamming codes, CRC.

Section 7: Electromagnetics

Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector. Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth. Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – ECONOMICS

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

HNB Garhwal University

Syllabus For Ph. D. Entrance Exam,

Subject: ECONOMICS

Unit-1 : Micro Economics

- Theory of Consumer Behaviour
- Theory of Production and Costs
- Decision making under uncertainty Attitude towards Risk
- Game Theory – Non Cooperative games
- Market Structures, competitive and non-competitive equilibria and their efficiency properties
- Factor Pricing
- General Equilibrium Analysis
- Efficiency Criteria: Pareto-Optimality, Kaldor – Hicks and Wealth Maximization
- Welfare Economics: Fundamental Theorems , Social Welfare Function
- Asymmetric Information: Adverse Selection and Moral Hazard

Unit-2 : Macro Economics

- National Income: Concepts and Measurement
- Determination of output and employment: Classical & Keynesian Approach
- Consumption Function
- Investment Function
- Multiplier and Accelerator
- Demand for Money
- Supply of Money
- IS – LM Model Approach

- Inflation and Phillips Curve Analysis
- Business Cycles
- Monetary and Fiscal Policy
- Rational Expectation Hypothesis and its critique
-

Unit- 3 : Statistics and Econometrics

- Probability Theory: Concepts of probability, Distributions, Moments, Central Limit theorem
- Descriptive Statistics – Measures of Central tendency & dispersions, Correlation, Index Numbers
- Sampling methods & Sampling Distribution
- Statistical Inferences, Hypothesis testing
- Linear Regression Models and their properties – BLUE
- Identification Problem
- Simultaneous Equation Models – recursive and non-recursive
- Discrete choice models
- Time Series Analysis

Unit-4 : Mathematical Economics

- Sets, functions and continuity, sequence, series
- Differential Calculus and its Applications
- Linear Algebra – Matrices, Vector Spaces
- Static Optimization Problems and their applications
- Input-Output Model, Linear Programming
- Difference and Differential equations with applications

Unit-5 : International Economics

- International Trade: Basic concepts and analytical tools
- Theories of International Trade
- International Trade under imperfect competition
- Balance of Payments: Composition, Equilibrium and Disequilibrium and Adjustment Mechanisms
- Exchange Rate: Concepts and Theories
- Foreign Exchange Market and Arbitrage
- Gains from Trade, Terms of Trade, Trade Multiplier

- Tariff and Non-Tariff barriers to trade; Dumping
- GATT, WTO and Regional Trade Blocks; Trade Policy Issues
- IMF & World Bank

Unit-6 : Public Economics

- Market Failure and Remedial Measures: Asymmetric Information, Public Goods, Externality
- Regulation of Market – Collusion and Consumers' Welfare
- Public Revenue: Tax & Non-Tax Revenue, Direct & Indirect Taxes, Progressive and non-Progressive Taxation, Incidence and Effects of Taxation
- Public expenditure
- Public Debt and its management
- Public Budget and Budget Multiplier
- Fiscal Policy and its implications

Unit-7 : Money and Banking

- Components of Money Supply
- Central Bank
- Commercial Banking
- Instruments and Working of Monetary Policy
- Non-banking Financial Institutions
- Capital Market and its Regulation

Unit-8 : Growth and Development Economics

- Economic Growth and Economic Development
- Theories of Economic Development: Adam Smith, Ricardo, Marx, Schumpeter, Rostow, Balanced & Unbalanced growth, Big Push approach.
- Models of Economic Growth: Harrod-Domar, Solow, Robinson, Kaldor
- Technical progress – Disembodied & embodied; endogenous growth
- Indicators of Economic Development: PQLI, HDI, SDGs
- Poverty and Inequalities – Concepts and Measurement
- Social Sector Development: Health, Education, Gender

Unit-9 : Environmental Economics and Demography

- Environment as a Public Good
- Market Failure
- Coase Theorem
- Cost-Benefit Analysis and Compensation Criteria
- Valuation of Environmental Goods
- Theories of Population
- Concepts and Measures: Fertility, Morbidity, Mortality
- Age Structure, Demographic Dividend
- Life Table
- Migration

Unit-10 : Indian Economy

- Economic Growth in India: Pattern and Structure
- Agriculture: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Industry: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Services: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Rural Development – Issues, Challenges & Policy Responses
- Urban Development – Issues, Challenges and Policy Responses.
- Foreign Trade: Structure and Direction, BOP, Flow of Foreign Capital, Trade Policies
- Infrastructure Development: Physical and Social; Public-Private Partnerships
- Reforms in Land, Labour and Capital Markets
- Centre-State Financial Relations and Finance Commissions of India; FRBM
- Poverty, Inequality & Unemployment

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – EDUCATION

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

SYLLABUS

PH. D ENTRANCE TEST (2025)

EDUCATION

UNITE-1: PSYCHOLOGY OF LEARNING AND DEVELOPMENT: Relationship between Psychology and Education. Methods of Educational Psychology. Major Schools of Psychology: Behaviorism, Gestalt Psychology, Psychoanalysis, Humanism, and Constructivism. Theories of Piaget and Bruner's Psychosocial development, Kohlberg's moral development, Chomsky's language development, Intelligence - concepts and theories- Guilford's Model of Intellect, Multiple Intelligence Theory, and Measurement of Intelligence. Personality - Theories of Personality: Allport, Eysenck, Freud & Erickson, Murray's Need Theory, Humanistic Approach - Carl Rogers, Maslow. Techniques of personality measurement. Learning and Learning Theories: Cognitive Field theories of Tolman, Hull, Ausubel's Reception Learning Theory, E.L. Thorndike – Basic laws of learning, Skinner's Operant Conditioning, and Pavlov's Classical Conditioning Theory, Gestalt's Field Theory of Learning. Motivation and learning.

UNITE-2: PHILOSOPHICAL FOUNDATION OF EDUCATION- Philosophy meaning, Nature and Significance, Metaphysics, Epistemology and Axiology. Indian Schools of Philosophy: Sankhya, Vedanta, Buddhism, Jainism and Islamic traditions with special reference to their education implications. Western Schools of Philosophy -Idealism, Naturalism, Pragmatism, Realism, Existentialism. Indian Thinkers- Ravindranath Tagore, Swami Vivekananda, M. K. Gandhi, Sri Aurobindo and Pandit Madan Mohan Malviya and Western Thinkers: John Dewey, Bertrand Russell, Frobel and Plato.

UNIT - 3 – SOCIOLOGICAL FOUNDATION OF EDUCATION - Process of socialisation. Social Structure: Components, Class and Caste Structure in India, Family- Educational role of the family. Culture: need and importance – Characteristics of culture, Relationship between Culture and Education. Social Change. Social Mobility, Social Stratification and Education. Social Group – Inter Group Relationship, Group Dynamics & Educational Opportunity and Social Justice, Concept of Secularism in India and World Prospect. Govt. Policies for the Educational Enhancement of various social groups - Schedule castes, Schedule tribes, other backward classes,

Women and minorities. Globalisation and Sustainable Development Goals. Issues of Equality of Educational Opportunity, Equality vs. Equity in Education and Professionalism in Education.

UNIT - 4: CURRICULUM- Concept, Components of Curriculum- Objectives, Content, Transaction Mode and Evaluation. Types of Curriculum- Subject-centred, Activity-centred, Learner-centred. Humanistic Curriculum: Psychological Basis of Humanistic Curriculum, Role of the Teacher. Critical issues in Curriculum Design: environmental concerns, gender differences, inclusiveness, value concerns, and social sensitivity. Curriculum Construction Process - Steps of Curriculum Construction, Criteria for Selection of Content, Scope, Sequence and Relevance, Models of Implementation- Formative, Summative and Continuous comprehensive evaluation. Curriculum Evaluation: Importance of Evaluation of Curriculum Models of Curriculum Evaluation, Issues and Trends in Curriculum Development.

UNIT- 5: TEACHER EDUCATION: Historical perspective of the Development of Teacher Education in India- Ancient, Medieval, British, and Post-Independence Period. Constitutional Provisions for Education, Recommendation of Various Education Commissions and Committees -Indian University Commission, Mudaliar Commission, Kothari Commission, Yashpal Committee, New Education Policy on Education (1986) & Programme of Action (1992), Right to Education Bill 2009 and National Policy on Education (2020). RMSA and NCF 2005 &National Curriculum Framework for Quality Teacher Education 2009. Issues Related to Admission Policies and Procedures, Standards, Quality Assurance and Accreditation in Teacher Education, Role of different Agencies in Teacher Education – District Level, State Level, National Level, International Level. Concept and Objectives of Pre-Service and In-Service Teacher Education Programme, Role of NCERT, NCTE, UGC, SCERT, DITEs, Open University, Academic Staff Colleges.

UNITE -6: INSTITUTIONAL ADMINISTRATION AND MANAGEMENT: Institutional Planning and Evaluation of Institutional Planning & Institutional Management at Secondary & Senior Secondary level. Management at the national level: Ministry of Education, CABE, NCERT, State & District level. Educational Planning: Approaches to Educational Planning. **a.** Social demand approach **b.** Manpower approach & **c.** Return of Investment approach. Educational organisation: structure, communication, decision making, management by objectives (MBO). Strategies for efficient management: motivation, job satisfaction, conflict management.

Educational leadership: meaning, need, nature and importance, Types of leadership: Styles of leadership; Traits & skills for effective leadership Grid Concept of Academic Leadership and Measurement of Leadership.

UNIT-7: EDUCATIONAL TECHNOLOGY AND TEACHING: Concepts and Approaches to Educational Technology & Information and Communication Technology (ICT). Recent trends in Educational Technology: Educational Television: Telecast and Video recordings - Strengths and limitations, Use of Television and Computers in instruction and Training, Teleconferencing, Video Conferencing, countrywide classroom project and Satellite instructions, Gyandarshan and SIET programmes. Computer-assisted instruction, e-learning, online learning and m-learning. Role of computers and Multimedia in education. Teaching: Concept, variables, phases and levels of teaching. Models of Teaching: Basic teaching model, Concept Attainment model and Advance & Organizer Model. Teacher Training Techniques- Microteaching, Instructional Design: Concept, Views. Process and stages of Development of Instructional Design. Programmed Instruction.

UNIT 8: INCLUSIVE EDUCATION, special education, integrated education and inclusive education. National and international initiatives for inclusive education, Current laws and policy perspectives supporting Inclusive Education for children with diverse needs, building inclusive learning-friendly classrooms, Inclusive instruction design peer-tutoring, cooperative learning, buddy system and team teaching. The role of teachers, parents, and other community members is to support the inclusion of children with diverse needs.

UNIT-9- CONCEPT OF GUIDANCE AND COUNSELLING: Integration of guidance with curriculum, Types of guidance: Educational, vocational/career and personal guidance. Guidance and Counselling for gifted, creative, slow learners, socially disadvantaged children, and problem children. Counselling approaches – directive, non-directive & Characteristics of goods counselling. Theories of counselling- Person–centred theory, Rational–emotional behaviour theory, & Reality theory. School guidance: a team approach of school and community. Planning of guidance programme in schools. Use of tests in guidance and counselling- Standardized and non-standardized techniques/tests - Intelligence tests, creativity & aptitude tests, personality tests, interest inventory, achievement tests. The questionnaire, observation, sociometry, rating scale, anecdotal records, cumulative records, case studies, and interviews.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – ENGLISH

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Department of English
H.N.B. Garhwal University, Srinagar (Garhwal)

SYLLABUS
(Effective from 2013)

M. A. (English) Semesters I- IV
Core and Elective Courses

DEPARTMENT OF ENGLISH

M. A. COURSES

SEMESTER - I

Course I	English Literature from Geoffrey Chaucer to John Milton	(3 credits)
Course II	Drama Excluding Shakespeare	(3 credits)
Course III	Early Humanists' Literature	(3 credits)
Course IV	Literary Criticism 1	(3 credits)
Course V	English Prose	(3 credits)
Course VI	American Literature	(3 credits)

SEMESTER -II

Course VII	William Shakespeare	(3 credits)
Course VIII	Eighteenth Century Literature	(3 credits)
Course IX	Literary Criticism 2	(3 credits)
Course X	English Romantic Poetry	(3 credits)
Course XI	Nineteenth Century Literature	(3 credits)
Course XII	Indian Writing in English	(3 credits)

SEMESTER - III

Core Courses:

Course XIII	Twentieth Century Poetry	(3 credits)
Course XIV	Indian Texts and Poetics	(3 credits)
Course XV	Literary Criticism 3	(3 credits)

Elective Courses:

Course XVI	Group (A) (One of the following)	
	(a) Commonwealth Literature	(3 credits)
	(b) Translation Studies	(3 credits)
Course XVII	Group B (One of the following)	
	(a)World Classics in Translation	(3 credits)
	(b)European Literature in Translation	(3 credits)
Course XVIII	Group (C) (One of the following)	
	(a) Modern Indian Writing	(3 credits)
	(b) Indian Literature in Translation	(3 credits)

SEMESTER - IV

Core Courses:

Course XIX	Twentieth Century Drama	(3 credits)
Course XX	Colonial/Postcolonial Literatures and Theory	(3 credits)
Course XXI	Modern Critical Thought	(3 credits)

Elective Courses:

Course XXII	Group (A) (One of the following)	
	(a) Literature of the Indian Diaspora	(3 credits)
	(b) Special Study of Authors	(3 credits)

Course XXIII	Group (B) (One of the following)	
	(a) African and Afro-American Literature	(3 credits)
	(b) Literature and Gender	(3 credits)
Course XXIV	Dissertation & Viva Voce	(3 credits)

Self Study Courses:

1. Language and Linguistics. (3 credits)
2. Popular Literature (such as the writings of Chetan Bhagat, Ruskin Bond, J. K. Rowling and A. P. J. Abdul Kalam). (3 credits)
3. English writings of Indian national leaders (such as M. K. Gandhi, Jawaharlal Nehru and Sarvepalli Radhakrishnan). (3credits)
4. Literature and Films. (3 credits)
5. Literature and Theatre (3 credits)

M.A. (English)

Syllabus

M.A. (Part I)

SEMESTER - I

Core Courses

Course I **SACL/Eng/C-101**
English Literature from Geoffrey Chaucer to John Milton

Unit I:	*Geofrrey Chaucer	*The Canterbury Tales*: 'The General Prologue'
Unit II:	Edmund Spenser	*The Faerie Queen*, Book I
Unit III:	*William Shakespeare	Sonnets 18, 29, 110, 116, 130
Unit IV:	*John Donne	'A Valediction: of my Name on the Window', 'Canonization', 'Death Be Not Proud'
Unit V:	John Milton	*Paradise Lost*, Book I

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course II **SACL/Eng/C-102**
Drama excluding Shakespeare

Unit I:	*Christopher Marlowe	*Doctor Faustus*
Unit II:	Ben Jonson	*The Alchemist*
Unit III:	*John Webster	*The Duchess of Malfi*
Unit IV:	William Congreve	*The Way of the World*
Unit V:	*G. B. Shaw	*Man and Superman*

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course III **SACL/Eng/C-103**
Early Humanists' Literature

Unit I:	Renaissance Humanism: General Background	
Unit II:	Thomas More	*Utopia*
Unit III:	Niccolò Machiavelli	*The Prince*

Unit IV:	Michel de Montaigne:	*The Essays*: *A Selection*: 'On fear', 'On Solitude', 'On Prayer,' 'On the affection of fathers for their children'
Unit V:	Desiderius Erasmus:	*Praise of Folly*

Course IV SACL/Eng/C-104
Literary Criticism 1

Unit I:	Plato	*Republic*, Book X
Unit II:	Aristotle	*Poetics*
Unit III:	Longinus	*On the Sublime*
Unit IV:	Philip Sydney	*An Apology for Poetry*
Unit V:	John Dryden	*An Essay of Dramatic Poesy*

Course V SACL/Eng/C-105
English Prose

Unit I:	*Francis Bacon	'Of Truth,' 'Of Studies', 'Of Simulation and Dissimulation', 'Of Marriage and Single Life', 'Of Travel'
Unit II:	*Charles Lamb	'Dream Children: A Reverie', 'All Fools Day', 'New Year's Eve'
Unit III:	William Hazlitt	'The Indian Jugglers', 'On The Ignorance of the Learned', 'On Going a Journey'
Unit IV:	*Joseph Addison	*The Spectator*: 'The Spectator's Account of Himself', 'Of the Club', 'Sir Roger at Home', 'On Ghosts and Apparitions'
Unit V:	John Ruskin	*Unto This Last*

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course VI SACL/Eng/C-106
American Literature

Unit I:	*Ralf Waldo Emerson	American Scholar
Unit II:	*Walt Whitman	'On the Beach at Night', 'One's Self I Sing,' 'I Celebrate Myself', 'Animals'
	*Robert Frost	'Mending Wall', 'The Road Not Taken', 'Birches'

	Emily Dickinson	'Success is Counted Sweetest', 'The Soul Selects her Own Society', 'Because I could not stop for Death', 'A Light Exists in Spring'
Unit III:	Mark Twain	*The Adventures of Huckleberry Finn*
Unit IV:	Hawthorne	*The Scarlet Letter*
Unit V:	Eugene O'Neill	*The Hairy Ape*

* For detailed study. Passages for explanation will be set from the prescribed texts.

SEMESTER - II

Core Courses

Course VII SACL/Eng/C-201
William Shakespeare

Unit I:	**Hamlet*
Unit II:	*King Lear*
Unit III:	**The Tempest*
Unit IV:	*The Merchant of Venice*
Unit V:	**King Henry IV, Part 1*

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course VIII SACL/Eng/C-202
Eighteenth Century Literature

Unit I:	*Alexander Pope	*The Rape of the Lock*
Unit II:	*John Dryden	*Absalom and Achitophel*
Unit III:	Jonathan Swift	*Gulliver's Travels*
Unit IV:	Henry Fielding	*Tom Jones*
Unit V:	* William Collins	'Ode to Evening'
	*Thomas Gray	'Elegy Written in a Country Churchyard'

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course IX SACL/Eng/C-203
Literary Criticism 2

Unit I:	Samuel Johnson	*Preface to Shakespeare*
Unit II:	William Wordsworth	*Preface to Lyrical Ballads*
Unit III:	P. B. Shelley	*A Defence of Poetry*
Unit IV:	Mathew Arnold	*The Study of Poetry*
Unit V:	T. S. Eliot	'Tradition and Individual Talent', 'Hamlet and His Problems', 'The Metaphysical Poets'

Course X SACL/Eng/C-204
English Romantic Poetry

Unit I:	*William Wordsworth	'Lines Composed a Few Miles Above Tintern Abbey', 'Solitary Reaper', 'Ode: Intimations of Immortality', 'The World Is Too Much with us'
Unit II:	S.T. Coleridge	'The Rime of the Ancient Mariner', 'Kubla Khan', 'Dejection: An Ode'
Unit III:	*John Keats	'Ode to a Nightingale', 'Ode to Autumn', 'Ode on a Grecian Urn,' 'Ode on Melancholy'
Unit IV:	*P.B. Shelley	'Ode to the West Wind'
Unit V:	William Blake	*Songs of Innocence*: 'The Lamb', 'The Chimney Sweeper', 'The Divine Image', 'Holy Thursday' *Songs of Experience*: 'Earth's Answer', 'Holy Thursday', 'The Chimney Sweeper', 'The Tyger'

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course XI SACL/Eng/C-205
Nineteenth Century Literature

Unit I:	*Alfred Lord Tennyson	'The Lotos - Eaters', 'Tears, Idle Tears', 'The Lady of Shallot', 'Morte d' Arthur'

Unit II:	*Robert Browning	'The Last Ride Together', 'Rabbi Ben Ezra', 'Andrea del Sarto', 'Prospice'
Unit III:	*Mathew Arnold	*Scholar Gypsy*
Unit IV:	Thomas Hardy	*Jude the Obscure*
Unit V:	George Eliot	*Middlemarch*

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course XII SACL/Eng/C-206
Indian Writing in English

Unit I:	A.K. Ramanujan	'A River', 'Still Life', 'Small Scale Reflections on a Great House', 'The Striders'
Unit II:	Nissim Ezekiel	'A Morning Walk', 'Case Study', ' Night of the Scorpion', 'Philosophy', 'Patriot'
Unit III:	Sarojini Naidu	'The Indian Weavers', 'The Pardah Nashin'
Unit IV:	Raja Rao	*The Serpent and The Rope*
Unit V:	Mulk Raj Anand	*Untouchable*

M.A. Final

SEMESTER - III

Core Courses
Course XIII SACL/Eng/C-301
Twentieth Century Poetry

Unit I:	*W. B. Yeats	'The Second Coming', 'Sailing to Byzantium', 'When You are Old'
Unit II:	*T. S. Eliot	'The Love Song of J. Alfred Prufrock ', *The Waste Land*
Unit III:	*W. H. Auden	'In Memory of W.B. Yeats', 'Lay your sleeping head, My Love'

Unit IV:	Stephen Spender	'I Think Continually', 'An Elementary School Classroom in a Slum', 'The Truly Great'
Unit V:	Gerald Manley Hopkins	'The Wreck of the Deutschland'

* For detailed study. Passages for explanation will be set from the prescribed texts.

Course XIV SACL/Eng/C-302
Indian Texts and Poetics

Unit I:	Bharatamuni	*The Natyashashtra*: Chapters VI and VII On the aesthetics of *rasa* and *bhava*
Unit II:	Anandavardhana	The Theory of Dhvani
Unit III:	Kalidasa	*Abhigyanshakuntalam*
Unit IV:	Rabindranath Tagore	*Gitanjali*: Songs III, XI, XIII, XX, XXVIII, XXXV, XXXVI, LXIII, LXXIII
Unit V:	Premchand	Sahitya Ka Uddeshya ('The Aim of Literature') in *The Oxford India Premchand*, with an introduction by Francesca Orsini

Course XV SACL/Eng/C-303
Literary Criticism 3

Unit I:	New Criticism/ Formalism
Unit II:	Structuralism and Poststructuralism
Unit III:	Marxism
Unit IV:	New Historicism
Unit V:	Cultural Materialism

Recommended Reading:

Bennett, Tony. 1979. *Formalism and Marxism*. London: Methuen.

Brannigan, John. 1998. *New Historicism and Cultural Materialism*. London: Macmillan.

Connor, Steven. 1997. *Postmodernist Culture: An Introduction to Theories of the Contemporary,* 2nd edn. Oxford: Blackwell.

Culler, Jonathan. 1983. *On Deconstruction: Theory and Criticism After Structuralism*. London: Routledge and Kegan Paul.

Eagleton, Terry. 1976. *Marxism and Literary Criticism*. London: Routledge.

Gallagher, Catherine and Stephen Greenblatt. 2000. *Practising New Historicism*. Chicago: University of Chicago Press.

Mulhern, Francis, ed. 1992. *Contemporary Marxist Literary Criticism*. London: Longman.

Norris, Christopher. 2002. *Deconstruction: Theory and Practice*. New York: Routledge.

Veeser, H. Aram, ed. 1994. *The New Historicism Reader*. New York: Routledge.

Elective Courses

Course XVI- Group (A)
(One of the following)

SACL/Eng/C-304(a)
Commonwealth Literature

Unit I:	A.D. Hope	'Australia', 'The Wandering Islands', 'Imperial Adam','Moschus Moschiferus','On an Engraving by Casserius'
Unit II:	Patrick White	*A Fringe of Leaves*
Unit III:	George Lamming	*In the Castle of My Skin*
Unit IV:	Margaret Atwood	*Surfacing*
Unit V:	Kamala Markandaya	*Nectar in a Sieve*

SACL/Eng/C-304 (b)
Translation Studies

Unit I: Nature and scope of translation. Concept of translation in the West and in the Indian tradition.

Unit II: Issues in translation: autonomy, linguistic, textual and cultural equivalence, transcreation, inter-cultural transference, translation as metatext.

Unit III: Translation theories.

Unit IV: The Cultural Turn in Translation Studies.

Unit V: Translation and Multilingualism.

Recommended Reading:

Bassnett, Susan. 2002. *Translation Studies*. London: Routledge.

Bassnett, Susan. 1993. *Comparative Literature: A Critical Introduction*. Oxford: Blackwell.

Bassnett, Susan and Andre Lefevere. 1998. *Constructing Cultures: Essays on Literary Translation*. Clevedon: Multilingual Matters.

Bassnett, S. and Trivedi, H. Eds. 1999. *Post-colonial Translation: Theory and Practice.* London: Routledge.

Baker, M. ed., 1998. *Routledge Encyclopedia of Translation Studies.* London: Routledge.

Barnstone, W. 1993. *The Poetics of Translation: History, Theory, Practice.* Yale: Yale University Press.

Benjamin, W. 1970. The task of the translator (H. Zohn, trans.). In W. Benjamin (H. Arendt, ed.) *Illuminations* (pp. 69-82). London: Fontana.

Chaudhuri, Sukanta. 1999. *Translation and Understanding*, Delhi: Oxford University Press.

Mukharjee, Sujit. 1981. *Translation As Discovery*. New Delhi: Allied Publishers, 1981.

Niranjana, Tejaswani, 1992. *Siting Translation: History, Post-Structuralism, and the Colonial Context*, University of California Press

Venuti, Lawrence ed. 2000. *The Translation Studies Reader*, London: Routledge

Course XVII – Group (B)
(One of the following)

SACL/Eng/C-305 (a)
World Classics in Translation

Unit I:	Sophocles	*Antigone*
Unit II:	Ovid	*Metamorphoses*: 'Appollo and Dephne', 'Echo and Narcissus', 'Orpheus and Euridyce'

Unit III:	Virgil	*Aeneid*
Unit IV:	Dante	*The Divine Comedy*: 'Inferno'
Unit V:	Valmiki	*The Ramayana*: 'The Balakanda'

SACL/Eng/C-305 (b)
European Literature in Translation

Unit I:	Leo Tolstoy	*Anna Karenina*
Unit II:	Rainer Maria Rilke	*The Duino Elegies*: 'The First Elegy', 'The Second Elegy','The Third Elegy','The Fourth Elegy'
Unit III:	Moliere	*The Misanthrope*
Unit IV:	Nikolai Gogol	*Dead Souls*
Unit V:	Franz Kafka	*The Trial*

Course XVIII – Group (C)
(One of the following)

SACL/Eng/C-306 (a)
Modern Indian Writing

Unit I:	Salman Rushdie	*Midnight's Children*
Unit II:	Girish Karnad	*Tughlaq*
Unit III:	Arundhati Roy	*The God of Small Things*
Unit IV:	Arun Kolhatkar	'Woman', 'Irani Restaurant, Bombay', 'Biograph','Jejury,' in *Oxford Anthology of Twelve Modern Indian Poets*, edited by Arvind Krishna Mehrotra
Unit V:	A. K. Ramanujan	'Is there an Indian Way of Thinking?' An Informal Essay,' in *The Collected Essays of A. K. Ramanujan*
	Amartya Sen	'Indian Traditions and the Western Imagination', in Amartya Sen, *The Argumentative Indian*

Recommended Reading:

Dharwadker, Vinay. ed. 1999. *The Collected Essays of A. K. Ramanujan*. New Delhi: Oxford University Press.

Iyengar, K R Srinivasa. 1962. *Indian Writing in English*, Sterling Publications, New Delhi, 1962.

Mehrotra, Arvind Krishna. 2008. *A Concise History of Indian Literature in English*. Ranikhet: Permanent Black.

Sen, Amartya. 2005. *The Argumentative Indian: Writings on Indian History, Culture and Identity*. London: Allen Lane Penguin Books.

SACL/Eng/C-306 (b)
Indian Literature in Translation

Unit I:	Premchand	*Godan*
Unit II:	O. Chandumenon	*Indulekha*
Unit III:	Bankimchandra Chattopadhyay	*Anandamath*
Unit IV:	U. R. Ananthamurthy	*Samskara*
Unit V:	Shrilal Shukla	*Raag Darbari*

SEMESTER - IV

Core Courses

Course XIX SACL/Eng/C-401
Twentieth Century Drama

Unit I:	Bertolt Brecht	*Mother Courage and Her Children*
Unit II:	Samuel Becket	*Waiting for Godot*
Unit III:	Arthur Miller	*Death of a Salesman*
Unit IV:	G. B. Shaw	*Candida*
Unit V:	T. S. Eliot	*Murder in the Cathedral*

Course XX SACL/Eng/C-402
Colonial/Postcolonial Literatures and Theory

Unit I:	M. K. Gandhi	*Hind Swaraj*
Unit II:	Joseph Conrad	*Heart of Darkness*
Unit III:	Edward Said	From *Orientalism*: 'The Scope of Orientalism'
Unit IV:	Aijaj Ahmad	'Literary Theory and Third World Literature'
Unit V:	Homi Bhabha	'Of Mimicry and man: The ambivalence of Colonial Discourse'
	Gayatri Chakravorty Spivak	'Can the Subaltern Speak?'

Recommended Reading:

Ahmad, Aijaz. 1992. *In Theory: Classes, Nations, Literatures*. London: Verso.

Ashcroft, Bill, Gareth Griffiths and Helen Tiffin, eds. 1989. *The Empire Writes Back.* London: Routledge.

Ashcroft, Bill, Gareth Griffiths and Helen Tiffin, eds. 1995. *The Post-Colonial Studies Reader*. London: Routledge.

Bhabha, Homi K. 1994. *The Location of Culture*. London and New York: Routledge

Boehmer, Elleke. 1995.*Colonial and Postcolonial Literature: Migrant Metaphors*. Oxford, UK: Oxford UP.

Fanon, Frantz. 1967. *The Wretched of the Earth*, trans. Constance Farrington. Harmondsworth: Penguin.

Gandhi, Leela. 1998. *Postcolonial Theory: A Critical Introduction*. New York: Columbia UP.

Gates, Henry Louis, Jr, ed. 1986. *'Race', Writing, and Difference*. Chicago: University of Chicago Press.

Gates, Henry Louis, Jr, 1988. *The Signifying Monkey: A Theory of Afro-American Literary Criticism*. Oxford: Oxford University Press.

Goldberg, David Theo & Ato Quayson, eds., 2002. *Relocating Postcolonialism*. Oxford :Blackwell.

Gregory Castle, ed., 2001. *Postcolonial Discourses*. Oxford: Blackwell.

Harrison, Nicholas. 2003. *Postcolonial Criticism: History, Theory and the Work of Fiction*. Cambridge: Polity Press.

King, Bruce, 1996. *New National and Post-Colonial Literatures: An Introduction*. Oxford: Clarendon Press.

Loomba, Ania. 1998. *Colonialism*/*Postcolonialism*. London: Routledge.

McLeod, John, 2010. *Beginning Postcolonialism*. Manchester.

Peter Childs & R. J. Patrick Williams, 1997. *An Introduction to Post-colonial Theory*. NY: Prentice Hall; London: Harvester Wheatsheaf.

Peter Childs, ed., 1999. *Post-Colonial Theory and English Literature: A Reader*. Edinburgh UP.

Said, Edward W. 1978. *Orientalism*. London: Routledge and Kegan Paul.

Course XXI SACL/Eng/C-403
Modern Critical Thought

Unit I:	Walter Benjamin	'The Work of Art in the Age of Mechanical Reproduction'
Unit II:	Mikhail Bakhtin	'Epic and Novel' in *The Dialogic Imagination*
Unit III:	Michel Foucault	'What is an Author?'
Unit IV:	Raymond Williams	From *Marxism and Literature*, Cultural Theory: 'Hegemony' 'Traditions, Institutions, and Formations' 'Dominant, Residual Emergent'
Unit V:	Louis Althusser	'Ideology and Ideological State Apparatuses'

Recommended Reading:

Arendt Hannah, 1973. *Illuminations*. London: Fontana.

Bakhtin, M.M. 1981. *The Dialogic Imagination: Four Essays*, trans. M. Holquist and C. Emerson. Austin: University of Texas Press.

Bhabha, Homi K. 1994. *The Location of Culture*. London and New York: Routledge.

During, Simon. 1992. *Foucault and Literature: Towards a Genealogy of Writing*. London: Routledge.

Eagleton, Terry. 1996. *Literary Theory: An Introduction*. Oxford: Basil Blackwell.

Foucault, Michel. 1979. 'What Is an Author?' in *Textual Strategies: Perspectives in Post-Structuralist Criticism*, ed. Josué V. Harari. London: Methuen.

Lodge, David and Nigel Wood, eds. 1998. *Modern Criticism and Theory: A Reader*. Essex: Pearson Education Limited.

Montag, Warren. 2003. *Louis Althusser*. Basingstoke: Palgrave Macmillan.

Williams, Raymond. 1997. *Marxism and Literature*. Oxford: Oxford University Press.

Elective Courses

Course XXII- Group (A)
(One of the following)

SACL/Eng/C-404(a)
Literature of the Indian Diaspora

Unit I:	Bharati Mukherjee	*Jasmine*
Unit II:	Jhumpa Lahiri	*Namesake*
Unit III:	Amitav Ghosh	*Shadow Lines*
Unit IV:	Rohinton Mistry	*A Fine Balance*
Unit V:	V. S. Naipaul	*A House for Mr. Biswas*

SACL/Eng/C-404 (b)
Special Study of Authors
(Any one of the following)

Jane Austen
Charles Dickens
D. H. Lawrence
Virginia Woolf
E. M. Forster

Course XXIII – Group (B)
(One of the following)

SACL/Eng/C-405 (a)
African and Afro-American Literature

Unit I:	Chinua Achebe	*Things Fall Apart*
Unit II:	Harriet Beecher Stowe	*Uncle Tom's Cabin*
Unit III:	Langston Hughes	'Dreams Deferred,' 'As I Grow Older,' Advertisement For the Woldorf Astoria,' 'The Negro Mother,' The Negro Speaks of Rivers'
Unit IV:	Martin Luther King	'I Have a Dream' : Text of Public Speech delivered on August 28, 1963 at the Lincoln Memorial, Washington DC during the Civil Rights March
Unit V:	Tony Morrison	*Beloved*

SACL/Eng/C-405 (b)
Literature and Gender

Unit I:	Mary Wollstonecraft	*A Vindication of the Rights of Woman*
Unit II:	Virginia Woolf	*A Room of One's Own*
Unit III:	Elaine Showalter	*Toward a Feminist Poetics*
Unit IV:	Judith Butler	*Gender Trouble*: 'Subjects of Sex/Gender/Desire'
Unit V:	Mahasweta Devi	*Douloti*

Recommended Reading:

Butler, Judith. 1990. *Gender Trouble: Feminism and the Subversion of Identity*. London: Routledge.

Devi, Mahasweta, 1995. *Imaginary Maps*, tr. & ed. by Gayatri Chakravorty Spivak. London: Routledge

Gilbert, Sandra M. and Susan Gubar. 1979. *The Madwoman in the Attic: The Woman Writer and the Nineteenth-Century Literary Imagination*. New Haven: Yale University Press.

Millett, Kate. 1969. *Sexual Politics*. London: Rupert Hart-Davis.

Mills, Sara, ed. 1994. *Gendering the Reader*. Hemel Hempstead: Harvester Wheatsheaf.

Moi, Toril. 1985. *Sexual/Textual Politics: Feminist Literary Theory*. London: Routledge.

Showalter, Elaine. 1977. *A Literature of Their Own: British Women Novelists from Brontë to Lessing*. New Jersey: Princeton University Press.

Showalter, Elaine, ed. 1989. *Speaking of Gender*. London: Routledge.

Warhol, Robyn R. and Diane Price Herndl, eds. 1997. *Feminisms: An Anthology of Literary Theory and Criticism*. London: Macmillan.

Course XXIV – Dissertation & Viva Voce

Self Study Courses:

One of the following courses (one is mandatory, and the maximum is three) to be taken up in Semesters II/III/IV. The Heads/ conveners of English departments of campuses / affiliated colleges shall prepare the course structures for their candidates with the approval of the Head of the Department of English, H. N. B. Garhwal University.

1 Language and Linguistics.

2 Popular Literature (such as the writings of Chetan Bhagat, Ruskin Bond, J. K. Rowling and A. P. J. Abdul Kalam).

3 English writings of Indian national leaders (such as M. K. Gandhi, Jawaharlal Nehru and Sarvepalli Radhakrishnan).

4 Literature and Films.

5 Literature and Theatre.

Professor S. C. Aikant
Head, Department of English

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – ENVIRONMENTAL SCIENCES

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

HNB Garhwal University
(A Central University)
Srinagar-Garhwal, Uttarakhand
School of Life Sciences

Syllabus
M.Sc. Environmental Sciences
[Effective from Academic Session 2022-23 (Batch 2022-2024)]

SEMESTER I

PAPER CODE	PAPER NAME	CREDITS
SOLS/EVS-C-001	Fundamentals of Environmental Sciences	03
SOLS/EVS- C-002	Man and Environment	03
SOLS/EVS-C-003	Natural Resources and its Management	03
SOLS/EVS-C-004	Environmental Chemistry and Instrumentation	03
SOLS/EVS-C-005	Lab Course –I	03
SOLS/EVS-C-006	Lab Course –II	03
TOTAL	**18 Core Credits**	

SEMESTER II

PAPER CODE	PAPER NAME	CREDITS
SOLS/EVS-C-007	Environmental Monitoring and Pollution Control	03
SOLS/EVS- C-008	Climate Science: Climate Change, Impact, Mitigation and Adaptation	03
SOLS/EVS-C-009	Environmental Microbiology, Biotechnology and Environmental Toxicology	03
SOLS/EVS-C-010	Ecology and Ecosystem services	03
SOLS/EVS-C-011	Lab Course –I	03
SOLS/EVS-C-012	Lab Course –II	03
SOLS/EVS-SS-001	Environment *Vs* Development	03
TOTAL	**18 Core Credits (03 Self Study)**	

SEMESTER III

PAPER CODE	PAPER NAME	CREDITS
SOLS/EVS-C-013	Environmental Economics and Sustainable Development	03
SOLS/EVS- C-014	Biodiversity Conservation and Restoration Ecology	03
SOLS/EVS-C-015	Lab Course –I	03
SOLS/EVS-E-001	Environmental Geosciences and Disaster management	03
SOLS/EVS-E-002	Traditional Ecological knowledge	03
SOLS/EVS-E-003	Remote sensing, GIS and Environmental Modeling	03
SOLS/EVS-E-004	Environmental Toxicology	03
SOLS/EVS-E-005	Lab Course –II	03
SOLS/EVS-SS-002	Research Methodology and Environmental Statistics	03
TOTAL	**09 Core Credits, 09 Elective Credits (03 Self Study)**	

SEMESTER IV

PAPER CODE	PAPER NAME	CREDITS
SOLS/EVS-C-016	Environmental Management: EIA and Environmental Auditing	03
SOLS/EVS- C-017	Environmental Laws, Ethics and Policies	03
SOLS/EVS-C-018	Lab Course –I	03
SOLS/EVS-E-006	Dissertation	06
SOLS/EVS-E-007	Mountain Ecology	03
SOLS/EVS-E-008	Himalayan Wildlife	03
TOTAL	**09 Core Credits 09 Elective Credits**	

Total Credits: 78 (Core = 54, Elective=18, Self study=06)

SEMESTER I

SOLS/EVS-C 001 Fundamentals of Environmental Sciences (03 credits)

Unit I. Environment

1.1 Definition, scope and importance of Environmental Sciences
1.2 Components of environment: atmosphere, hydrosphere, lithosphere and biosphere
1.3 Concept of Biosphere-2, Noosphere and Technosphere
1.4 Various activities under national environment awareness Campaigns (NEAC)

Unit II. Ecosystem

2.1 Structure of an ecosystem
2.2 Major ecosystems: Himalaya, Marine ecosystems, Deserts, Freshwater ecosystems, Forests and Antarctica ecosystem
2.3 Ecosystem Goods and Services
2.3Energy pathways and ecological processes
2.4 Ecosystem productivity (primary and secondary)
2.5 Biogeochemical cycles: Nitrogen, Carbon, Phosphorus, Sulphur, Water and Oxygen
2.6 Food chain, food web and ecological pyramids

Unit III. Population, Community, Ecological Succession

3.1 Characteristics of population
3.2 Population growth
3.3 Concept and characteristics of communities (concept of habitat, niche, keystone species, dominant species, flagship species and ecotones)
3.4 Ecological succession: primary and secondary succession, climax communities and trends in succession
3.5 Ecological adaptations (Air, Hill, Stream water, Desert and Deep sea)

Unit IV. Self Sustenance of Ecosystem

4.1 Homeostasis in natural ecosystems
4.2 Ecosystem stability and resilience
4.3 Biodiversity and ecosystem stability
4.4 Drivers influencing ecosystem stability

Unit V. Environmental Issues and Problems

5.1 Green house effect, Global warming and climate change
5.2 Conflicts on emission of green house gases
5.3 Eutrophication
5.4 Mega dams and its impact on Environment
5.5 International and national water disputes and coastal zone conflicts

SOLS/EVS-C 002 Man and Environment (03 credits)

Unit I. Man and Environment Relationship

1.1 Pre-historic man and Environment
1.2 Hunting and Gathering society and Environment
1.3 Pastoralism and Environment
1.4 Agro-society and Environment
1.5 Industrial society and Environment
1.6 Future Society (Sustainable Society)

Unit II. Fundamentals of Environmental Sociology

2.1 Definition, concepts, issues and scope of Environmental Sociology
2.2 Concept of caste, tribe, clan, society and social structure
2.3 Cultural Resources
2.4 Indigenous/traditional wisdom for Environmental protection

Unit III. Religion, Culture and Environment

3.1 Role of religion, culture, belief and traditions in conserving environment
3.2 Hinduism and The Environment
3.3 Buddhism and The Environment
3.4 Islam and The Environment
3.5 Christianity and The Environment
3.6 Jainism and The Environment
3.7 Sikhism and The Environment

Unit IV. Environmental Ethics and Moral

4.1 Definition and concept of Environmental Ethics
4.2 Resource consumption patterns and need for equitable utilization
4.3 Anthropocentrism, stewardship, biocentrism, ecocentrism, Cosmo centrism
4.4 Conservation ethics, traditional value system in India
4.5 Sacred Landscapes, Sacred grooves and Sacred species

SOLS/EVS-C 003 Natural Resource Management (03 credits)

Unit I. Principles of Natural Resource Management

1.1 Natural resources- concepts, types and their values
1.2 Factors influencing resource availability, distribution and uses
1.3 Process of resource depletion
1.4 Ecosystem services by various natural resources

Unit II. Forest and Wildlife Resources and their Management

2.1 Forest resources: Major Forest types, their characteristics and distribution status of forest cover
2.2 Forest use and over exploitation: Timber extraction, mining, dams and their effects on forest and tribal people
2.3 Forest management practices
2.4 Wildlife resources: Current status, services and threats
2.5 Human-wildlife conflict and its resolution
2.6 Principles and practices of wildlife management: Need for wildlife planning
2.7 Human dimensions in wildlife management: Project Planning, Monitoring and Evaluation.

Unit III. Water Resources and their Management

3.1 Water resources: Historical background, world scenario and current challenges, status of surface and groundwater
3.2 Use and over exploitation of surface and ground waters
3.3 Integrated Water Resource Management (IWRM): Key challenges and issues
3.4 Legal aspects of water resources and management: Water legislations in India, Water Governance, Policies and legal frameworks

Unit IV. Energy Resources and their Management

4.1 Definition, concept and classification of energy resources
4.2 Non-renewable energy resources (Fossil fuels, Nuclear energy, Hydrogen fuel cell)
4.3 Renewable energy resources (Solar energy, Wind energy, Hydropower energy, Tidal energy, Geo-thermal energy)
4.4 Energy Management : Energy Crisis, Energy audit and sustainable use of energy resources

SOLS/EVS-C 004 Environmental Chemistry and Instrumentation (03 credits)

Unit I. Fundamentals of Environmental Chemistry

1.1 Stochiometry
1.2 Laws of Thermodynamics and Gibbs energy
1.3 Chemical potential
1.4 Chemical kinetics and Chemical equilibrium
1.5 Solubility product
1.6 Concentration Units (Normality, Molarity and Molality
1.7 Saturated and unsaturated hydrocarbons
1.8 Radionuclides
1.9 Redox Potential

Unit II. Atmospheric chemistry

2.1 Tropospheric chemistry
2.2 Atmospheric aerosols and gaseous pollutants
2.3 Mixing height/depth, Lapse rates and Gaussian plume model
2.4 Smog and Fog
2.5 Black carbon
2.6 Stratospheric chemistry

Unit III. Water Chemistry

3.1 Physico-chemical properties of water
3.2 Hydrological Cycle
3.3 Sedimentation, Coagulation, flocculation, filtration
3.4 Freshwater chemistry
3.5 Chemistry of marine water and major ions
3.6 Carbonate system

Unit IV. Soil Chemistry

4.1 Inorganic and organic components of soil
4.2 Mechanism of rock weathering
4.3 Soil pH, Nitrogen pathways
4.4 NPK in soil

Unit V. Instrumentation Techniques

5.1 Titrimetry, Gravimetry
5.2 Flame photometry
5.3 Spectrophotometry (UV-VIS, AAS, ICP-MS)
5.4 Chromatography- Paper, TLC, GLC, HPLC
5.5 Electrophoresis

SOLS/EVS-C 005 Lab Course - I **(03 credits)**

- Exercise 1. Analysis of various components (producer, consumer, decomposer) of ecosystems- lake, pond, river, forest, and mountain
- Exercise 2. Calculation of Importance Value Index (IVI) of different plant species in a grassland ecosystem/forest patch
- Exercise 3. Calculation of frequency, density and abundance of different macrozoobenthos dwelling in the riverine/lacustrine ecosystem
- Exercise 4. Determination of soil texture in different terrestrial habitats
- Exercise 5. Monitoring of biological diversity and calculation of Shannon Wiener diversity index in aquatic/ terrestrial habitats
- Exercise 06. To study the various stages of human evolution
- Exercise 07. To study the artifacts of ancient human
- Exercise 08. To study the social structure of communities in nearby area
- Exercise 09. To study the environmental concerns in various religions
- Exercise 10. To study traditional conservational ethics in various Indian communities

SOLS/EVS-C 006 Lab Course - II **(03 credits)**

- Exercise 01. To prepare an inventory of natural resources of any forest ecosystem located in nearby area.
- Exercise 02. To study the characteristics and functions of a watershed.
- Exercise 03. To study principle and working of solar cooker.
- Exercise 04. To study principle and working of water heating system.
- Exercise 05. To study principle and working of water mill (*Gharat)*
- Exercise 06. Determination of dissolved oxygen (Modified Winkler's method), BOD and COD in a given sample of water
- Exercise 07. Determination of Total solid, total dissolved solids (TDS) and total suspended solids in a water sample
- Exercise 08. Determination of alkalinity, acidity and total hardness in a given water samples
- Exercise 09. Determination of chloride in a given water sample
- Exercise 10. Determination of heavy metals in water and soil samples

SEMESTER II

SOLS/EVS-C 007 Environmental Monitoring and Pollution Control (03 credits)

Unit I. Environmental Monitoring

1.1 Concept and objectives of environmental monitoring
1.2 Global environmental monitoring system (GEMS)
1.3 National environmental monitoring programmes
1.4 Bio indicators and biological monitoring

Unit II. Air and Water Pollution

2.2 Major sources of air and water pollution
2.2 Effects of pollutants on human beings, plants and animals
2.3 Control measures and management techniques for air and water pollution
2.4 Sewage and industrial effluent treatment
2.5 National and international standards for ambient air quality and drinking water quality and effluent water quality
2.6 Indoor air pollution (Smoke, Hydrocarbons, Particulate matter, VOCs, Radon, CO, Biological pollutants, Formaldehyde / Pressed wood Products)
2.7 Marine pollution

Unit III. Noise Pollution

3.1 Sources of noise pollution
3.2 Measurement of noise, exposure levels and standards
3.3 Impact of noise on human health
3.4 Noise control and abatement measures

Unit IV. Radioactive and Thermal Pollution

4.1 Radioactive pollution: causes and consequences
4.2 Radioactive fallout, Chernobyl Accident: Three Mile Island accident, Fukushima radio-active leakage
4.3 Radioactive waste management
4.4 Thermal pollution: causes and consequences

Unit V. Solid Waste Management

5.1Types and major sources of solid waste
5.2 Waste characteristic: physical, chemical and biological
5.3 Solid waste and environmental problems
5.4 Integrated solid waste management of municipal waste
5.5 E-waste and its management

SOLS/EVS-C-008 Climate Science: Climate Change, Impact, Mitigation and Adaptation

(03 credits)

Unit I. Introduction to Climatology

1.1 Definition, brief history and scope of Climatology

1.2 Meteorological parameters: temperature, pressure, precipitation, humidity, radiation, wind and clouds

1.3 Composition, structure and importance of atmosphere

1.4 Concept of weather , season and Climate

Unit II. Different Climatological process

2.1 Atmospheric heating and cooling, Heat budget and Heat balance, Global temperature circulation

2.2 Planetary wind pattern and General atmospheric circulation

2.3 Atmospheric moisture: Condensation and different types of precipitation

2.4 Atmospheric humidity: Measurement and distribution

2.5 Oceans and international variations in climate (El Nino, ENSO, La Nina)

2.6 Natural and atmospheric extreme events: Tropical cyclone, thunder storms, tornadoes, flood, cloud burst, drought

Unit III. Regional Climatology

3.1 Definition, microclimate and meso-climate scale

3.2 Climate and distribution of vegetation

3.3 Mid-latitude climate

3.4 Polar and high land climate

Unit IV. Applied Climatology or Responses to Climate Change: Adaptation and Mitigation

4.1 Natural and Anthropogenic (man- made) causes of climate change

4.2 Consequences of climate change

4.3 Climate Change: Biodiversity, agriculture and industry

4.4 Climate change and Food security

4.5 Human response to climate

4.6 Adaptation concepts and strategies

4.7 Limiting climate change: Adaptation and Mitigation

UNIT V. Arctic and Polar Affairs

5.1 Introduction, history and importance of polar and arctic regions/zones on earth

5.2 Structure and Specificity of arctic and polar ecosystems

5.3 Vulnerability of arctic ecosystems

5.4 Periglacial and terrestrial habitats in arctic and polar regions

5.5 Arctic and polar species diversity

5.6 Stress, adaptation and survival in arctic and polar regions

5.7 Climate change and environmental degradation in arctic and polar zones

SOLS/EVS-C-009 Microbiology, Biotechnology and Environmental Toxicology (03 Credits)

Unit I. Environmental Microbiology

1.1 Introduction, history and scope of Environmental Microbiology
1.2 Microbial diversity: major groups of microbes in water, air and soil
1.3 Microbes of extreme environment
1.4 Microbial pathogen and their control

Unit II. Microbial Nutrition and ecology

2.1 Mode Microbial nutrition
2.2 Determination of growth
2.3 Microbial interactions
2.4 Chemolithotrophy and humus
2.5 Effects of environmental factors (Light, temperature, moisture, pH) on microorganisms
2.6 Mechanism of chemotaxis
2.7 Biochemical and molecular methods for microbial isolation and identification

Unit III. Environmental Biotechnology

3.1 Concept, history and scope of Environmental Biotechnology
3.2 Bioremediation and bio-augmentation
3.3 Bio-indicators, bio-fuels and biosensors
3.4 Bio-fertilizer technology
3.5 Fermentation technology
3.6 Aquaculture
3.7 Vermiculture technology

Unit IV. Environmental Toxicology

4.1 Definition, concept and scope of Environmental Toxicology
4.2 Xenobiotic components- Dyes and Detergent, Food Additives, Pesticides and Heavy metals
4.3 Biotransformation: Principle, sites, biotransformation enzymes, biotransformation for gaseous toxicants
4.4 Bioaccumulation: Principle, sub-lethal and indirect effects of bioaccumulation
4.5 Bioremediation, Bio-magnification, and Bio-concentration

Unit V. Toxicity assessment, System Toxicity and Risk Assessment

5.1 *In-vivo* and *in-vitro* toxicity assessment
5.2 Acute and chronic toxicity; Acute , sub acute , sub chronic and chronic toxicity test; concept of bioassay, threshold limit value, margin of safety, therapeutic index
5.3 LD50, LC50, EC50, and IC50
5.4 Factors affecting toxicity
5.5 Translocation and mechanism of toxicants (Absorption, distribution and excretion of toxic agents)
5.6 Risk Assessment (Models, Methods and Management)

SOLS/EVS-C-010 Ecology and Ecosystem Services (03 credits)

Unit I. Fundamentals of Freshwater Ecology

1.1 Definition, concept and scope of Freshwater Ecology
1.2 History of Freshwater Ecology
1.3 Goods and services of freshwater ecosystem
1.4 Freshwater: distribution and depletion
1.5 Freshwater ecosystem: Lake, stream, river, wetland (origin, evolution and characteristics)
1.6 Freshwater biota (lake, river, stream and wetland)
1.7 Basic concept of Hyporheic biodiversity and crenobiodiversity
1.8 Drivers of degradation of freshwater ecosystems and their conservation and management

Unit II. Terrestrial Ecology

2.1 Structure, function and distribution of terrestrial ecosystem
2.2 Major terrestrial ecosystem in the world
2.3 Biomes and Biogeographic realms of worlds
2.4 Forest ecology
2.5 Grassland ecology
2.6 Desert ecology
2.7 Goods and services provided by terrestrial ecosystems
2.8 Drivers of degradation of terrestrial ecosystems and their conservation and management

Unit III. Marine Ecology

3.1 Definition, concept, history and scope of marine ecology
3.2 Physico-chemical aspects of estuaries, marine and mangrove ecosystems
3.3 Biotic communities of estuaries, marine and mangrove ecosystems
3.4 Coral Reef: as a specialized oceanic ecosystem
3.5 Drivers of degradation of coastal ecosystems and their conservation and management

Unit IV. Agro-ecosystem and their Management

4.1 Agriculture in India and the World
4.2 Key concepts of Agro-ecosystems
4.3 Functional basis for the sustainable management of Agro-ecosystems
4.4 Management of Agro-ecosystems

SOLS/EVS-C-011 Lab Course – I **(03 credits)**

- Exercise 1. Monitoring of Particulate matter (PM_{10} and $PM_{2.5}$)
- Exercise 2. Determination of Noise levels at different places
- Exercise 3. Case study of effluent treatment plant and sewage treatment plant in any industry
- Exercise 4. Determination of SOx and NOx in ambient air
- Exercise 5. Identification of biological indicators of pollution in terrestrial and aquatic habitat
- Exercise 6. Measurement of dry and wet bulb temperature
- Exercise 7. Recording of wind speed and direction
- Exercise 8. Preparation of wind roses with the given data
- Exercise 9. Recording of diurnal variations in temperature
- Exercise 10. Modeling of impact of global warming on glaciers

SOLS/EVS-C-012 Lab Course – II **(03 credits)**

- Exercise 1.To study the three dimensional structure of a stream/river
- Exercise 2. Collection and identification of periphyton, phytoplankton and macrophytes
- Exercise 3. Collection and identification of zooplankton and macrozoobenthos
- Exercise 4. Determination of total microbial count in water sample
- Exercise 5. Determination of total count (MPN) of coliform in a water sample
- Exercise 6.Quantitative analysis of heavy metals in environmental samples. Lead, Cadmium, Mercury, Chromium and Arsenic in air, water and soil samples
- Exercise 7. Study of risk assessment model through flow chart
- Exercise 8. Assessment and calculation of toxicity (LD50 / LC 50) through dose response relation
- Exercise 9. To study the different economic value and valuation methods for ecosystem services
- Exercise 10. A case study of ecosystem services provided by any ecosystem (forest/lake/river)

SOLS/EVS-SS-001 Environment *versus* Development (03 credits)

Unit I. Growth and Development

1.1 Definition, concept and scope of economic growth and development
1.2 Classical theories of development
1.3 Contemporary models of development and underdevelopment
1.4 Poverty, inequality and development
1.5 Evolution of worldwide awareness about environment and activity of Nations, environment and awareness programs

Unit II. Resource and Development

2.1 Environment and human resources
2.2 Urbanization and informal sector
2.3 Agriculture transformation and rural development
2.4 International aspect of development

Unit III. Environment *versus* Development

3.1 Development dominant phases at global and National levels
3.2 Conflict between environment development
3.3 Environmental Activism
3.4 Resolution of conflict between environment and development
3.5 Sustainable Development: Various dimensions

Unit IV. Controversies Related with Environment and Development

4.1 Industrial revolution and environment
4.2 Hydropower development and environment in the Himalayas
4.3 Impact of road construction and widening on environment and wildlife
4.4 Ganga *Bachao / Nadi Bachoa Andolan*
4.5 Sand mining and environment

SEMESTER III

SOLS/EVS-C013 Environmental Economics and Sustainable Development (03 credits)

Unit I. Fundamentals of Environmental Economics

1.1 Definition, concepts, issues and scope of Environmental Economics
1.2 Concept of the commons, tragedy of commons, externalities (indirect costs), economic goods/ services, supply, demand, intangibles, public goods and bads
1.3 Limitations of Environmental Economics

Unit II. Economic Tools

2.1 Valuing the environment and natural resources
2.2 Ecology and equity
2.3 Natural resource accounting, cost-benefit analysis
2.4 Life cycle assessment (LCA)
2.5 Intellectual property rights (IPR) and environment

Unit III. Sustainable Development

3.1 Principles of Sustainable Development: History and emergence of the concept and definition of Sustainable Development
3.2 Goals of Sustainable Development
3.3 Stake holders of Sustainable development: People, Government, investor, Industry, Judiciary & international organization working for Sustainable development
3.4 From unsustainable to sustainable development

Unit IV. Social Issues and the Environment

4.1 Resettlement and rehabilitation: Problems and concerns
4.2 National Policy for Rehabilitation and resettlement (NPRR 2007)
4.3 Genesis and evolution of environmental movements
4.4 Major environmental movements (Chipko, Appiko, Narmada Bachao Andolan, Tehri dam conflicts and Silent valley movement, Nadi Bachao Andolan, Beej Bachao Andolan)

SOLS/EVS-C-014 Biodiversity Conservation and Restoration Ecology (03 credits)

Unit I. Introduction to Biodiversity

1.1 Concept and values of biodiversity

1.2 Biodiversity and ecosystem services

1.3 Biodiversity at different levels (genetic, species and ecosystem)

1.4 Magnitude and distribution of biodiversity

1.4 Threats to biodiversity and its loss

1.4 Hotspots of biodiversity

Unit II. Biodiversity: Conservation and Management

2.1 Need for biodiversity conservation and management

2.2 Biodiversity and livelihood

2.3 IUCN threatened species categories

2.4 *In -situ* and *Ex-situ* conservation

2.5 International and National conferences and conventions related to biodiversity

2.6 Biodiversity Act, Biodiversity Rules and Regulations

2.7 International organizations involved in biodiversity management: IUCN, UNEP, UNESCO, WWF

Unit III. Restoration Ecology

3.1 Introduction, concept and scope of Restoration Ecology

3.2 History of Restoration Ecology and Future needs

3.2 Elements of ecological restoration

3.3 Restoration of degraded aquatic ecosystems: springs, rivers and wetlands

3.4 Restoration of terrestrial ecosystem: forest and landscape

Unit IV. Management of Restoration Project

4.1 Setting goals

4.2 Planning

4.3 Action plan

4.4 Adaptive management

4.5 Monitoring

4.6 Legal framework and international agreements

4.7 Indian guidelines for sustainable mining management

SOLS/EVS-C-015 Lab Course- I **(03 credits)**

- Exercise 1. To study socio-economic status- Preparing of questionnaire and case studies
- Exercise 2. Inventorization of local NTPFs.
- Exercise 3. Economic evaluation of a forest area/lake/river
- Exercise 4. Cost-benefit analysis of a river valley project
- Exercise 5. Market survey for forest products
- Exercise 6. To study the restoration of limestone mined area, Doon valley
- Exercise 7. To study restoration and management plan for river sand mined area of any river
- Exercise 8. Preparation of an inventory of WCS/IUCN categories of animal and plant species of any National Park/ Sanctuary
- Exercise 9. Preparation of inventory of endangered and extinct species of plants/animals of India
- Exercise 10. Assessment of threats to biodiversity of a given region

SOLS/EVS-E-001 Environmental Geosciences and Disaster Risk Reduction (03 credits)

Unit I. Fundamentals of Environmental Geosciences and Earth System

1.1 Definition, concept and scope of Environmental Geosciences
1.2 Origin and evolution of the Earth; plate tectonics, rocks and their classification
1.3 Relationship among various geospheres
1.4 Energy budget and thermal environment of the Earth

Unit II. Environmental Geochemistry and Land use Planning

2.1 Concept, importance and use of the Earth elements
2.2 Weathering, soil formation, soil profile, soil classification and distribution
2.3 Land use planning: Soil survey, methods of site selection and evaluation

Unit III. Earth's Processes and Geological Hazards

3.1 Catastrophic geological hazards, hazards in Himalayan and coastal areas
3.2 Terrestrial hazards; floods, landslides, cloud burst, earthquakes, volcanism, avalanche and glacier lake outburst
3.3 Coastal hazards; Tsunami, storms in oceans, ice sheets and fluctuation s of sea levels, marine pollution by toxic wastes

Unit IV. Disaster Management

4.1 Introduction and definition of vulnerability, risk, hazard, disaster and catastrophe
4.2 Impact of disaster on economy and society
4.3 Disaster management cycle
4.4 Disaster management and sustainability

Unit V. Disaster Mitigation and Risk Reduction

5.1 Risk and vulnerability assessment
5.2 Disaster preparedness; information, education, awareness and communication
5.3 Disaster mitigation; approaches and strategies
5.4 Disaster response and planning; Search, Rescue and evacuation, damage, community health and casualty management
5.5 Disaster recovery: social and economic aspects of rehabilitation and resettlement
5.6 Prediction and perception of the hazards
5.7 Community based disaster risk reduction strategies

SOLS/EVS-E-002 Traditional Ecological Knowledge (03 credits)

Unit I. Introduction

1.1. Definition, concept, and scope of TEK
1.2. Traditional ecological knowledge as a science
1.3. TEK in different forms (stories, legends, folklore, rituals, folk songs, and dictums)
1.4. Traditional technology of subsistence (artifacts, crafts *etc.*)
1.5. Language and traditional knowledge

Unit II. Cultural, Sacred, Myth, Rituals and Beliefs

2.1. Basic concept of society, culture and religion
2.2. Nature, aims and objectives of comparative religion (caste, community and their culture).
2.3. Basic feature of religion and principal sets of religion
2.4. Myths, rituals and beliefs associated with TEK in Hinduism, Buddhism, Islam and Christainity
2.5. TEK in Indian Himalayan states

Unit III. TEK and Natural Resources Management

3.1. TEK for forest conservation,
3.2. TEK for water harvesting,
3.3. TEK for wildlife case study
3.4. TEK for conservation of biodiversity
3.5. TEK related with medicinal plants
3.6. TEK related with agriculture and cattle rearing
3.7. TEK related with horticulture

Unit IV. Knowledge Transfer: Old Concepts and Barriers

4.1. Old concepts and barriers in transferring indigenous traditional knowledge
4.2. Old myths in transferring traditional knowledge
4.3. God and man
4.4. Ways of prayers, rituals in different communities

Unit V. Documentation and Preservation of TEK

5.1. Need for Documentation and Preservation
5.2. International laws and policy of TEK
5.3. Laws and policy in India for TEK

SOLS/EVS-E-003 Remote Sensing, GIS and Environmental Modeling (03 credits)

Unit I. General Introduction to Remote Sensing

1.1 Definition, concepts and scope of remote sensing
1.2 History of remote sensing
1.3 Electromagnetic radiations (EMR) and electromagnetic spectrum and atmosphere window
1.4 Platforms, sensors and types of scanning systems
1.5 Basic characteristics of sensors; salient features of sensors used in LANDSAT, SPOT and Indian remote sensing satellites
1.6 Earth's and atmospheric interaction with EMR
1.7 Spectral reflectance of vegetation, soil and water

Unit II. Application of Remote Sensing

2.1 Application of remote sensing in EIA
2.2 Application of remote sensing in groundwater
2.3 Applications of remote sensing in mining
2.4 Application of remote sensing in forest management
2.5 Application of remote sensing in characterization and monitoring of biodiversity
2.6. Application of remote sensing in mapping of wetlands

Unit III Geographic Information System (GIS)

3.1 Introduction and basic principle and scope of GIS
3.2 Application of GIS
3.3 Brief outline of Digital Image Processing

Unit IV: Environmental Modeling

4.1 Definition, concept and role of modeling in Environmental Sciences
4.2 Components of a model
4.3 Models of population (growth and interaction) and pollution dispersal
   a. Lotka Voltera model
   b. Leslie Matrix model
   c. Gaussian Plume model

SOLS/EVS-E-004 Environmental Toxicology (03 credits)

Unit I. Introduction to Environmental Toxicology

1.1 Definition, concept and scope of Environmental Toxicology

1.2 Common environmental toxicants

1.3 Heavy metals: Sources and their effects on life and environment

1.4 Pesticides: Types, uses and harmful effect of pesticides; brief note on biopesticides, persistent organic pesticides.

1.5 Mutagenic and carcinogenic chemicals, polyaromatic hydrocarbons, nitrosamines, organic solvents, alcohol, carbon tetrachloride, anesthetic (chloroform, ether, xylocaine) tobacco chewing and smoking

Unit II. Toxicity Assessment

2.1 *In-vivo* and *in-vitro* toxicity assessment

2.2 Accute, subacute , sub chronic and chronic toxicity test

2.3 Skin and eye test, behavioural, neurotoxic, reproductive, mutagenic test, hypersensitivity and allergy.

2.4 LD50, LC_{50}, EC_{50}, and IC_{50}

2.5 Factors affecting toxicity

Unit III. Systemic Toxicity

3.1 Absorption, translocation and excretion Xenobiotics: Membrane permeability and mechanism of chemical transfer, Absorption of xenobiotics, distribution of toxicants, storage depots, translocation of xenobiotics, membrane barriers, excretion of xenobiotics(major detoxifying glands)

3.2 Neuro toxicity, hepatotoxicity, immunotoxicity, cardio-vascular toxicity, respiratory disfunction and hypersensitivity

Unit IV. Biotransformtion, Bioaccumulation and Biomagnification

4.1 Biotransformtion: Principle, sites, biotransformation enzymes, biotransformation for gaseous toxicants

4.2 Bioaccumulation: Principle, sublethal and indirect effects of bioaccumulation

4.3 Biomagnification, bioconcentration

4.4 Bioremediation

Unit V. Environmental Health and Risk Assessment

5.1 Risk assessment

5.2 Risk assessment models

5.3 Risk assessment methods

5.4 Risk management

SOLS/EVS-E-005 Lab Course – II **(03 credits)**

Section A: Environmental Geosciences and Disaster Management

- Exercise 1. To understand the interior of the Earth
- Exercise 2. To understand the process of soil formation
- Exercise 3. To study the soil profile
- Exercise 4. To study the classification and orders of soil
- Exercise 5. To study the various soil types of India

Section B: Traditional Ecological Knowledge

- Exercise 1: To study origin and evolution of Environmental movement
- Exercise 2 Preparation of an inventory of TEK for water conservation
- Exercise 3: Preparation of an inventory of TEK for biodiversity conservation
- Exercise 4: Preparation of an inventory of TEK related to medicinal plants
- Exercise 5. Documentation of traditional technology of subsistence (Artifacts, Crafts, Handlooms etc.)

Section C: Remote Sensing, GIS and Environmental Modeling

- Exercise 1. Basics of Remote Sensing
- Exercise 2. Photo-interpretation of satellite imagery
- Exercise 3. Ground truth estimation of aerial photographs
- Exercise 4. Basic knowledge of GIS
- Exercise 5. Basic knowledge and use of GPS

Section D: Environmental Toxicology

- Exercise 1. Assessment of toxicity on an organism (fish or tadpole) through dose response relation (LC50/LC50)
- Exercise 2. Bioremediation experiment with the help of water hyacinth
- Exercise 3. Assessment of impact of high temperature on organisms (control experiment)
- Exercise 4. Study of risk assessment model through flow chart
- Exercise 5. Case study of biomagnification in any food chain
- Exercise 6. Quantitative analysis of heavy metals in environmental samples. Lead, Cadmium, Mercury, Chromium and Arsenic in air, water and soil samples

SOLS/EVS-SS-002 Research Methodology and Environmental Statistics (03 credits)

Unit I. Introduction of Research Aptitude

1.1 Research: Meaning, Types and Characteristics
1.2 positivism and post positivistic approach to research
1.3 Methods of research
1.4 Qualitative and Quantitative methods

Unit II. Various steps in the Research

2.1 Identification of research problems
2.2 Search of literature
2.3 Experimental design/construction of hypothesis
2.4 Materials and methods
2.5 Field study and collection of samples/questionnaire
2.6 Collection and analysis of data
2.7 Presentation of data in graphic and tabular form
2.8 Use of statistical tools
2.9 Discussion of results/ testing of hypothesis
2.10 Citation of references and bibliography

Unit III. Application of computer in Environmental Research

3.1 Use of different software for analysis of data- SPSS, Excel
3.2 Use of internet and search for literature
3.3 Format and styles of referencing
3.4 writing of thesis and dissertation
3.5 Plagiarism and research ethics

Unit IV. Environmental Statistics

4.1 Measurement of central tendency- Mean, Mode and Median
4.2 Dispersion- Standard deviation, Standard error, Mean deviation and Coefficient of variation
4.3 Moments – measure of Skewness and Kurtosis
4.4 Distributions - Normal, log-normal, Binomial, Poisson
4.5 Simple and multiple correlation and regression coefficient
4.6 Basic laws and concept of probability
4.7 Test of hypothesis and significance.
4.8 t, F, chi square tests
4.9 ANOVA

SEMESTER IV

SOLS/EVS-C-016 Environmental Management: EIA and Environmental Auditing

(03 credits)

Unit I. Environmental Impact Assessment (EIA)

1.1 Concept, scope and objectives of EIA
1.2 Evolution of EIA and developmental projects under EIA
1.3 Protocol for Environmental Impact Statement (EIS)
1.4 EIA guidelines 1994: Notifications of Government of India
1.5 EIA Notification 2006 and subsequent modifications

Unit II. Methods of Impact Analysis

2.1 Procedure of EIA
2.2 Impact assessment methodologies (Ad-hoc, Simple Checklist, Overlays, Matrices, Network, Combination Computer aided)
2.3 Impact prediction on air, water, land, biota, socio-economic environment
2.4 Concept of Cumulative Environmental Impact Assessment (CEIA)

Unit III. Statuary Clearance Procedure and Public Consultation

3.1 Expert Appraisal Committee(EAC)
3.2 Environmental Clearance, Wildlife Clearance and Forest Clearance
3.3 State Expert Appraisal Committee (SEAC) and State EIA Authority (SEIAA)
3.4 Concept, objectives and procedures of Public Consultation

Unit IV. Post-Project Monitoring and Environmental Auditing

4.1 Principles and guidelines of environmental auditing
4.2 General Audit: Methodology and basic structure of environmental auditing
4.3 ISO 14000 series: ISO 9001, 9002

Unit V. Environmental Management and Management Plan

5.1 Concept, objectives and scope of environmental management.
5.2 Guidelines for EMP
5.3 Development of EMP- air, water, groundwater, noise, land and biodiversity
5.4 Rehabilitation and resettlement
5.5 Compensatory Afforestation
5.6 Green belt development

SOLS/EVS-C-017 Environmental Laws, Ethics and Policies (03 credits)

Unit I. National and International Efforts for Environmental Protection

1.1 Brief introduction about the structure of Indian Constitution
1.2 Environmental protection in the Indian Constitution
1.3 Major Environmental issues, challenges and its response at national and international Level
1.4 International and national efforts related to environmental Pollution, Climate change, Green house Gas emission, Ozone layer depletion and biodiversity conservation)

Unit II. National Environmental Laws

2.1 Indian Forest Act 1927; The Forest Conservation Act 1980, and Forest conservation Rules 2003
2.2 Wildlife Protection Act 1972 and its successive amendments
2.3 Biological Diversity Act 2002 and Biological Diversity Rules 2004
2.4 Water (Prevention and Control of Pollution) Act 1974 and Rules 1975 and subsequent amendments
2.5 Air (Prevention and Control of Pollution) Act 1978 and Rules 1982 and successive amendments
2.6 The Environmental (Protection) Act 1986 and its amendment in 1991, The environment (Protection) Rules 1986
2.7 The National Green Tribunal Act 2010
2.8 The Public Liability Insurance Act 1991

Unit III. National Laws related to waste management

3.1 Biomedical Waste Management rules, 2016, as Amended 2019
3.2 Hazardous and other waste (Management & Transboundary movement) Rules, 2016
3.3 Plastic waste management rules 2016, as amended 2021
3.4 Solid waste management rules 2016
3.5 E-waste rules 2016 and E-waste (Management) Amendment Rules, 2018

Unit IV. National Policies

4.1 Forest Policy
4.2 Environmental Policy
4.3 Water Policy

SOLS/EVS-C-018 Lab course I **(03 credits)**

Exercise 1. Presentation of procedure of Environmental Impact Assessment (EIA) through flowchart

Exercise 2. Presentation of procedure of Environmental Clearance through flowchart

Exercise 3. Presentation of procedure of Forest Clearance through flowchart

Exercise 4. Presentation of procedure of Environmental Auditing through flow chart

Exercise 5.Presentation of procedure of Environmental Management Plan (EMP) through flow chart

Exercise 6. Presentation of salient features of Wildlife Protection Act 1972

Exercise 7. Presentation of salient features of Water (Prevention and Control of Pollution) Act 1974

Exercise 8. Presentation of salient features of the Air (Prevention and Control of Pollution) Act 1981

Exercise 9. Presentation of salient features of The Environmental (Protection) Act and Rules 1986

Exercise 10. Presentation of salient features of The Indian Forest Act 1927

SOLS/EVS-E-007 Mountain Ecology **(03 credits)**

Unit I. Introduction

1.1 Definition, importance and scope of Mountain Ecology
1.2 Specificity of mountain ecosystems
1.3 Environmental importance of mountains

Unit II. Mountain Ecosystem

2.1 Structure and its components
2.2 Geological formations of mountains
2.3 Vulnerability of mountain ecosystems
2.4 Environmental degradation in mountains

Unit III. Environmental Hazards in the Mountains

3.1 Landslides, soil erosion and sedimentation
3.2 Cloud bursts
3.3 Flash floods and river blockades
3.4 Avalanches and Glaciers Lake Outburst Floods (GLOF)
3.5 Earthquakes
3.6 Forest fires

Unit IV. Conservation and Management of Natural Resources of Mountains

4.1 Natural resources of mountains (Forest, Water, Wildlife and Minerals)
4.2 Sustainable exploitation of natural resources
4.3 Traditional wisdom for management of natural resources
4.4 National and international efforts for management of mountains

Unit V. Mountains and People

5.1 Indigenous people of mountains
5.2 Livelihood of mountain people
5.3 Migration of mountain people
5.4 Livelihood security of mountain people

SOLS/EVS-E 008 Himalayan Wildlife **(03 credits)**

Unit I. An Introduction to the Himalaya

1.1 Physiography- location, expansion and importance
1.2 Origin and evolution of the Himalaya
1.3 Himalayan Environment
1.4 Natural resources of the Himalaya
1.5 Fragility of the mountain ecosystem

Unit II. Wildlife of the Himalaya

2.1 Unique characteristics and importance of the wildlife
2.2 Himalayan biodiversity
2.3 Endemism
2.4 Depletion of Himalayan wildlife

Unit III. Manifestation of Himalayan Wildlife

3.1 Himalayan wild Mammals
3.2 Himalayan wild Birds
3.3 Himalayan Reptiles and Amphibians
3.4 Himalayan Fish
3.5 Himalayan Butterflies
3.6 Rare and Endangered Himalayan wild flora

Unit IV. Conservation and Management

4.1 Administrative and legislative measures for protection of wildlife
4.2 Protected areas (National parks, sanctuaries, biosphere reserves) in the Himalaya
4.3 Tiger Project, Project Elephant, Project Rhino, Project Snow Leopard
4.4 Man-Wildlife Conflict: agriculture-wildlife conflict
4.5 Wildlife Protection Act 1972 and successive amendments
4.6 Problems in implementation of the Wildlife Protection Act

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – FORESTRY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Restructured and Revised Syllabus of PG Programme
M.Sc. FORESTRY IN SILVICULTURE AND AGROFORESTRY
Course Contents

Semester 1					
Code	**Title**	**Theory**	**Internal**	**Practical/ Term Paper**	**Total**
Major Courses					
SOA/FCMC/501	Silviculture	60 (2)	20	20 (2+1)	100 (3)
SOA/FCMC/502	Forest Biometry	60 (1)	20	20 (1+1)	100 (2)
SOA/FCMC/503	Silvicultural Practices	60 (1)	20	20 (1+1)	100 (2)
SOA/FCMC/504	Agroforestry System	60 (2)	20	20 (2+1)	100 (3)
Supporting Course					
SOA/FESC/511A	General Statistical Methods and Computer Application	60 (2)	20	20 (2+1)	100 (3)
Common Course					
SOA/FECC/01	Library and Information Services	-	40	60 (0+1)	100 (1)
SOA/FECC/02	Technical Writing & Communication Skills	-	40	60 (0+1)	100 (1)
SOA/FECC/03	Intellectual Property & Its Management in Agriculture	60 (1)	40	- (1+0)	100 (1)
SOA/FECC/04	Basic Concepts in Laboratory Techniques	-	40	60 (0+1)	100 (1)
SOA/FECC/05	Agricultural Research, Research Ethics & Rural Development Programmes	60 (1)	40	- (1+0)	100 (1)
		Total Marks and Credits			**1000 (18)**
Semester II					
Major Courses					
SOA/FCMC/505	Interactions in Agroforestry Systems	60 (1)	20	20 (1+1)	100 (2)
SOA/FCMC/506	Modern Nursery & Plantation Technology	60 (2)	20	20 (2+1)	100 (3)
SOA/FCMC/508	Industrial Agroforestry	60 (1)	20	20 (1+1)	100 (2)
Minor Courses					
SOA/FEMC/01	Forest Ecology & Biodiversity Management	60 (2)	20	20 (2+0)	100 (3)
SOA/FEMC/02	Applied Forest Tree Improvement	60 (2)	20	20 (2+1)	100 (3)
SOA/FEMC/03	Clonal Forestry	60 (1)	40	- (2+0)	100 (2)
Supporting Courses					
SOA/FCSC/511B	Experimental Designs	60	20	20 (2+1)	100 (3)
		Total Marks and Credits			**700 (18)**
Semester III					
SOA/FCMC/509	Climate Change and Conservation Silviculture	60 (1)	20	20 (2+0)	100 (2)
SOA/FCMC/510	Tree and Shrubs for Agroforestry	60 (1)	20	20 (1+1)	100 (2)
SOA/FCMC/511	Economics of Agroforestry System	60 (2)	20	20 (2+1)	100 (3)
SOA/FCMC/512	Tree Seed Technology	60 (2)	20	20 (2+1)	100 (3)
SOA/FCMC/591	Master's Seminar	-	-	100 (1)	100 (1)
SOA/FCMC/599A	Research Review (Master Thesis)	-	-	100 (7)	100 (7)
		Total Marks and Credits			**600 (18)**
Semester IV					
SOA/FEMC/513	Nutrient and Weed Management in Production Forestry	60 (1)	20	20 (1+1)	100 (2)
SOA/FEMC/514	Crops and Live Stock Management in Agroforestry	60 (1)	40	- (2+0)	100 (2)
SOA/FE/599B	Master's Research (Thesis)	-	-	100 (23)	100 (23)
		Total Marks and Credits			**300 (27)**

SEMESTER I

MAJOR COURSES

SOA/FCMC/501 - SILVICULTURE

I – Title	II - Code	III - Credit Hours	Theory	Internal	Practical	Total
Silviculture	SOA/FCMC/501	2+1	60	20	20	100 (3)

IV – Aim of the Course
To understand stand growth, development and provide knowledge regarding the application of silvicultural principles for the production and protection benefits from the forests.

V – Theory

Unit I

Forest ecosystems- Introduction to tropical/ temperate silviculture. Role of silviculture in forest and wild land management, major forest formations classification, distribution, composition and structure. Vegetation dynamics- species richness-diversity indices. Vegetation forms of India and their productivity. Forest ecosystem-structure and functioning, community development, competitive interactions in forest communities, forest succession, concepts and models of succession-Connell-Slatyer models, climax theories, tolerance.

Unit II

Ecophysiology of tree growth- effect of radiation and water relationship, mineral nutrients and temperature. Forest stand development – stand development, even aged and uneven-aged stands, age and site quality. Tree architecture and its role in stand management.

Unit III

Stand density determination-stand density indices-stand density management density management diagram, silvicultural treatments involved- thinning as a stand management tool, objectives of thinning, effects on growth and yield, thinning effect on economic yield of stands. Forest site quality evaluation-direct and indirect methods.

Unit IV

Treatment analysis-silvicultural regimes- factors influencing choice of regimes, use of system analysis to determine regimes, models for evaluating silvicultural alternatives, development of silvicultural regimes to suit management objectives, optimum management strategies, silvicultural prescriptions for maximum production regime.

VI – Practical

Visit to forest areas to study forest composition, classification, factors of locality, site quality, form and growth of forest trees- study plant succession- study stand density, changes on productivity- thinning effects

VII – Suggested Reading

- Daniel TW, Helms JA and Baker FS. 1979. Principles of Silviculture. McGraw-Hill Book Company.
- Julius E. 1992. Plantation Forestry in the Tropics. Oxford University Press.
- Khanna LS. 1996. Principle and Practice of Silviculture. International Book Distributors.
- Khanna LS. 2015. Theory and Practice of Indian Silviculture Systems. Bio-Green Publisher.
- Lamprecht. 1986. Silviculture in the Tropics.Verlag Paul Parey, Hamburg und Berlin.
- Nyland RD, Laura S, Kenefic, Kimberly K, Bohn and Susan LS.2016 Silviculture: Concepts and Applications (III edition), Kindle Edition, USA.
- Pascal. 1988. Wet Evergreen Forests of the Western Ghats.
- Shepherd KR. 1986. Plantation Silviculture. Springer.
- Smith DM, Larson BC, Ketty MJ and Ashton PMS. 1997. The Practices of Silviculture- Applied Forest Ecology. John Wiley & Sons.

SOA/FCMC/502 - FOREST BIOMETRY

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Forest Biometry	SOA/FCMC/502	2+1	60	20	20	100 (2)

IV – Aim of the Course
To develop understanding of students about tree and stand measurements, forest inventory and yield concepts.

V – Theory

Unit I

Measurement of tree parameters. Determination of tree age and dendrochronology for growth history and climate change studies.

Unit II

Estimation of volume, growth and yield of individual tree and forest stands. Preparation of volume tables. Application of yield and stand tables.

Unit III

Forest inventory, sampling methods adopted in forestry, Use of GIS in forest inventory. Quantification of regeneration and stand establishment. Measurement of crown density and crown ratios. Simulation techniques. Growth and yield prediction models – their preparation and applications.

VI – Practical

- Calculations of volume of felled as well as standing trees;
- Volume table preparation;
- Application of different sampling methods;
- Preparation of yield and stand table;
- Quantification of regeneration and stand establishment;
- Measurement of crown density and crown ratios;
- Crown profiling of trees and stand;
- Dendrochronological studies.

VII - Suggested Reading

- Chaturvedi AN and Khanna LS. 1994. Forest Mensuration. International Book Distributor.
- Ram Parkash 1983. Forest Surveying. International Book Distributor.
- Sharpe GW, Hendee CW and Sharpe WE. 1986. Introduction to Forestry. McGraw-Hill.
- Simmons CE. 1980. A Manual of Forest Mensuration. Bishen Singh Mahender Pal Singh, Dehradun.

SOA/FCMC/503 – SILVICULTURAL PRACTICES

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Silvicultural Practices	SOA/FCMC/503	1+1	60	20	20	100 (2)

IV – Aim of the Course
To acquaint the students with the advanced silvicultural practices in forestry with particular reference to commercial and short rotation forestry.

V – Theory

Unit I

Sivilculture under changing context of forestry- sivilculture and ecosystem management, stand dynamics, silvicultural practices for pure and mixed stand, even aged and uneven aged stand – silvicultural practices for changing climatic conditions.

Unit II

Silvicultural practices for natural and artificial regeneration – Ecology of regeneration, forest site management- enrichment of site – quality classes and site index models – stand density – spacing and tree growth – forest vegetation management – techniques for early stand growth- tending operations. Biomass allocation: belowground and aboveground. Changing trends in adoption of silvicultural systems.

Unit III

Stand development – stages- crown dynamics, Crown Competition factor, Maximum crown area, thinning – pruning – response of trees and impact on wood quality, salvage cutting – improvement felling and enrichment planting – management of weeds, Invasive weeds in forests, Silvicultural practices for short rotation forestrycoppice forestry, Continuous cover forestry.

Unit IV

Site specific selection of tree species. Precision silviculture –silvicultural practices for important fast growing trees and bamboos of India- *Populus* spp., *Neolamarkia cadamba*, *Eucalyptus* sp., *Casuarina* spp.,*Tectona grandis*, *Melia dubia*, *Dalbergia sissoo*, *Gmelina arborea*, *Leucaena leucocephala*, *Ailanthus excelsa*, *Azadirachta indica*, *Swietenia macrophylla*, *Dendrocalamus* spp., *Bambusa* spp., – Mechanization of silvicultural practices.

VI – Practical

- Visit to different forest sites to study the influence of site factors on composition;
- Determination of site quality;
- Studies on stand structure and composition of different forest types;
- Practicing pruning and its impact on wood quality;
- Characterizing methods of thinning;
- Working out intensity of thinning;
- Study of stand densities in natural forest stand and plantation stand;
- Afforestation techniques, Wood management techniques for forest tree crops;
- Planning and designing a tree planting programme;
- Exercise on precision silviculture practices;
- Exercise on mechanized silvicultural practices.

VII – Suggested Reading

- Daniel TW, Helms JA and Baker FS. 1979. Principles of Silviculture. McGraw-Hill Book Company.
- Julius E. 1992. Plantation Forestry in the Tropics. Oxford University Press.
- Khanna LS. 1996. Principle and Practice of Silviculture. International Book Distributors.
- Khanna LS. 2015. Theory and Practice of Indian Silviculture Systems. Bio-Green Publisher.
- Lamprecht. 1986. Silviculture in the Tropics-Verlag Paul Parey, Hamburg und Berlin.
- Nyland RD, Laura S, Kenefic, Kimberly K, Bohn and Susan LS.2016 Silviculture: Concepts and Applications (III edition), Kindle Edition, USA.
- Shepherd KR. 1986. Plantation Silviculture. Springer.
- Smith DM, Larson BC, Ketty MJ and Ashton PMS. 1997. The Practices of Silviculture- Applied Forest Ecology. John Wiley & Sons.

SOA/FCMC/504 – AGROFORESTRY SYSTEMS

I – Title	II - Code	III - Credit Hours	Theory	Internal	Practical	Total
Agroforestry Systems	SOA/FCMC/504	2+1	60	20	20	100 (3)

IV – Aim of the Course

To impart knowledge on the concept of agroforestry as a sustainable land use including diagnosis and design methodologies; overview of agroforestry and case studies.

V – Theory

Unit I

Agroforestry: objectives, importance, potentials and limitations for implementations. Land capability classification and land evaluation. Basis of classification of agroforestry systems and principles, indigenous vs. exotic, intraspecific variations, crown architecture of tropical/ temperate trees. Ideotype concept for selection of multipurpose trees. Nitrogen fixing trees. Overview and case studies of different agroforestry systems.

Unit II

Structural and functional attributes of agroforestry systems, shifting cultivation, taungya system, multiple and mixed cropping, alley cropping, silvopastoral systems, shelter-belts and windbreaks, energy plantations and home gardens.

Unit III

Role of trees in soil productivity and conservation– micro-site enrichment- litter and fine root dynamics, Nitrogen fixation and nutrient pumping. Soil productivity and management in agroforestry.

Unit IV

Community forestry and social forestry, linear strip plantations.

Unit V

Trends in agroforestry systems research and development, Diagnosis and Design –PRA-RRA tools in agroforestry problem diagnosis.

Unit VI

Climate Change mitigation and adaptation through agroforestry- climate negotiations- LULUCF- agroforestry options.

VI – Practical

- Survey and analysis of land use systems in the adjoining areas;
- Study of tree crown architecture;
- Design and plan of suitable models for improvement;
- PRA-RRA tools in agroforestry problem diagnosis.

VII – Suggested Reading

- Buck LE, Lassoie, Fernandes ECM 1999. Agroforestry in Sustainable Agri. Systems. CRC Press.
- Kumar BM and Nair PKR. 2006. Tropical Homegardens: A Time-Tested Example of Sustainable Agroforestry. Springer publication.
- Kumar BM and Nair PKR. 2013. Carbon Sequestration Potential of Agroforestry Systems: Opportunities and Challenges (Advances in Agroforestry). Springer publication.
- Nair PKR and Latt 1998. Directions in Tropical Agroforestry Research. Kluwer.
- Nair PKR, Rai MR and Buck LE. 2004. New Vistas in Agroforestry. Kluwer
- Nair PKR. 1993. An Introduction to Agroforestry. Kluwer Academic Pub.
- Ong CK and Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.
- Peter Huxley. 1999. Multiple Cropping with Woody and Non-Woody Plants. John Wiley and Sons Ltd, Oxford, United Kingdom.
- Tejwani KG. 1994. Agroforestry in India. Oxford & IBH Publishing Co. Pvt Ltd.
- Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.
- Young A. 1997. Agroforestry for Soil Management. CABI.

SUPPORTING COURSES

SOA/FESC/511A – GENERAL STATISTICAL METHODS AND COMPUTER APPLICATIONS

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
General Statistical Methods and Computer Applications	SOA/FESC/511A	2+1	60	20	20	100 (3)

IV – Aim of the Course

This course is meant for students who do not have sufficient background of statistical methods. The students would be exposed to concepts of general statistical methods and statistical inference that would help them in understanding the importance of statistical methodology. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation of results.

V – Theory

Unit I

Review of probability. Random variable and mathematical expectation. Discrete and continuous probability distributions, viz., Binomial, Poisson and Normal distributions.

Unit II

Correlation and regression, Rank correlation, Non-linear regression, Partial and multiple correlation coefficient,

Intra class correlation, Multiple linear regression.

Unit III

Introduction to theory of estimation, Testing of statistical hypothesis: chi-square, t and F distributions. Tests of significance based on chi-square, t and F tests. Large sample tests, Fisher Z transformation.

Unit IV

Analysis of variance: One way and two way classification. Design of Experiments: Basic Principles of design of experiments, Completely Randomised Design, Randomised Block Design, Latin Square Design. Elementary idea of factorial experiments. Estimation of genetic parameters from ANOVA table.

Unit V

Non-parametric tests: Sign test, Wilcoxon test, Mann-Whitney U-test, Wald Wolfowitz run test, Median test, Kruskal- Wallis test. MS Excel, Introduction to computer softwares.

VI – Practical

- Random variable and mathematical expectation;
- Fitting of distributions, viz., Binomial, Poisson, Normal;
- Correlation and regression;
- Non-linear regression
- Multiple linear regression;
- Testing of hypothesis based on chi square, t and F tests. Large sample tests. Completely Randomised Design, Randomised Block Design, Latin Square Design and Factorial experiments. Non-parametric tests. Exercises based on computer software.

VII – Suggested Reading

- Aggarwal BL. 1996. Basic Statistics. Wiley Eastern Limited, New Age International Ltd.
- Bansal ML, Singh S, Singh TP and Kumar R. 2004. Statistical Methods for Research Workers. Kalyani Publishers.
- Chandel SRS. 2014. A Handbook of Agricultural Statistics. Achal Prakashan.
- Goon AM, Gupta MK and Dasgupta B. 1968. Fundamentals of Statistics, vol I, II. The World Press, Calcutta.
- Snedecor GW and Cochran WG. 1980. Statistical Methods. East West Press.

COMMON COURSES

SOA/FECC/01 – LIBRARY AND INFORMATION SERVICES

I - Title	II – Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Library and Information Services	SOA/FECC/01	0+1	-	40	60	100 (1)

IV. Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines, etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/ Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; eresources access methods.

SOA/FECC/02 -TECHNICAL WRITING AND COMMUNICATIONS SKILLS

I - Title	II – Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Technical Writing and Communications Skills	SOA/FECC/02	0+1	-	40	60	100 (1)

Objective

To equip the students/ scholars with skills to write dissertations, research papers, etc. To equip the students/ scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical (Technical Writing)

• Various forms of scientific writings- theses, technical papers, reviews, manuals, etc.;
• Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion);
• Writing of abstracts, summaries, précis, citations, etc.;
• Commonly used abbreviations in the theses and research communications;
• Illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations;
• Writing of numbers and dates in scientific write-ups;
• Editing and proof-reading;
• Writing of a review article;
• Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks);
• Error analysis (Common errors), Concord, Collocation, Phonetic symbols and transcription;
• Accentual pattern: Weak forms in connected speech;
• Participation in group discussion;
• Facing an interview;
• Presentation of scientific papers.

Suggested Readings

1. Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
2. Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
3. Collins' Cobuild English Dictionary. 1995.
4. Harper Collins. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed.
5. Holt, Rinehart and Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
6. James HS. 1994. Handbook for Technical Writing. NTC Business Books.
7. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
8. Mohan K. 2005. Speaking English Effectively. MacMillan India.
9. Richard WS. 1969. Technical Writing.
10. Sethi J and Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
11. Wren PC and Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

SOA/FECC/03 -INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE

I - Title	**II - Code**	**III - Credit Hours**	**Theory**	**Internal**	**Practical/ Term Paper**	**Total**
Intellectual Property and its Management in Agriculture	SOA/FECC/03	1+0	60	40	No Practical	100 (1)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of Intellectual Property Rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

1. Erbisch FH and Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
2. Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
3. Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies.
4. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
5. Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI. 6. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House. The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; The Biological Diversity Act, 2002.

SOA/FECC/04 - BASIC CONCEPTS IN LABORATORY TECHNIQUES

I - Title	II - Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Basic Concepts in Laboratory Techniques	SOA/FECC/04	0+1	-	40	60	100 (1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

- Safety measures while in Lab;
- Handling of chemical substances;
- Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets;
- Washing, drying and sterilization of glassware;
- Drying of solvents/ chemicals;
- Weighing and preparation of solutions of different strengths and their dilution;
- Handling techniques of solutions;
- Preparation of different agro-chemical doses in field and pot applications;
- Preparation of solutions of acids;
- Neutralisation of acid and bases;
- Preparation of buffers of different strengths and pH values;
- Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath;
- Electric wiring and earthing;
- Preparation of media and methods of sterilization;
- Seed viability testing, testing of pollen viability;
- Tissue culture of crop plants;
- Description of flowering plants in botanical terms in relation to taxonomy.

Suggested Readings

1. Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
2. Gabb MH and Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

SOA/FECC/05 - AGRICULTURAL RESEARCH, RESEARCH ETHICS & RURAL DEVELOPMENT PROGRAM.

I - Title	II – Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Agricultural Research, Research Ethics & Rural Development Program.	SOA/FECC/05	1+0	60	40	No Practical	100 (1)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/ Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings

1. Bhalla GS and Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
2. Punia MS. Manual on International Research and Research Ethics. CCS Haryana Agricultural University, Hisar.
3. Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
4. Singh K. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

2.4 Mandatory requirement of seminars

• It has been agreed to have mandatory seminars one in Masters (One Credit) and two in Doctoral programmes (two Credits).

• The students should be encouraged to make presentations on the latest developments and literature in the area of research topic. This will provide training to the students on preparation for seminar, organizing the work, critical analysis of data and presentation skills.

3. Residential requirements

• The minimum and maximum duration of residential requirement for Masters'

SEMESTER II

MAJOR COURSES

SOA/FCMC/505 – INTERACTIONS IN AGROFORESTRY SYSTEMS

I – Title	II - Code	III - Credit Hours	Theory	Internal	Practical	Total
Interactions in Agroforestry Systems	SOA/FCMC/505	1+1	60	20	20	100 (2)

IV – Aim of the Course

To impart knowledge to the students regarding tree-crop interaction, their quantification and techniques to neutralize the negative tree- crop interactions.

V – Theory

Unit I

Tree-crop interphase- biological factors affecting form and function in woody and non-woody plant mixtures. Nature and types of interactions- positive and negative, aboveground and belowground interactions- competition, complementarity in resource sharing.

Unit II

Method for quantifying interactions, principles of resource capture and utilization of light and water, nutrition and space. Tree-soil-crop interactions- nitrogen fixing trees interactions in agroforestry. Allelopathy. Use of radioisotopes in tree-crop interaction studies. Root distribution of trees and crops-competition and/or complementarity. Animal-tree-crop interaction.

Unit III

Management options to neutralize negative (competitive) interactions, tree husbandry practices for alleviating competition- tree density manipulation, pruning, mixture of trees and herbaceous crops.

VI – Practical

- Different methods for quantifying interactions;
- Studies on allelopathy;
- Effect, microclimate modifications, different plant mixtures, tree-soil-crop interactions;
- Estimation of Land Equivalent Ratio, Estimation of competition indices;
- Measurement and interpretation of light interception in agroforestry systems;
- Interpretation of yield responses to shelter, soil water and drainage measurement, transpiration measurement, quantifying root distribution.

VII – Suggested Reading

- Avery MA, Cannel MGR and Ong CK. 2005. Biophysical Research for Asian Agroforestry. Oxford and IBH Publishing Co. Pvt. Ltd.
- Mac Dicken, KG and Vergara NT. 1989. Agroforestry-classification and Management. Nair PKR. 1993. An Introduction to Agroforestry. Kluwer Academic Pub.
- Ong CK and P Huxley. 2002. Tree-Crop Interactions- A Physiological approach, CAB International.
- Patra AK. 2013. Agroforestry-Principles and Practices. New India Publishing AGENCY, New Delhi (India).

SOA/FCMC/506 – MODERN NURSERY & PLANTATION TECHNOLOGY

I – Title	II - Code	III - Credit Hours	Theory	Internal	Practical	Total
Modern Nursery & Plantation Technology	SOA/FCMC/506	2+1	60	20	20	100 (3)

IV – Aim of the Course

To impart knowledge and develop understanding about modern nursery techniques for mass production along with various aspects of productivity, integrated nutrient and irrigation management as well as ecological factors in raising forest plantation.

V – Theory

Unit I

Introduction and importance of nursery. Types of nurseries-temporary and permanent, bare root, containerized and clonal nursery. Bare root nursery- nursery soil and water management, bed preparation, pre-sowing seed treatments, seed sowing and intermediate operations, viz., pricking, watering, fertilization, weeding and hoeing.

Unit II

Root culturing techniques. Types of green house and mist chamber for propagation.

Unit III Vegetative propagation – importance, selection of superior genotypes. Advanced methods of propagation, growing media, fertilizers, sanitation and management in vegetative propagation. Special requirement for clonal propagation. Propagation structure and management.

Unit III

Clonal propagation: miniclonal and micro cuttings technology. Vegetative propagation of bamboos and canes. Factors affecting rooting of cuttings. Lifting windows. Important forest nursery pests and diseases and their management. Seedling quality assessment, grading, packaging, storing and transportation.

Unit IV

Role of plantation foresty in meeting the wood demand. Purpose of plantation. Factors determining scale and rate of plantation. Land suitability and choice of species.

Unit V

Preliminary site preparation for establishing plantation. Plantation planning. Project formulation and appraisal. Planting programme. Time of planting. Spacing, pattern and planting methods.

Unit VI

Nutritional dynamics and irrigation of plantation. Mechanization in plantation. Protection and after care of plantation. Pruning and thinning in plantations. Rotation in plantation. Failures of plantations.

Unit VII

Sustainable yield from plantations. Case studies in plantations of Eucalyptus. *Poplars, Acacias, Pine, Gmelina, Bamboo,* etc. Production technology of energy plantations. Industrial plantations.

VI – Practical

- Introduction and identification of modern equipments and tools used in nursery;
- Pre-sowing seed treatments;
- Preparation of nursery beds and growing media for containerized nursery;
- Sowing of seed and other intermediate operations;
- Preparation and planting of cuttings;
- Assessment of seedling quality;
- Visit to forest nurseries;
- Nursery practices of commercially important tree species;
- Preparation of plantation calendar;
- Preliminary arrangement for a plantations programme;
- Planting geometry and calculation of planting stock;
- Studies on wood based industries – problems and prospects;
- Management of *Eucalyptus, Casuarina, Teak, Sal, Poplar, Acacias* and *Bamboo* plantations;
- Production technology for energy plantations. INM in plantations.

VII – Suggested Reading

- Bhardwaj RL and Sarolia DK. 2011. Modern Nursery Management. Published by Agrobios Publishing. New Delhi (India).
- Kumar GA and Gopikumar. 2003. Forest Nursery and Tree Husbandry.
- Kumar V. 2012. Nursery and Plantation Practices in Forestry. Scientific Publishers (India).
- Saini RS, Kaushik N, Kaushik RA and Godara NR. 2012. Practical Nursery Production. Agrobios, New Delhi (India).
- Dwivedi AP 1993. Forestry in India. Surya Publ.
- Julius E. 1982. Planation Forestry in the Topics. Clarendon Press Oxford.
- Kumar, V. 1999. Nursery and Plantation Practices in Forestry. Scientific Publ.
- Luna R.K. 1989. Plantation Forestry in India. International Book Distributors.
- Prakash R. Chaudhary DC and Negi SS. 1998. Plantation and Nursery Techniques of Forest Trees. International Book Distributors.

SOA/FCMC/508 – INDUSTRIAL AGROFORESTRY

I – Title	II - Code	III - Credit Hours	Theory	Internal	Practical	Total
Industrial Agroforestry	SOA/FCMC/508	1+1	60	20	20	100 (2)

IV – Aim of the Course
To develop skill and expertise on industrial wood production and processing technology.

V – Theory

Unit I

Role of forests in industrial sector, industrial raw material, demand and supply, indigenous and exotic industrial resources, extent of area, policy and legal issues towards industrial wood plantation. Major wood based industries in India; timber, pulp wood, plywood, matches, etc. Raw material requirements and their procurements.

Unit II

Industrial wood plantations – status in India and different states, preferred species – current plantation management and establishment, propagation and plantation technique, economics of industrial agroforestry, pest and disease management for major industrial wood species, harvesting, reduced impact logging, mechanization.

Unit III

Supply chain; definition, concept, supply chain network, logistic activities, Marketing system; marketing type and channel, price patterns of various industrial wood agroforestry plantations. Contract farming: concept and methods, contract tree farming system in India. Industrial experiences– price support system – constraints. Corporates in industrial agroforestry: International and National corporate, success stories. Corporate social responsibilities. Tree insurance.

Unit IV

Impacts of industrial agroforestry – ecological impacts; climatic, edaphic and biotic– carbon sequestration. Carbon storage potential of industrial agroforestry and carbon trading mechanism of industrial agroforestry, socio-economic impacts–clean development mechanism. Certification of industrial plantations.

VI – Practical

- Study of various wood based industries;
- Study on raw material requirement and sourcing of plywood, pulp and paper, matchwood, timber processing;
- Biomass power generation industries;
- Value addition technology of various wood products;
- Industrial wood plantations – economics and impact assessment.

VII – Suggested Reading

- Cosasalter C and C Pye-Smith. 2003. Fast Wood Forestry – Myths and Realities. CIFOR. Bogor, Indonesia. 50p.
- Mehta T. 1981. A Hand Book of Forest Utilization. International Book Distributors, Dehradun.
- Nair PKR. 1993. An Introduction to Agroforestry. Kluwer Academic publishers.
- Parthiban KT, Umarani R, UmeshKanna S, Sekar I, Rajendran P and Durairasu P. 2014. Industrial Agroforestry: Perspectives and Prospectives. Scientific Publishers.
- Tejwani KG. 1994. Agroforestry in India. Oxford and IBH publishing Co., New Delhi.

MINOR COURSES

SOA/FEMC/01 – FOREST ECOLOGY & BIODIVERSITY MANAGEMENT

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Forest Ecology & Biodiversity Management	SOA/FEMC/01	2+1	60	20	20	100 (3)

IV – Aim of the Course
To develop understanding among students about ecological aspects of forest, conservation of forest resources and biodiversity, consequences of depleting biodiversity and concept of sustainability.

V – Theory
Unit I Hierarchy issues in ecology and ecosystem. Advanced topics in forest ecology including forest population, forest community dynamics, forest community structure and analysis, forest productivity, ecology of forest landscapes spatial heterogeneity and ecological succession. **Unit II** Conservation of natural resources (hotspot areas, wildlife sanctuaries, national parks, biosphere reserve). Climate change, Global warming and forests. Green house effect and its consequences. Ozone depletion. Conservation laws and acts. Forest genetics resources of India: timber and non timber species. Survey exploration and sampling strategies Phytogeography and vegetation types of India. **Unit III** Documentation and evaluation of forest genetical resources (FGR), in situ and ex situ conservation of gene resources. Phytodiversity and its significance to sustainable use. Handling and storage of FGR. Intellectual property rights. Quarantine laws and FGR exchange.
VI – Practical
• Study of forest community structure and its successional status; • Estimation of productivity of forest ecosystem; • Study tours to different regions of the state to study forest vegetation; • Collection and preservation of specimen, Methods of vegetation analysis; • Measurement of biomass and productivity; • Quantification of litter production and decomposition; • Visit to national parks, wildlife sanctuaries. Botanical gardens and arboreta.
VII – Suggested Reading
• Avery TE and Burkharts H. 2001. Forest Measurements. McGraw-Hill Education. • Barnes BV, Zak DR, Denton SR and Spurrs SH. 1998. Forest Ecology. Wiley. • Jha BC, Pandey BN, Jaiswal K, Katiha PK, Pandey PN and Sharma AP. 2012. Biodiversity: Issues Threats and Conservation. Narendra Publishing House, Delhi. • Kumar Biju. 2013. Biodiversity and Taxonomy. Narendra Publishing House, Delhi. • Larocque GR. 2016. Ecological Forest Management Handbook (Applied Ecology and Environmental Management). • Taylor & Francis. Mahato B, Pandy BN, Singh LB, Panday PN and Singh RK. 2010. Text Book of Environmental Pollution. Narendra Publishing House, Delhi. • Mikusiñski G, Roberge JM and Fuller R. 2018. Ecology and Conservation of Forest Birds (Ecology, Biodiversity and Conservation). Cambridge University Press. • Pandey PN. 2009. Biodiversity and Environment Ecology. Narendra Publishing House, Delhi. • Perry DA, Oren R and Hart SC. 2008. Forest Ecosystems. 2nd ed. Baltimore: Johns Hopkins University Press. • Young RA and Giese RL. 2003. Introduction to Forest Ecosystem Science and Management. Wiley.

SOA/FEMC/02 –APPLIED FOREST TREE IMPROVEMENT

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Applied Forest Tree Improvement	SOA/FEMC/02	2+1	60	20	20	100 (3)

IV – Aim of the Course
Toacquaintthestudentsaboutgeneralprinciplesoftreebreedingwithexamplesofimportanttrees.

V – Theory

Unit I

General concept of forest tree breeding, tree improvement and forest genetics.

Unit II

Reproduction in forest trees, dimorphism, pollination mechanism. Pollen dispersal, pollinators. Attractants for pollinators.

Unit III

Variation in trees, importance and its causes. Natural variations as a basis for tree improvement. Geographic variations – Ecotypes, clines, races and land races.

Unit IV

Selective breeding methods- mass, family, within family, family plus within family. Plus tree selection for wood quality, disease resistance and agroforestry objectives. Selection strategies and choice of breeding methods and progress in selective breeding in forest trees.

Unit V

Seed orchards – type, functions and importance, Genetic testing- mating designs and field designs. Progeny and clone testing estimating genetic parameters and genetic gain, clonal and breeding values. Average performance of half sibs and fullsibs. GxE interaction in trees.

Unit VI

Heterosis breeding: inbreeding and hybrid vigour. Manifestation and fixation of heterosis. Species and racial hybridization. Indian examples – *Teak, shisham, eucalypts, acacias, poplar*, etc.

Unit VII

Polyploidy, aneuploidy and haploidy in soft and hard wood species. Induction of polyploidy. Unit VIII Elements of biotechnology in tree improvement.

VI –Practical

- Floral biology, modes of reproduction and modes of pollination in forest trees;
- Estimating pollen viability. Controlled pollination and pollen handling;
- Manipulation of flowering through hormones;
- Identification of ecotypes, races and land-races in natural forest;
- Visit to species, provenance and progeny trials;
- Selection of superior phenotypes;
- Marking of candidate trees, plus trees and elite trees;
- Visit to seed orchards;
- Comparison of parents and their putative hybrids;
- Induction of polyploidy through colchicine treatment;
- In-vitro propagation, study of molecular markers.

VII – Suggested Reading

- Dutta M and Saini GC. 2009. Advances in Forestry Research in India, Vol. XXX. Forest Tree Improvement and Seed Technology. International Book Distributors.
- Finkeldey R and Hattemer HH. 2006. Tropical Forest Genetics. Springer.
- Mandal AK and Gibson GL. (Eds). 1997. Forest Genetics and Tree Breeding. CBS.
- Sedgley M and Griffin AR. 1989. Sexual Reproduction of Tree Crops. Academic Press.
- Surendran C, Sehgal RN and Paramathma M. 2003. Text Book of Forest Tree Breeding. ICAR.
- White TL, Adams WT and Neale DB. 2007. Forest Genetics. CABI, UK.
- Wright JW. 1976. Introduction to Forest Genetics. Academic Press.
- Zobel BJ and Talbert J. 1984. Applied Forest Tree Improvement. John Wiley and Sons.

SOA/FEMC/03 – CLONAL FORESTRY

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Clonal Forestry	SOA/FEMC/03	2+0	60	40	No Practical	100 (2)

IV – Aim of the Course

To provide information about genetics, conservation, biotechnological approaches for trees in clonal forestry system for higher biomass/ yield productivity

V – Theory

Unit I

Introduction to Clonal Forestry. History of clonal forestry. Clonal propagation. Clonal planting. Strategies for clonal forestry for higher productive potential.

Unit II

Juvenility and maturation, rejuvenation and maintainance, regulation of phase changes, markers of phase changes. Breeding strategies using vegetative propagation- selection and breeding for extreme genotypes. Physiological research for higher productivity of clonal forest. Field design, testing and evaluation of clones. Genetic gains from breeding with clonal option. Clonal conservation approaches- management of populations for genetic diversity and gain.

Unit III

Biotechnological approaches for clonal forestry, Plant tissue culture, micropropagation, Rejuvenation of tissues from mature trees, Testing of Clonal fidelity using molecular markers.

VI – Suggested Reading

- Ahuja MR and Libby WJ. 1993. Clonal Forestry I Conservation and Application. Springer
- Ahuja MR. 1992. Micropropagation of Woody Plants: Volume 41 (Forestry Sciences). Springer
- Ahuja MR and Libby WJ. 1993. Clonal Forestry II Genetics and Biotechnology. Springer
- Mandal AK and Gibson GL. 2002. Forest Genetics and Tree Breeding. CBS Publishers, New Delhi

SUPPORTING COURSES

SOA/FCSC/511B – EXPERIMENTAL DESIGNS

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Experimental Designs	SOA/FCSC/511B	2+1	60	20	20	100 (3)

IV – Aim of the Courses

This course is meant for students who do not have sufficient background of statistical methods. The students would be exposed to concepts of general statistical methods and statistical inference that would help them in understanding the importance of statistical methodology. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation of results.

V – Theory

Design of Experiments: Basic Principles of design of experiments, Completely Randomised Design, Randomised Block Design, Latin Square Design. Elementary idea of factorial experiments. Estimation of genetic parameters from ANOVA table. Unit V Non-parametric tests: Sign test, Wilcoxon test, Mann-Whitney U-test, Wald Wolfowitz run test, Median test, Kruskal- Wallis test. MS Excel, Introduction to computer softwares.

VI – Practical

- Random variable and mathematical expectation;
- Fitting of distributions, viz., Binomial, Poisson, Normal;
- Correlation and regression;
- Non-linear regression • Multiple linear regression;
- Testing of hypothesis based on chi square, t and F tests. Large sample tests. Completely Randomised Design, Randomised Block Design, Latin Square Design and Factorial experiments. Non-parametric tests. Exercises based on computer software.

VII – Suggested Reading

- Aggarwal BL. 1996. Basic Statistics. Wiley Eastern Limited, New Age International Ltd.
- Bansal ML, Singh S, Singh TP and Kumar R. 2004. Statistical Methods for Research Workers. Kalyani Publishers. Chandel SRS. 2014. A Handbook of Agricultural Statistics. AchalPrakashan.
- Goon AM, Gupta MK and Dasgupta B. 1968. Fundamentals of Statistics, vol I, II. The World Press, Calcutta. Snedecor GW and Cochran WG. 1980. Statistical Methods. East West Press.

SEMESTER III

SOA/FEMC/509 - CLIMATE CHANGE AND CONSERVATION SILVICULTURE

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Climate Change and Conservation Silviculture	SOA/FCMC/509	2+0	60	40	No Practical	100 (2)

IV – Aim of the Course

To understand the scenario of climate change and international treaties on climate change, adaptive silviculture for climate change mitigation, silviculture for conservation of ecosystems.

V – Theory

Unit I

Global climate change-factors involved, green house gases, potential threats, global carbon cycle and C-budget, carbon sequestration. Forests and climate change: Forest responses and vulnerabilities to climate change mitigation.Status of forests in global climate change. Harnessing Forests for Climate Change Mitigation, International climate negotiation, UNFCCC, IPCC, CoP:LULUCF, REDD++ and CDM.

Unit II

Silviculture and sustainability-criteria and indicators for sustainable plantation forestry in India-CIFOR guidelines. Silvicultural and stand management strategies for carbon sink maximization and source minimization. Adaptive silviculture for climate change.

Unit III

Disturbance- natural and anthropogenic, short and long term impacts and their implications. Fire loss estimation in forests. Deforestation and degradation trends at global, national and regional levels. Mega development projects, Road widening projects and conservation of native and threatened species, management and rehabilitation plans.

Unit IV

Impacts of 'No Green Felling' on stand productivity and health. Restoration forestry silvicultural treatments for habitat restoration, catchment area treatments, enrichment planting, Analog forestry for site productivity and carbon value. Expanding forest and tree cover area- TOF sector in India.

Unit V

Role of canopy in regulating functional inputs to stand: canopy and forest continuum, Continuous Cover Forestry. Silviculture of old growth stands and sacred grooves their ecological significance and biodiversity values. Carbon sequestration potential of Trees Outside forests (TOFs), homegardens and urban forests.

VII – Suggested Reading

- Anderson P and Palik B. 2011. Silviculture for Climate Change. U.S. Department of Agriculture, Forest Service, Climate Change Resource Center.

SOA/FCMC/510 – TREE AND SHRUBS FOR AGROFORESTRY

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Tree and Shrubs for Agroforestry	SOA/FCMC/510	1+1	60	20	20	100 (2)

IV – Aim of the Course

To make students familiar with trees and shrubs (fruit, fodder and small timber) suitable for agroforestry.

V – Theory

Unit I

Introduction, importance of woody elements in agroforestry systems, their role in biomass production. Suitability

of species for different purposes. Multipurpose trees in agroforestry systems. Fodder from trees/ shrubs and their nutritive value, propagation techniques.

Unit II

Role of nitrogen fixing trees/ shrubs. Choice of species for various agro-climatic zones for the production of timber, fodder, fuel wood, fibre, fruits, medicinal and aromatic plants. Generic and specific characters of trees and shrubs for agroforestry.

Unit III

Fruit crop and small timber trees and their need and relevance in agroforestry, trees suitable for various assemblage and their planting plan in different agroclimatic zones and agroforestry system. Intercropping in fruit orchards like *Apple, Walnut, Jack fruit, Mango, Sapota, Pomegranate, Orange, Citrus, Guava*, etc. Modification in tending and pruning operations and canopy management. Fertility management, yield and quality improvement.

VI – Practical

- Field survey and acquaintance with specialized features of trees, shrubs and fruit species and varieties for Agroforestry;
- Planting plans including wind breaks;
- Training and pruning of forest trees, shrubs and fruit trees for enhancing production in agroforestry system.

VII – Suggested Reading

- Dwivedi AP. 1992. Agroforestry: Principles and Practices. Oxford & IBH.
- Nair PKR, Rai MR and Buck LE. 2004. New Vistas in Agroforestry. Kluwer.
- Nair PKR. 1993. An Introduction to Agroforestry. Kluwer.
- Ong CK and Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF.
- Srivastava KK. 2007. Canopy Management of Fruit Crops, IBD.
- Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.

SOA/FCMC/511 – ECONOMICS OF AGROFORESTRY SYSTEMS

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Economics of Agroforestry Systems	SOA/FCMC/511	2+1	60	20	20	100 (3)

IV – Aim of the Course

To acquaint the students with principles of economics and use of economic tools in appraisal of the agroforestry systems. Evaluation of ecosystem services from agroforestry- economic and ecological aspects of agroforestry.

V – Theory

Unit I

Basic principles of economics applied to agroforestry. Financial measures. Quantification and valuation of inputs and outputs- direct and indirect methods.

Unit II

Optimization techniques-Planning, budgeting and functional analysis. Role of time, risk and uncertainty in decision making. Agroforestry budgeting. Risk analysis, reassessment.

Unit III

Financial and socio-economic analysis of agroforestry projects. Principles of financial management and harvesting, post harvest handling, value addition, marketing of agroforestry products including benefit sharing.

Unit IV

Valuation of ecosystem services in agroforestry and payment for ecosystem systems. Bankable agroforestry projects, incentives, tree insurance, etc. Certification process in agroforestry based carbon projects, carbon finance, etc.

VI – Practical

- Exercises on agroforestry production relationships;
- Preparation of agroforestry based enterprise, partial and complete budgets;
- Application of various methods in formulation and appraisal of agro-forestry projects;
- Case studies on harvesting, post harvest management and marketing of agroforestry products;

• Valuation of ecosystem services in agroforestry and payment for ecosystem services.
VII – Suggested Reading
• Alavalapati JRR and Mercer D Evan. 2004 Valuing Agroforestry Systems: Methods and Applications. Kluwer Academic Publishers. • Kant S and Janaki A. 2014. Handbook of Forest Resource Economics. Publisher: Routledge • Nair PKR, Rai MR and Buck LE. 2004. New Vistas in Agroforestry. Kluwer Academic Publishers. • Nair PKR. 1993. An Introduction to Agroforestry. Kluwer Academic Publishers. • Ong CK and Huxley PK. 1996. Tree Crop Interactions – A Physiological Approach. ICRAF. Sullivan • Gregory M, Susan Hoke M and Jefferson M. Fox (editors). 1992. Financial and Economic Analyses of Agroforestry Systems. • Proceedings of a workshop held in Honolulu. Hawaii. USA. July 1991. Paia, Ill: Nitrogen Fixing Tree Association. • Thampan PK. 1993. Trees and Tree Farming. Peekay Tree Crops Development Foundation.

SOA/FCMC/512 – TREE SEED TECHNOLOGY

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Tree Seed Technology	SOA/FCMC/512	2+1	60	20	20	100 (3)

IV – Aim of the Course
To impart knowledge and to develop understanding about tree seed development, harvesting, processing, storage, dormancy, germination of tropical, sub-tropical and temperate species, their testing and certification.

V – Theory
Unit I Introduction, trends and development in tropical, sub-tropical and temperate forestry and their influence on seed demand. Seed problems, limiting factors in tree propagation and afforestation. **Unit II** Reproductive biology of seed plants – development and maturation of seed bearing organs and seeds – morphology of fruit and seed – seed dispersal – ecological fruit and seed types- seasonality and periodicity of flowering and fruiting – reproductive age – influence of external factors on seed production. Seed structure and chemical composition – development and maturation – germination – breakdown of storage products – endogenous hormonal regulation – effect of stimulators and inhibitors– dormancy – its causes and breakage specific problems of seeds of woody plants. **Unit III** Determining maturity indices. Factors influencing choice of collection methods. Methods of seed collection and processing. Storage methods – loss of viability during storage. Dormancy and pre-treatment. Germination and seedling establishment and seed testing techniques. Unit IV Quality seed production technologies – seed certification. **Unit V** Eco-physiological role of seed storage. Classification of seed storage potential. Factors affecting seed longevity. Pre-storage treatment. Physiological change during ageing. Storage of orthodox, recalcitrant and intermediate seeds, Fumigation and seed treatment.
VI – Practical
• Identification of forest seeds; • Seed sampling, different storage methods, Seed quality testing-purity, viability and germination, collection and processing of seeds/ fruit; • Tests of viability, viz., cutting, hydrogen peroxide, excised embryo, tetrazolium, seed health testing primarily to the presence or absence of disease-causing organisms such as fungi, bacteria, virus and animal pests, recording, calculation and use of results of seed treatment.
VII – Suggested Reading
• Baldwin HI. 1942. Forest Tree Seed of the North Temperate Regions. Periodical Experts Book Agency, Delhi. • Bedell PE. 1998. Seed Science and Technology: Indian Forestry Species. Allied Publisher Limited. • Chin HF and Roberts EH. 1980. Recalcitrant crop seeds. Tropical Press Sdn. Bhd. Malaysia. • Dutta M and Saini GC. 2010. Forest Tree Improvement and Seed Technology.

- Hong TD and Ellis RH. 1996. A protocol to determine seed storage behaviour. IPGRI Technical Bulletin No. 1. (J. M. M. Engels and J. Toll, vol. Eds.) International Plant Genetic Resources Institute, Rome, Italy.
- ISTA. 1993. International Rules for Seed Testing. International Seed Testing Association, Zurich, Switzerland.
- Khullar P. et al. 1992. Forest Seed. ICFRE, New Forest, Dehra Dun.
- Leadem CL. 1984. Quick Tests for Tree Seed Viability. B.C. Ministry of Forests and Lands, Canada.
- Schmidt L. 2000. Guide to handling of tropical and subtropical forest seed. DANIDA Forest Seed Centre, Denmark. Umarani R and Vanangamudi K. 2004. An Introduction to Tree Seed Technology. IBD, Dehradun.
- Vanangamudi K. 2007. Advances in Seed Science and Technology: (Vol. 1. to 5).
- Willan RL. 1985. A guide to forest seed handling. FAO Forestry Paper 20/2, DANIDA Forest Seed Centre, Denmark and FAO, Rome.

SOA/FCMC/591 – MASTER'S SEMINAR

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Master's Seminar	SOA/FCMC/591	0+1	--	--	100 (1)	100 (1)
• Concerned department will organize in house seminars about pre-discussion of the master thesis topics. • Departmental committee will discuss and finalize synopsis of master thesis through ppt. presentation.						

SOA/FCMC/599A – RESEARCH REVIEW (MASTER THESIS)

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Research Review (Master Thesis)	SOA/FCMC/599A	0+7	--	--	100 (7)	100 (7)
• Mid-term progress will be presented by each student by ppt. presentation. • Mater thesis review work will be presented by each student.						

SEMESTER IV

SOA/FEMC/513 – NUTRIENT AND WEED MANAGEMENT IN PRODUCTION FORESTRY

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Nutrient and Weed Management in Production Forestry	SOA/FEMC/513	1+1	60	20	20	100 (2)

IV – Aim of the Course
To make students to understand the concepts of nutrients and their management, weeds and their management in nurseries and plantations.

V – Theory

Unit I

History of nutrient management in forest nurseries and plantations. Essential nutrient elements and their deficiency. Mechanism of nutrient uptake by plants, functions and translocation/ interactions. Concept of nutrient availability.

Unit II Climatic and soil conditions causing micronutrient deficiencies in plants. Occurrence and treatment of micronutrient disorders. Evaluation of soil for the supply of micronutrient. Rare and non-essential elements.

Unit III Technology and use of complex liquid and suspension fertilizers. Fertilizer use efficiency. Biological nitrogen fixation and bio-fertilizers. Farm yard manure and other organic fertilizers. Mycorrhizal associations and their significance. Economic implications of nutrient management. Importance of renewable wastes and their

recycling.

Unit IV Principles of weed control. Methods of weed control-cultural, biological, mechanical and chemical. Herbicide/ weedicide classification, properties and their application.

VI – Practical

- Methods of soil and plantanalysis.
- Preparation of nutrient solutions.
- Practical application of fertilizers;
- Study of fertilizer response and diagnosis of deficiency symptoms.
- Fertilizer testing and pot experiments;
- Nursery inoculation techniques of bio-fertilizers;
- Methods of application of formulated products-seed treatment, root dip, suckers treatment, soil application, foliar application and combination of different methods;
- Important weeds in forest nurseries and plantations. Control of weeds.

VII – Suggested Reading

- Allen V and Barker. 2007. Handbook of Plant Nutrition. Pilbeam London.
- Gupta OP. 2011. Modern Weed Management. Agrobios, New Delhi (India).
- Kumar D, Chowdhary S and Sharma R. 2011. Weed Management: Principles and Practices. Narendra Publishing House.
- Rajaram C. 2012. Hand book of Plant Nutrition. Neha Publishers and Distributors.
- Rammoorthy and Subbian P. 2012. Weed Management. Agrotech Publishing Academy, Udaipur (India).

SOA/FEMC/514 – CROPS AND LIVE STOCK MANAGEMENT IN AGROFORESTRY

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical	Total
Crops and Live Stock Management in Agroforestry	SOA/FEMC/514	2+0	60	40	No Practical	100 (2)

IV – Aim of the Course

To impart knowledge on interactions between tree and live stock including their management, principles of crops and fodder production in agroforestry.

V – Theory

Unit I

Choice of inter-crops for different tree species, sowing and planting techniques. Planting patterns, crop geometry, nutrient requirements, and weed management. Management of fodder tree species, thinning, lopping, pruning. Ecological and socio-economic interactions.

Unit II

Role of tree architecture and its management on system's productivity. Production potentials of fodder based agroforestry systems in different agro-climatic conditions and crop combinations. Importance of cattle, sheep and goat vis-à-vis agro-forestry systems. Feed and fodder resources in agro-forestry systems and live stock management.

Unit III

Nutrient analysis of forages derived from fodder trees/ shrubs. Nutrient requirement for various livestock and their ration computation with agroforestry forages and tree leaves. Forage and tree leaves preservation.

Unit IV

Calendars for forage crop production in agro-forestry systems including lopping schedules. Optimization of animal production. Animal products technology and marketing.

Unit V

Integrated Agroforestry Farming System.

VII – Suggested Reading

- Bran Powell. 2017. Livestock Production and Management. L & K Education.
- Kundu SS, Dagar JC, Prakash O, Chaturvedi and Sirohi SK. 2008. Environment, Agroforestry and Livestock Management.

SOA/FE/599B – Master Research (Thesis)

I – Title	II – Code	III - Credit Hours	Theory	Internal	Practical/ Term Paper	Total
Master Research (Thesis)	SOA/FE/599B	0+23	--	--	100(23)	100 (23)

Evaluation of the master thesis shall be as follows:

1. Periodical presentation 20 Marks
2. Viva-Voce 20 Marks
3. Thesis evaluation 60 Marks

Evaluation of the thesis shall be done by one external and one internal examiner.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – GEOGRAPHY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

PH.D. ENTRANCE TEST SYLLABUS FOR GEOGRAPHY

Subject : GEOGRAPHY **Code No.: (443)**

Section-A

Research Aptitude & Methodology Code No. : 00

Unit-I: Teaching Aptitude

Teaching: Concept, Objectives, Levels of teaching (Memory, Understanding and Reflective), Characteristics and basic requirements. *Learner's characteristics*: Characteristics of adolescent and adult learners (Academic, Social, Emotional and Cognitive). Teacher, Learner, Support material, Instructional facilities, Learning environment and Institution. Methods of teaching in Institutions of higher learning: Teacher centred vs. Learner centred methods; Off-line vs. On-line methods (Swayam, Swayam Prabha, MOOCs etc.). Teaching Support System: Traditional, Modern and ICT based. Evaluation Systems: Elements and Types of evaluation, Evaluation in Choice Based Credit System in Higher education, Computer based testing, Innovations in evaluation systems.

Unit-II: Research Aptitude

Research: Meaning, Types, and Characteristics, Positivism and Post- positivistic approach to research. Methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods. Steps of Research. Thesis and Article writing: Format and styles of referencing. Application of ICT in research. Research ethics.

Unit-III: Data Interpretation

Sources, acquisition and classification of Data. Quantitative and Qualitative Data. Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data. Data Interpretation. Data and Governance.

Unit-IV: Information and Communication Technology (ICT)

ICT: General abbreviations and terminology. Basics of Internet, Intranet, E-mail, Audio and Video-conferencing. Digital initiatives in higher education. ICT and Governance.

Unit-V: Higher Education System

Institutions of higher learning and education in ancient India. Evolution of higher learning and research in Post-Independence India. Oriental, Conventional and Non-conventional learning programmes in India. Professional, Technical and Skill Based education. Value education and environmental education. Policies, Governance, and Administration.

Section-B

Subject : GEOGRAPHY **Code No.: (443)**

Unit I - Geomorphology

Unit II - Climatology

Unit III - Oceanography

Unit IV - Geography of Environment

Unit V - Population and Settlement Geography

Unit VI - Geography of Economic Activities and Regional Development

Unit VII - Cultural, Social and Political Geography

Unit VIII - Geographic Thought

Unit IX - Geographical Techniques

Unit X - Geography of India

Unit XI - Geography of Himalaya with Special Reference to Uttarakhand

UNIT-I: Geomorphology

Continental Drift, Plate Tectonics, Endogenetic and Exogenetic forces. Denudation and Weathering, Geomorphic Cycle (Davis and Penck), Theories and Process of Slope Development, Earth Movements (seismicity, folding, faulting and vulcanicity), Landform Occurrence and Causes of Geomorphic Hazards (earthquakes, volcanoes, landslides and avalanches)

UNIT –II: Climatology

Composition and Structure of Atmosphere; Insolation, Heat Budget of Earth, Temperature, Pressure and Winds, Atmospheric Circulation (air-masses, fronts and upper air circulation, cyclones and anticyclones (tropical and temperate), Climatic Classification of Koppen & Thornthwaite, ENSO Events (El Nino, La Nina and Southern Oscillations), Meteorological Hazards and Disasters (Cyclones, Thunderstorms, Tornadoes, Hailstorms, Heat and Cold waves Drought and Cloudburst , Glacial Lake Outburst (GLOF), Climate Change its impact mitigation and adaptation strategies.

UNIT-III: Oceanography

Relief of Oceans, Composition: Temperature, Density and Salinity, Circulation: Warm and Cold Currents, Waves, Tides, Sea Level Changes, Hazards: Tsunami and Cyclone

UNIT –IV: Geography of Environment

Components: Ecosystem (Geographic Classification) and Human Ecology, Functions: Trophic Levels, Energy Flows, Cycles (geo-chemical, carbon, nitrogen and oxygen), Food Chain, Food Web and Ecological Pyramid, Human Interaction and Impacts, Environmental Hazards and Disasters (Global Warming, Urban Heat Island, Atmospheric Pollution, Water Pollution, Land Degradation), National Programmes and Policies: Legal Framework, Environmental Policy, International Treaties, International Programmes and Polices (Brundtland Commission, Kyoto Protocol, Agenda 21, Sustainable Development Goals, Paris Agreement)

UNIT –V: Population and Settlement Geography Population Geography

Sources of population data (census, sample surveys and vital statistics, data reliability and errors). World Population Distribution (measures, patterns and determinants), World Population Growth (prehistoric to modern period). Demographic Transition, Theories of Population Growth (Malthus, Sadler, and Ricardo). Fertility and Mortality Analysis (indices, determinants and world patterns). Migration (types, causes and consequences and models), Population Composition and Characteristics (age, sex, rural-urban, occupational structure and educational levels), Population Policies in Developed and Developing Countries.

Settlement Geography

Rural Settlements (types, patterns and distribution), Contemporary Problems of Rural Settlements (rural-urban migration; land use changes; land acquisition and transactions), Theories of Origin of Towns (Gordon Childe, Henri Pirenne, Lewis Mumford), Characteristics and Processes of Urbanization in Developed and Developing Countries (factors of urban growth, trends of urbanisation, size, structure and functions of urban areas). Urban Systems (the law of the primate city and rank size rule) Central Place Theories (Christaller and Losch), Internal Structure of the City, Models of Urban Land Use (Burgess, Harris and Ullman , and Hoyt), Concepts of Megacities, Global Cities and Edge Cities, Changing Urban Forms (peri-urban areas, rural-urban fringe, suburban , ring and satellite towns), Social Segregation in the City, Urban Social Area Analysis, Manifestation of Poverty in the City (slums, informal sector growth, crime and social exclusion).

Unit–VI: Geography of Economic Activities and Regional Development

Economic Geography

Factors affecting spatial organisation of economic activities (primary, secondary, tertiary and quarternary), Natural Resources (classification, distribution and associated problems), Natural Resources Management. World Energy Crises in Developed and Developing Countries.

Agricultural Geography

Land capability classification and Land Use Planning, Cropping Pattern: Methods of delineating crop combination regions (Weaver, Doi and Rafiullah), Crop diversification, Von Thunen's Model of Land Use Planning. Measurement and Determinants of Agricultural Productivity, Regional variations in Agricultural Productivity, Agricultural Systems of the World.

Industrial Geography

Classification of Industries, Factors of Industrial Location; Theories of Industrial Location (A. Weber, E. M. Hoover, August Losch, A. Pred and D. M. Smith).
World Industrial Regions, Impact of Globalisation on manufacturing sector in Less Developed Countries, Tourism Industry, World distribution and growth of Information and Communication Technology (ICT) and Knowledge Production (Education and R & D) Industries.

Geography of Transport and Trade

Theories and Models of spatial interaction (Edward Ullman and M. E. Hurst) Measures and Indices of connectivity and accessibility; Spatial Flow Models: Gravity Model and its variants, World Trade Organisation, Globalisation and Liberalisation and World Trade Patterns. Problems and Prospects of Inter and Intra Regional Cooperation and Trade.

Regional Development

Typology of Regions, Formal and Fictional Regions, World Regional Disparities, Theories of Regional Development(Albert O. Hirschman, Gunnar Myrdal, John Friedman, Dependency theory of Underdevelopment, Global Economic Blocks, Regional Development and Social Movements in India

Unit – VII: Cultural, Social and Political Geography

Cultural and Social Geography

Concept of Culture, Cultural Complexes, Areas and Region, Cultural Heritage, Cultural Ecology. Cultural Convergence, Social Structure and Processes, Social

Well-being and Quality of Life, Social Exclusion, Spatial distribution of social groups in India (Tribe, Caste, Religion and Language), Environment and Human Health, Diseases Ecology, Nutritional Status (etiological conditions, classification and spatial and seasonal distributional patterns with special reference to India) Health Care Planning and Policies in India, Medical Tourism in India.

Political Geography

Boundaries and Frontiers (with special reference to India), Heartland and Rimland Theories. Trends and Developments in Political Geography, Geography of Federalism, Electoral Reforms in India, Determinants of Electoral Behaviour, Geopolitics of Climate Change, Geopolitics of World Resources, Geo-politics of India Ocean, Regional Organisations of Cooperation (SAARC, ASEAN, OPEC, EU). Neopolitics of World Natural Resources.

Unit VIII: Geographic Thought

Contributions of Greek, Roman, Arab, Chinese and Indian Scholars, Contributions of Geographers (Bernhardus Varenius, Immanuel Kant, Alexander von Humboldt, Carl Ritter, Scheafer & Hartshorne), Impact of Darwinian Theory on Geographical Thought. Contemporary trends in Indian Geography: Cartography, Thematic and Methodological contributions. Major Geographic Traditions (Earth Science, manenvironment relationship, area studies and spatial analysis), Dualisms in Geographic Studies (physical vs. human, regional vs. systematic, qualitative vs. quantitative, ideographic vs. nomothetic), Paradigm Shift, Perspectives in Geography (Positivism, Behaviouralism, Humanism, Structuralism, Feminism and Postmodernism).

Unit IX: Geographical Techniques

Sources of Geographic Information and Data (spatial and non-spatial), Types of Maps, Techniques of Map Making (Choropleth, Isarithmic, Dasymetric, Chorochromatic, Flow Maps) Data Representation on Maps (Pie diagrams, Bar diagrams and Line Graph, GIS Database (raster and vector data formats and attribute data formats). Functions of GIS (conversion, editing and analysis), Digital Elevation Model (DEM), Georeferencing (coordinate system and map projections and Datum), GIS Applications (thematic cartography, spatial decision support system), Basics of Remote Sensing (Electromagnetic Spectrum, Sensors and Platforms, Resolution and Types, Elements of Air Photo and Satellite Image Interpretation and Photogrammetry), Types of Aerial Photographs, Digital Image Processing: Developments in Remote Sensing Technology and Big Data Sharing and its applications in Natural Resources Management in India, GPS Components (space,

ground control and receiver segments) and Applications, Applications of Measures of Central Tendency, Dispersion and Inequalities, Sampling, Sampling Procedure and Hypothesis Testing (chi square test, t test, ANOVA), Time Series Analysis, Correlation and Regression Analysis, Measurement of Indices, Making Indicators Scale Free, Computation of Composite Index, Principal Component Analysis and Cluster Analysis, Morphometric Analysis: Ordering of Streams, Bifurcation Ratio, Drainage Density and Drainage Frequency, Basin Circularity Ratio and Form Factor, Profiles, Slope Analysis, Clinographic Curve, Hypsographic Curve and Altimetric Frequency Graph.

Unit – X: Geography of India

Major Physiographic Regions and their Characteristics; Drainage System (Himalayan and Peninsular), Climate: Seasonal Weather Characteristics, Climatic Divisions, Indian Monsoon (mechanism and characteristics), Jet Streams and Himalayan Cryosphere, Types and Distribution of Natural Resources: Soil, Vegetation, Water, Mineral and Marine Resources. Population Characteristics (spatial patterns of distribution), Growth and Composition (rural-urban, age, sex, occupational, educational, ethnic and religious), Determinants of Population, Population Policies in India, Agriculture (Production, Productivity and Yield of Major Food Crops), Major Crop Regions, Regional Variations in Agricultural Development, Environmental, Technological and Institutional Factors affecting Indian Agriculture; Agro-Climatic Zones, Green Revolution, Food Security and Right to Food. Industrial Development since Independence, Industrial Regions and their characteristics, Industrial Policies in India. Development and Patterns of Transport Networks (railways, roadways, waterways, airways and pipelines), Internal and External Trade (trend, composition and directions), Regional Development Planning in India, Globalisation and its impact on Indian Economy, Natural Disasters in India (Earthquake, Drought, Flood, Cyclone, Tsunami, Himalayan Highland Hazards and Disasters.)

Unit – X: Geography of Himalaya with Special Reference to Uttarakhand

Geo-physical identity, Origin of Himalaya and its structure; Himalaya as regional entity; Geo-political issues; Cultural Appraisal; Himalayan people and tribes; Geo-sensitivity of Himalaya; Future of Himalaya. Physiographic Structure; Landforms, Drainage System; Himalaya as water tower; Glaciers; Lakes; Passes; Climate; Natural Vegetation; Natural Hazards; Geo-Ecological Problems of Himalaya created by anthropogenic activities. Geographical account of Western, Central and Eastern Himalaya; Regional analysis of Kashmir Valley; Ladakh; Lahul and Spiti; Kathmandu Valley and Teesta Valley; Mountain Development Planning and Policy.

Uttarakhand Demography and Economy – Distribution, density and growth of population; Migration; Occupational structure; Tribes. Urbanization; Rural and Urban Population; Agriculture; Industry; Animal Husbandry; Horticulture; Tourism; Developing problems of Himalaya; Hydropower Power projects. Natural hazards and disasters: Mitigation strategies; Planning regions of Uttarakhand; Development challenges and contemporary issues; Natural and energy resources: Solar, Wind, Soil, Hydro, Geothermal, Biomass, Nuclear and Forests. Protected areas and Biosphere Reserves of Uttarakhand; Socio-economic and environment success stories.

Prof. (Dr.) M.S. Panwar

HoD

Department of Geography,

School of Earth Sciences,

HNB Garhwal University (A Central University),

Srinagar (Garhwal), Uttarakhand

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – GEOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

HNBGU Ph.D. Entrance Examination (Geology) 2024-25

The Ph.D. Entrance Examination of Geology 2024-25 includes; Paper Ist Research Methodology and Research Publications & Ethics. While the Paper IInd includes, topics that focus on the study of the Earth, its structure, and natural processes etc. The syllabus helps candidates to understand the key concepts and prepare them for the examination. It is designed to test knowledge in both theoretical and practical aspects of Geological science.

Paper 1 (Published in University Website)

Part A	Part B
Research Methodology:	**Research Publications & Ethics**
UNIT 1: Introduction	**UNIT 1:** Philosophy and Ethics
UNIT 2: Computer Application	**UNIT 2:** Scientific Conduct
UNIT 3: National & International Status	**UNIT 3:** Publication Ethics

Paper 2

Subject: Geology

Part A	Part B
UNIT 1:	**UNIT 1:**
• The Earth and the Solar System	• Crystallography, Mineralogy, Petrology,
• Earth Materials, Processes	• Structural Geology, Sedimentology
• Geological agents & Landforms.	• Paleontology, and Stratigraphy,
• Oceans, Atmosphere & Climate	**UNIT 2:**
UNIT 2:	• Economic Geology, Mineral Exploration
• Interior of the Earth	• Hydrogeology, Environmental Geology
• Mountain building Processes	• Engineering Geology Remote Sensing and GIS,
• Isostasy & Plate Tectonics,	

08/02/25

(Dr. Mahendra Pratap Singh Bisht)
HOD Geology

Head
Department of Geology
H.N.B. Garhwal University
Srinagar (Uttarakhand) 246174

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – HIMALAYAN AQUATIC BIODIVERSITY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Syllabus for Pre-Phd Entrance Test (Himalayan Aquatic Biodiversity)

Unit I: Himalaya:

Introduction: Origin of Himalaya.
Importance of Himalaya.
Geology of Himalaya.
Rivers, Lakes, and Glaciers of Himalaya.
Biogeographic regions & characteristics flora & fauna of Himalaya.
Freshwater algal flora of Himalaya
Freshwater Fish fauna of Himalaya

Unit II: Aquatic Ecosystem:

Classification of aquatic ecosystems and wetlands.
Fresh water, marine and wetland ecosystems.
Types of rivers, geomorphology, longitudinal profile of river, self-purification.
Eutrophication and trophic state index.
Biodiversity of Lakes, rivers, estuary and oceans
Nutrient cycling and dynamics, upwelling and downwelling of nutrients.

Unit III: Environmental Pollution:

Air Pollution: Sources and types of Pollutants - Natural and anthropogenic sources, primary and secondary pollutants. Control devices for particulate matter: Principle and working of: settling chamber, centrifugal collectors, wet collectors, fabric filters and electrostatic precipitator.

Water Pollution: Types and sources of water pollution. Impact on humans, plants, and animals. Measurement of water quality parameters: sampling and analysis for pH, EC, turbidity, TDS, hardness, chlorides, salinity, DO, BOD, COD, nitrates, phosphates, sulphates, heavy metals, and organic contaminants. Wastewater Treatment: Primary, Secondary and Advanced treatment methods.

Soil Pollution: Physio-chemical and biological properties of soil (texture, structure, inorganic and organic components). Analysis of soil quality. Soil Pollution control. Soil micro-organisms and their functions - degradation of pesticides and synthetic fertilizers.

Noise pollution: Sources of noise pollution, measurement, and indices.

Unit IV: Climate Change:

Composition of Atmosphere, lapse rate, Meteorological instruments
Introduction to Climate change
Energy budget, greenhouse effect, radiative forcing, and global warming potential.
Paleoclimatology, Impacts of Climate change
REDD+, Intergovernmental Panel on Climate Change (IPCC), Ecological footprint, Clean Development Mechanism (CDM).

Unit V: Fishery Science:

General Morphology and classification of fishes.
Basic Anatomy of fish- digestive, circulatory, respiratory, nervous, and reproductive systems.
Migration- fish tagging and marking.
Principle methods of fish preservation and processing.
Overview of freshwater fishes.

Unit VI: FRESHWATER BIODIVERSITY

Freshwater Bacteria, Fungi.
Freshwater Algae (Motile, Non-motile and Filamentous) and Macrophytes of India.
General characteristics and classification of freshwater protozoans (Amoeba, Paramecium, Euglena).

Characteristic of important freshwater Acoelomate taxa.
Characteristic of important freshwater coelomates.
Worms; Flat worms, Round worms, Annelids in India.
Molluscs: Gastropods, Bivalves in India.
Overview of freshwater Insect fauna, Adults, Nymphal, Larval stages in India.

Unit VII: Ecology and Biodiversity:

Overview of taxonomy and systematics
Origin of species. Biodiversity level
Threat to Biodiversity, measurement of biodiversity.
Hotspots and megadiversity nations.
Strategies for biodiversity conservation: in situ, ex situ and in vitro conservation.
Diversity indices (Shannon-Wiener diversity indices, Species Richness index).
Ecosystem Structure and functions: Structures - Biotic and Abiotic components. Functions - Energy flow in ecosystems, energy flow models, food chains and food webs. Biogeochemical cycles, Ecological succession.

Unit VIII: Aquatic Microbiology and Planktonology

General introduction to microbiology
Micro-organisms in freshwater and marine water systems.
Aquatic bacteriology - Pathogens, distribution preventions and control.
Evolution and gene flow, population and community dynamics, water and soil microbiology, biogeochemical cycling, and microorganisms in biodeterioration and bioremediation.
Classifications of plankton based on size, mode of life, life cycle and feeding habits. Luminous plankton, biology of important plankton.
Phyton and Zooplankton- Method of collection of plankton and estimation of primary and secondary productivity, factors affecting productivity, regional differences and seasonal variations. Adaptation of plankton –structural (weight increases of surface area, floatation) and physiological (specific gravity, water content, fat content, defensive vacuoles) mechanisms. Phytoplankton and Zooplankton inter relations. Red tide phenomenon- its causes and effects.

Unit IX: Environmental Policy:

National environmental policy, national forest policy, national water policy and other policies e.g. national biotechnology policy, national agricultural policy etc.
Overview of Environmental Laws: Wildlife Protection Act, 1972 , Forest Conservation Act, 1980, Indian Forest Act, Revised 1982, Biological Diversity Act, 2002, Water (Prevention and Control of Pollution) Act, 1974 amended 1988 and Rules 1975, Air (Prevention and Control of Pollution) Act, 1981 amended 1987 and Rules 1982, Environmental (Protection) Act, 1986 and Rules 1986, The Plastic Waste Management Rules, 2016, The Solid Waste Management Rules, 2016.
Environmental Conventions and Agreements: Montreal Protocol, 1987, Conference of Parties (COPs), Ramsar Convention on Wetlands (1971), Earth Summit at Rio de Janeiro, 1992, Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997, IPCC, UNEP, IGBP.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – HINDI

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

पीएच0 डी0 हिंदी विषय की प्रवेश परीक्षा हेतु पाठ्यक्रम

1. **हिंदी साहित्य का काल विभाजन** और नामकरण, प्रमुख इतिहास ग्रंथ।

2. **हिंदी साहित्य का इतिहास** (आदिकाल से आधुनिक काल तक) : प्रमुख रचनाकार, रचनाएं और प्रवृत्तियां।

3. **हिंदी साहित्य की विविध गद्य विधाएं** : उपन्यास, कहानी, नाटक, निबंध, आलोचना एवं अन्य गद्य विधाएं।

4. **प्रयोजनमूलक हिंदी** के विविध रूप : जनसंचार माध्यम, यूनिकोड, कार्यालयी हिंदी एवं अनुवाद, हिंदी पत्रकारिता का संक्षिप्त इतिहास।

5. **भारतीय काव्यशास्त्र** : काव्य–लक्षण, काव्य हेतु, काव्य–प्रयोजन, काव्य के प्रकार, रस–सिद्धान्त शब्द शक्ति, रस, छंद, अलंकार।

6. **भाषा विज्ञान एवं हिन्दी भाषा** : भाषा की परिभाषा, प्रकृति एवं विशेषताएं भाषा परिवर्तन की दिशाएं एवं कारण, भाषा संरचना और भाषा प्रकार्य। भाषा विज्ञान– परिभाषा एवं स्वरूप, अध्ययन की दिशाएं–वर्णनात्मक ऐतिहासिक एवं तुलनात्मक। स्वन–विज्ञान, स्वनिम विज्ञान का स्वरूप**,** रूपिम विज्ञान, वाक्य–विज्ञान।

7. **हिंदी व्याकरण** : ध्वनि व्यवस्था, शब्द शक्ति, संधि, समास, काल, वाक्य विन्यास।

8. **लोक साहित्य एवं जनपदीय साहित्य** : गढ़वाली एवं कुमाउंनी लोक साहित्य।

9. **आधुनिक काव्यः** जयशंकर प्रसाद–कामायनी, सूर्यकान्त त्रिपाठी निराला–राम की शक्ति पूजा तथा बादल राग, सुमित्रानन्दन पंत–मौन निमंत्रण, नौका बिहार, अल्मोड़े का वसंत, आ, धरती कितना देती है, दिनकर–उर्वशी (तृतीय अंक) ।

10. **कथा साहित्यः** शेखरः एक जीवनी (भाग 1 व 2), अज्ञेय, बाणभट्ट की आत्मकथा– आचार्य हजारी प्रसाद द्विवेदी, कहानी–हिन्दी कहानी के ग्यारह पग चिह्न, चन्द्रधर शर्मा गुलेरी– उसने कहा था, प्रेमचन्द –कफन, जैनेन्द्र –पत्नी, कमलेश्वर–पराया शहर, विद्यासागर नौटियाल –फटजा पंचधार, निर्मल वर्मा– लंदन की एक रात, उषा प्रियंवदा–वापसी ।

11. **छायावादोत्तर काव्यः** हरिवंश राय बच्चन–मधुकलश, अज्ञेय– नदी के द्वीप, असाध्य वीणा, मुक्तिबोध–ब्रह्मराक्षस, आत्मा के मित्र मेरे, भवानी प्रसाद मिश्र– कालजयी ।

12. **पाश्चात्य काव्यशास्त्रः** प्लेटो– काव्य सिद्धान्त, अरस्तू– अनुकरण सिद्धान्त, विरेचन सिद्धान्त, लौंजाइनस की उदात्त की अवधारणा, ड्राइडन के काव्य सिद्धान्त ।

13. **लोक साहित्यः** लोक और लोक–वार्ता, लोक विज्ञान, लोक–संस्कृति–अवधारणा, लोक संस्कृति और साहित्य। लोक साहित्य अवधारणा, लोक साहित्य के प्रमुख रुप–लोक गीत, लोक नाट्य, लोक–कथा, लोकगाथा, लोकनृत्य–नाट्य, लोक संगीत। संस्कार गीत, श्रम–गीत, ऋतु–गीत, जाति गीत।

14. **हिन्दी उपन्यास–साहित्य :** (1) रंगभूमि – प्रेमचन्द । (2) मृगनयनी – वृंदावनलाल वर्मा। (3) त्यागपत्र – जैनेन्द्र कुमार। (4) तमस – भीष्मसाहनी । (5) कसप – मनोहरश्याम जोशी।

15. **नाटक और रंगमंच :** (1) भारत दुर्दशा – भारतेन्दु । (2) लहरों के राजहंस – मोहन राकेश। (3) अन्धायुग – धर्मवीर। (4) एक कंठ विषपायी – दुष्यन्त कुमार। (5) संशय की एक रात – श्री नरेश मेहता।

16. **हिन्दी आलोचना साहित्य :** (1) आचार्य रामचन्द्र शुक्ल – त्रिवेणी। (2) आचार्य हजारी प्रसाद द्विवेदी – कबीर। (3) आचार्य नन्ददुलारे बाजपेयी – नया साहित्य : नये प्रश्न। (4) डॉ० रामविलास शर्मा – भाषा और समाज।

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – HISTORY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

M.A. HISTORY SYLLABUS FOR SEMESTER AND CREDIT PATTERN
(M.A. Part I and Part II)

First Semester

Core/ Compulsory Courses

SOHS/HIS/C001, Paper-I:	Principals of History	(03 Credits)
SOHS/HIS/C002, Paper-II:	World History(From C.1775to1848 AD)	(03 Credits)
SOHS/HIS/C003, Paper-III:	History of Afro-Asian Nationalism.	(03Credits)
SOHS/HIS/C004, Paper- IV:	Indian National Movement (From1857to1919 AD)	(03 Credits)
SOHS/HIS/C 005, Paper-V:	Women in Indian History	(03 Credits)
SOHS/HIS/C 006, Paper-VI:	Political History of Uttarakhand (From 600 BC to 1949 AD)	(03 Credits)

Second Semester

Core/ Compulsory Courses

SOHS/HIS/C 007, Paper-VII:	Sources of Indian History	(03 Credits)
SOHS/HIS/C 008, Paper-VIII:	World History(FromC.1848to1914 AD)	(03 Credits)
SOHS/HIS/C 009, Paper-IX:	Constitutional Development (FromC.1858-to1950AD)	(03 Credits)
SOHS/HIS/C 010, Paper- X:	Indian National Movement (From1919to1947AD)	(03Credits)
SOHS/HIS/C 011, Paper-XI:	Ecology and Environment in History	(03 Credits)
SOHS/HIS/C012, Paper-XII:	Cultural History of Uttarakhand (From early Times to 1949 AD)	(03 Credits)

Self Study Courses:Student has choose to one paper:

SSo1-	Science & Technology in Ancient India	(03 Credits)
	or	
SS02	Tribal Histories of India	(03 Credits)

Third Semester

Core/ Compulsory Courses

SOHS/HIS/C 013, Paper-XIII:	Historical writings:Schools & Historians	(03 Credits)
SOHS/HIS/C 014, Paper-XIV:	Historical Tourism	(03 Credits)
SOHS/HIS/C 015, Paper-XV:	Twentieth Century World (From C.1914to1945AD)	(03Cradits)

Elective Courses/ Specialised Courses - Student has to choose ONE GROUP of Elective papers out of A (Ancient India) Or B (Medieval India) Or C (Modern India).

Group-A (Ancient India)

SOHS/HIS/E01A, Paper-XVI:	History of Ancient India (From earliest Times to 185 BC)	(03 Credits)
SOHS/HIS/E02A, Paper- XVII:	History of Ancient India (From C. 186 BC to 650AD)	(03 Credits)
SOHS/HIS/E03A, Paper- XVII:	History of Ancient Northern India (From C. 650 to1200AD.)	(03 Credits)

or

Group-B (Medieval India)

SOHS/HIS/E01B, Paper- XVI: History of Delhi Sultanate(From C.1192 to1320 AD) (03 Credits)

SOHS/HIS/E02B,Paper- XVII:History of Delhi Sultanate(From C.1320 to1526 AD) (03 Credits)

SOHS/HIS/E03B,Paper-XVIII:History of Mughal India(FromC.1526 to1627AD.) (03 Credits)

or

Group-C (Modern India)

SOHS/HIS/E01C, Paper-XVI: History of Modern India (From 1757 to1857AD) (03 Credits)
SOHS/HIS/E02C, Paper-XVII: History of Modern India (From 1858-to 1947AD) (03 Credits)
SOHS/HIS/E03C, Paper-XVIII: History of Modern India (From 1948 to2000AD) (03 Credits)

Self Study Courses: Student has choose to one paper:

SS03	Science & Technology in Medieval India	(03 Credits)
	or	
SS04	Indian Society-Continuity and Change	(03 Credits)

Elective Courses/ Specialised Courses - Student has to choose ONE GROUP of Elective papers out of A (Ancient India) Or B (Medieval India) Or C (Modern India).

Fourth Semester

Core/ Compulsory Courses-

SOHS/HIS/C016, Paper- XIX: Twentieth Century World (FromC.1945to2000AD) (03 Credits)
SOHS/HIS/C017, Paper- XX: History of USA (FromC.1885 to1945AD) (03 Credits)
SOHS/HIS/C018, Paper- XXI: Project Work/ Dissertation (03 Credits)

Elective Courses/ Specialised Courses-

Group-A (Ancient India)

SOHS/HIS/E04A, Paper- XXII: History of Ancient Southern India (FromC. AD 650 to1200AD) (03 Credits)
SOHS/HIS/E05A, Paper-XXIII: Society and Culture of Ancient India (03 credits)
SOHS/HIS/E06A, Paper- XXIV: Economic Life in Ancient India (From earliest time to 1200 A.D.) (03 Credits)

or

Group-B (Medieval India)

SOHS/HIS/E04B, Paper- XXII: History of Mughal India (FromC. 1627 to 1757AD.) (03 Credits)
SOHS/HIS/E05B, Paper- XXIII: Society and Culture in Medieval India (From C. 1200 to 1757AD.) (03 Credits)
SOHS/HIS/E06B, Paper-XXIV: Economic Life in Medieval India (FromC..1200to1757AD) (03Credits)

or

Group-C (Modern India)

SOHS/HIS/E04C, Paper- XXII: History of Ideas in Modern India (03 Credits)
SOHS/HIS/E05C, Paper -XXIII: Society and Culture in Modern India (From C.1757 to1964AD) (03 Credits)
SOHS/HIS/E06C, Paper- XXIV: Economic life in Modern India (From C. 1757 to1964AD) (03Credits)

Self Study Courses:Student has choose to one paper:

SS05	Science & Technology in Colonial India	(03 Credits)
	or	
SSo6:	History of Indian Diaspora	(03 Credits)

M.A. HISTORY- First Semester

CORE/ COMPULSORY PAPER

SOHS/HIS/C001,: Principles of History

Unit 1 Meaning of History, Definition & Scope, Subject matter of History

Unit 2 Types of History–social, economic, intellectual, agrarian, urban, art history. Use and Misuse of history.

Unit 3 Problems of Periodisation.

Unit 4 Objectivity, Determinism, Relativism, Causation, Generalization in history and Moral judgement in history.

Unit 5 History and other Disciplines.
Ancillary Sciences : Archeology, Paleography, Epigraphy, Numismatics
Auxiliary Sciences: Linguistics, Sociology, Economics, Political Science, (Influences of statistics on historical methods.

Unit 6 Interpretation and speculation, causation verses evidence, historical Positivism.

Recommended Readings:

1. Ali, B. Shaikh, History: Its Theory and Methods, MacMillon, 1978
2. Bloch, Marc, The Historians Craft, Vintage Books
3. Carr, E. H., What is History, Penguin, 1961, 1964 (Hindi also-1976)
4. Collingwood,R.G., The Idea of History, Oxford, 1961
5. Thomson, David, The Aims of History, 1972
6. Elliot and Dowson., History of India as told by its own Historians,
7. Elton, G. R., The Practice of History, London, 1967
8. Mukhia, Harbans, Historians and History of Medieval India,N.Delhi, 976
9. Thompson, J. W., History of Historical writing, New York,1942,1954
10. Thapar, Romila, The Past and the Prejudices, Delhi, 1975
11. Phillips, G. G., Historians of India, Pakistan and Cylone.
12. Robert. N. Burns & Hugh Raymen,(edited) Philosophies of history, Oxford, 2000
13. Authur Marwick, The nature of history, Macmillan, London.
14.Michael Stanford, The companion to the Study of History, Blackwell, Oxford.1996
15. J. Gardiner, What is history today, Macmillan, London, 1988
16. Foucault Michel, The order of things, Tavistock Publications, London,1970 .
17. Appleby, Telling the truth about history,Norton, New York 1994
18. E.L. E. Roy Ladurie, The territory of the Historian, Harvester Press, Britain.1979
19. Verma, Lal Bahadur; Itihas Ke Bare Maen
20. Om Prakash, Hindi Kalam
21. Pande, G. C., Itihas Darshan, Jaipur, 1998
22. Saxena, R. K., Sultnat Kalin Itihaskar
23. Saxena, R. K., Madhya Kalin Itihaskar
24 Khurana and Bansal; Itihas Lekhan, Avdharnaen tatha paddhyatiya, L.N. prakashan, Agra,2005-2006
25. Shridharan, Itihas lekhan, Orient Longman, 2011
26. Kauleshwar Rai, Itihas Lekhan, Allahabad, $6^{th(edition)}$2010
27. Chaube, Jharkhand, Itihas darshan, Varanasi,8^{th} (editon)2010

SOHS/HIS/C002,: World History (C. 1775 to-1848 A.D.)

Unit 1- American Revolution (1776) –causes and effects.

Unit 2- France on the eve of the revolution of 1789 A.D.:-

a) Social, Political and Economic Condition of France.
b) Intellectuals and their impact.

Unit 3 - Course of French revolution:-

a) National Assembly and its works,

b) Working of National Convention and its estimate.

Unit 4- Napoleon:

a) Rise of Napoleon ; As first Consul and King

b) Downfall of Napoleon; Estimate of Napoleon.

Unit 5-Vienna Settlement – Principles and criticism.

a) Concert of Europe-Holy Alliance; Quadruple Alliance.

Unit 6- France 1815 to 1848 :-

a) Charles X and July Revolution

b) Louis Philippe's domestic and foreign policy.

c) Revolution of 1848- its internal and external impact.

Recommended Readings :

1. Fisher, H.A.L., A History of Europe (London, Fontana Library, 1969).
2. Hinsley, F.H. (ed.), And Modern History: Material Progress and World Wide Problems.
3. Joll. James, Europe Since 1870: An International History (Har-Row, 1973).
4. Langer, W.L., European Alliances and Alignments. (Greenwood, 1977).
5. Lefebvre, Georges, Coming of the French Revolution (Princeton, 1989).
6. Palmer, R.A. and Cotton, Joel, A History of Modern World, 6th ed. (Mcgraw, 1982).
7. Parks, H.B.,The United States of America.
8. Rude, George, Revolutionary Europe (1984).
9. Hazen, C.D.; Modern Europe,
10. Saboul, A., The French Revolution.
11. Stavrianos, L.S., The World Since 1500 (1928).
12. Thompson, David, Europe Since Napoleon (Penguin, 1957, 1966).
13. Jain & Mathur, Vishwa Ka Itihas from 1500 to 1950 AD, Jaipur, 1999, 2001
14. Parthasarthi, G., Vuishva Ka Itihas (Delhi, Hindi Directorate, 1983)
15. Khurana & Sharma, Vishva Ka Itihash, Laxmi Narayan Agarwal, Agra, 2007
16. Chauhan, Devendra Singh, Adhunik Europe ka Itihas
17. Katalbey,C.D.M.; Adhunik Kal Ka Itihas(1789 to present time) translated by Vishwa Prakash, S.Chand, Delhi.

SOHS/HIS/C003,: History of Afro-Asian Nationalism

Unit 1- Nationalism –Concept, meaning and definition – Theories of Nationalism – Colonisation – Anti-colonial struggles – Rise of Nationalism.

Unit 2- China – 1911 revolution – Sun Yat Sen – KMT – Chinese Communist party, People's Republic of China.

Unit 3- South East Asia – Dutch Colonisation of Indonesia – Nationalism struggle in Indonesia – French Colonization of Indo-China,

Unit 4- Colonisation of Middle East – Arab Nationalism – Nationalist struggle in Egypt.

Unit 5- Africa – Colonisation of Africa – Anti-colonial struggle in Africa – African Nationalist Movement in South Africa.

Recommended Readings :

1. S. Hall, D.G. E., History of South East Asia, MacMillan., London. 1981,
2. Clyde and Beers, History of East Asia.
3. Fisher, S.N., The Middle East.
4. Harrison Church, R.J., West Africa.
5. Baril Davidson, The Growth of African Civilisation East and Central Africa to the Late 19th Century.
6. Panthari, Shailendra, Sudur Poorva Ka Itihas, U.P.Hindi Sansthan, Lucknow,1973

7. Jain & Mathur, Vishwa Ka Itihas from 1500 to 1950 AD, Jaipur, 1999, 2001
8. Parthasarthi, G., Vuishva Ka Itihas (Delhi, Hindi Directorate, 1983)
9. Khurana & Sharma, Vishva Ka Itihash, Laxmi Narayan Agarwal, Agra, 2007

SOHS/HIS/C004,: Indian National Movement (C.1857 to 1919AD)

Unit 1 - The Revolt of 1857 – causes and consequences-Factors leading to the Emergence of Indian Nationalism.

Unit 2 - Founding of Indian National Congress - Moderate and Extremists-1885-1907AD

Unit 3- Partition of Bengal 1905 –Swadeshi and Boycott Movements, Rise of Muslim league .

Unit 4 - Congress Split, 1907. Revolutionary Trends at home and abroad for India's Freedom. Home Rule Movement- Lucknow Pact, 1916

Unit 5- Impact of the World War-I – Rowlatt Act and Jallianwallah Bagh Massacre, Peasant Movement In India.

Recommended Readings:

1. Bipan Chandra, Nationalism and Colonialism in Modern India.(Hindi- Bharat Mein Upniveshvad aur rashtravad, Anamika Publishers and Distributer, Delhi, 19980
2. Sumit Sarkar, Modern India.(Hindi- RajKamal Prakashan, Delhi, 8th edition 2001)
3. Sen, S.P., 1857.
4. Choudhary, V.C.P.,Theories on Indian Revolt of 1857.
5. Pandey, B.N., A Contemporary History of the Indian National Congress (Vols. 1, 2, 3)
6. Pattabi Sitaramaiah, The Indian National Congress.
7.Tara Chand, Freedom Movement in India,(IV Vols), Government of India, New Delhi,1972
8. Majumdar, R.C., History of Freedom Movement in India, 3 vols, Calcutta. 1962,
9. Aggarwal, R.C., Constitution Development and National Movement of India, S. Chand & Co., New Delhi, 1988,.
10. Judith Brown, Modern India.
11. Abel, M., Glimpses of Indian National Movement, (First Edition), The ICFAI University Press, Hyderabad, 2005,
12. Grover, B.L., and Grover, S., The Evolution of Indian Constitution and Freedom Struggle, S.Chand & Company Ltd, New Delhi, 1985,
13. Singh, Ayodhya; Bharat Ka Mukti Sangarsh
14. Singh, Gurumukh Nihal; Landmark of Indian Constitutional and National Development 1600-1919AD., Indian Book Shop, Bombay
15. Aggarval, R.C., Indian Constitutional and National Development
16.Bipan Chandra, Bharat Ka Swantantra Sangharsh, NBT, 6th edition, 1988
17.Durgadass, Bharat Curzen SE Nehru aur uske Pashchat, Wilco Pub. Bombay
18. Grover and Yashpal,Adhunik Bharat Ka Itihas, S.Chand & Company, Delhi.2001

SOHS/HIS/C005,: Women in Indian History

Unit 1 Definition of Women's Studies – Its Objectives – Status of Women in ancient, medieval and modern India

Unit 2 Women contribution to literature and fine arts

Unit 3 Contribution of women in Indian National movements.

Unit 4 Rise of Women's Organisations and Feminist Movement

Unit 5 Legal and Constitutional Rights of women in Indian.

Uniy 6 Role of Women in politics and administration in post independence era.

Recommended Readings:

1. Tara Ali Aog, India's Women Power.
2. Rama Mehta, Socio-legal, Status of Women in India.

3. Srinivas, M.A., The Changing position of Indian Women.
4. Nanda, B.R., Indian women from Purdah to Modernity, Vikas Publishing House, New Delhi.
5. Altekar, A.S., The Position of Women in Hindu Civilisation, Motilal Banarsi Das,1956
6. Neena Desai, A Decade of Women's Movement in India.
7. Bovehur David, The Feminist Challenge, The Movement for Women's Liberation in Britain and U.S,
8. Banbs Olive, Faces of Feminism – A Study of Feminism as a Social Movement.
9. Gandhi, M.K., Women and Social Justice.
10. Radha Kumar, The Women's Movement in India.
11. Education and Women Empowerment, Association of Indian University(AIU House), N.Delhi, 1999
12. Scott, J.,Gender and the Politics of India, OUP,, 1989
13. Mishra, R., Women in Mughal India(1526-1707), Munsilal Manohar das, Delhi, 1967
14. Tripathi, L.K., (Ed.)The Position and Status of Women in Ancient India, Varanasi, 1988 (2 Vols)
15. Sharma, R.K., Nationalism, Social reform, Indian Women (1921-1937), Patna, 1981
16. Bharat Maen Narivad, Delhi Uni. Hindi Karyanvayan Pub.
17. Agrawal, C.M. Yug-Yug Maen Nari, Almora, 2001
18. Bhartiya Samaj mein Stiaon ki Prasthiti, Rashtriya Simiti report, Allied pub. Delhi, ICSSR
19. Mishra, Urmila Prakash, Prachin bharat mein Nari, M.P. hindi granth Academy, 2002

SOHS/HIS/C006,: Political History Of Uttarakhand (C. 600 BC to 1949AD)

Unit 1- Early History of Uttarakhand

(i) Source Material for the Study of the History of Uttarakhand.
(ii) Outlines of the history of Uttarakhand from 600BC to Katyuri Period
(iii) Rise and downfall Of Katyuri dynasty.

Unit 2- State Formation in Uttarakhand

(i) Panwars Dynasty in Garhwal and Chands Dynasty in Kumaun and their administrative set up.
(iii Political Relations of Kingdoms of Uttarakhand with rulers of Delhi in medieval times and Sikh, Nepal and Sirmore.

Unit 3- Colonisation of Uttarakhand

(i) Gorkha invasion and its impact.
(ii) British administration in Uttarakhand-Land revenue and education..

Unit 4-Political Awakening and National Movement in Uttarakhand

(i) Press, Coolie Begar, Forest Agitations, Dola- Palki.
(ii) National movement in Uttarakhand since 1920.

Unit 5-Tehri Garhwal Princely State

(i) Administration
(ii) Prajamandal Movement and merger in Indian Union.

Recommended Readings:

1. Atkinson, E.T., The Himalayan Gazetteer, Vol. II,Pt.I-II (Hindi translation, Prakash Thapliyal, Dehradun, 2003)
2. Dabral, S.P., Uttarakhand Ka Itihas, Vol.1-17.Veergatha Prakashan, Dogadd, 1974-1991
3. Guha, Ramchandra, Unquite Woods,OUP, N. delhi 2001
4. Joshi, M.P., Morphogenesis of Kuninda Society, Almora, 1989
5. Joshi, M.P., Uttaranchal Sanskriti: RISHI,, Almora,1994

6. ---------- Uttarakhand Past and Present.(3 Vols),Almora,1990-93
7. Katauch, Y.S., Madhya Himalaya Ka Puratvatva, Lucknow, 1981
8. Katauch, Y.S.(ed.) Uttarakhand Ka Naveen Itihas, Dehradun, 2005
9. Nautiyal, K.P., Archaeology of Kumaon including Dehradun.Chowkhamba Prakashan Varanasi, 1969
10.Nautiyal, K.P.& B.M. Khanduri, Emergernce of Early Culture in Garhwal Himalaya, Srinagar. 1991.
11.Negi,S.S.,Madhya Himalaya Ka Rajnitik Avam Sanskritik Itihas,Vani Prakashan,Delhi, 1988.
12. Pande, B.., Kumaon Ka Itihas, Almora, 1990
13. PAHAR (Nainital) all relevant Volums
14. Khanduri, B.M., Archaeology of Alaknanda Valley,Book india, New Delhi, 1994'
15. Bhakuni, Hira, Sangramiyaun Ke Sartaj Pt. Badri Datt Pande, Bareilly, 1989
16. Manral, Dharam, Svatantrata Sangram Mein Yogdan.
17. Raturi, H.K., Garhwal Ka Itihas, Tehri, 1980
18. Rawat, A., History of Garhwal(1358 to 1947), Delhi, 1989
19. Saklani, Atul, The History of Princely State- Tehri.,Delhi, 1987
20. Saklani, Dinesh, Ancient Communities of Himalaya, Delhi, 1995
21.Tolia,R.S.,(ed.)British Kumaon-Garhwal(2 Vols), Walley, P.(discription),Almora,1994-96
22. Uttarankhand Bharati, all Vols.
23. Valdiya, K.S., (ed.), Kumaon Land and People,gyanodaya Prakashan, Nainital, 1988
24. Zaidi, Rehana, Madhya Himalaya Ke Partiya Rajya Avam Mughal Shashak, Delhi, 1994
25.Pathak Shekhar,Uttarakhand Mein Coolie Begar Pratha, Radhakrishna Prakashan, Delhi, 1987
26. Thapliyal, Rekha, Prachin Madhya Himalaya, N. Delhi, 1991
27. Kandari,O.P. & O.P. Gusain(ed.), Garhwal Himalaya: Society, Nature and Culture, Trans Media, Srinagar,2001
28. MUHA, Journal of Meerut University.Vols. 5- (Special Issue on Uttarakhand.)
29. Handa, O.C. History of Uttarachal, Indus Pub., N.Delhi, 2002
30.Bisht,Surendra Singh;Himalaya Maen Upniveshvad aur Paryavarnan, Trans Media Srinagar,2007
31. Khanduri, B.M & S.S.Negi; Uttarakhand : A Historical Profile, Trans Media, Srinagar, 2007
32. Zaidi,S.A.H.,& Rehana Zaidi, Garhwal-Mughal Sambandh, Aligarh, 1985
33. Sharma, D.D., Uttarakhand Gyan Kosh, Ankit Prakashan, Haldwani, 2012

M.A. HISTORY -Second Semester

Core/ Compulsory Courses

SOHS/HIS/C007,: Sources of Indian History

Unit 1 Ancient Indian literary sources: Sanskrit, Pali, Prakrit and archaeological sources

Unit 2 Medieval Sources: Sanskrit, Arabic, Persian, Urdu.

Unit 3 Bhakti literature

Unit 4 Modern Sources: English, and vernacular literature.

Unit 5 Modern Historians and their writings: V Smith, R.G.Bhandarkar, K.P. Jayaswal,R.C.Mazumdar,J.N.Sarkar,D.D.Kosambi,Irfan Habib,Bipin Chandra.

Recommended Readings :

1. Ali, B. Shaikh, History: Its Theory and Methods, MacMillon, 1978
2. Bloch, Marc, The Historians Craft, Vintage Books
3. Carr, E. H., What is History, Penguin, 1961, 1964 (Hindi also-1976)

4. Collingwood,R.G., The Idea of History, Oxford, 1961
5. Thomson, David, The Aims of History, 1972
6. Elliot and Dowson., History of India as told by its own Historians,
7. Elton, G. R., The Practice of History, London, 1967
8. Mukhia, Harbans, Historians and History of Medieval India,N.Delhi, 976
9. Thompson, J. W., History of Historical writing, New York,1942,1954
10. Gandhi, Leela, Post-colonial Theory
11. Thapar, Romila, The Past and the Prejudices, Delhi,1975
12. Thompson, Paul, The Voice of the Past
13. Phillips, G. G., Historians of India, Pakistan and Cylone.
14. Robert. N. Burns & Hugh Raymen,(edited) Philosophies of history, Oxford, 2000
15. Authur Marwick, The nature of history, Macmillan, London.
16.Michael Stanford, The companion to the Study of History, Blackwell, Oxford.1996
17. J. Gardiner, What is history today, Macmillan, London, 1988
18. Foucault Michel, The order of things, Tavistock Publications, London,1970 .
19. Appleby, Telling the truth about history,Norton, New York 1994
20. E.L. E. Roy Ladurie, The territory of the Historian, Harvester Press, Britain.1979
21. Toynbee, Arnold, A stduy of History (also in Hindi)
22. Edward, Said, Post Modernism – A Theory
23. ----------, Orientalism, London, 1978
24. Burke, Peter, History and Social Theory
25..Om Prakash, Hindi Kalam
26.Saxena, R. K., Sultnat Kalin Itihaskar
27. Saxena, R. K., Madhya Kalin Itihaskar
28.Khurana and Bansal; Itihas Lekhan, Avdharnaen tatha paddhyatiya, L.N. prakashan, Agra,2005-2006
29. Shridharan, Itihas lekhan, Orient Longman, 2011
30.Pande, G. C., Itihas Darshan, Jaipur, 1998
31.Verma, Lal Bahadur; Itihas Ke Bare Maen

SOHS/HIS/C008,: World History (C. 1848 to 1914 A.D.)

Unit 1- France

A. Establishment of second republic in 1848 A.D.
B. Napoleon III and the Second empire – Domestic and Foreign policy.
C. Problems faced by the Third Republic

Unit 2 -Germany

A. Unification of Germany 1848 A.D. to 1870 A.D.
B. Domestic and Foreign policy of Bismark 1870 A.D. to 1890 A.D.
C. William II and his world's politics.

Unit 3 -Italy

A. Unification of Italy 1848 A.D. to 1870 A.D.
B. Internal and External policy of Italy from 1870 A.D. to 1914 A.D.

Unit 4 -Eastern Question

A. Crimean War.
B. Berlin Congress – Circumstances, clauses and criticism.
C. Young Turk movement 1908 A.D.
D. Balkan Wars – 1912—1913 A.D.

Unit 5. -International diplomacy on the eve of World War I and Causes of First World War

Recommended Readings:

1. Bury, J.I.T. France, 1840 (Routledge Chapman and Hall, 1985).

2. Fisher, H.A.L., A History of Europe (London, Fontana Library, 1969).
3. Hill, Christopher, From Reformation to Industrial Revolution (Penguin, 1970).
4. Hill, Christopher, Lenin and the Russian Revolution (Penguin, 1978).
5. Hinsley, F.H. (ed.), And Modern History: Material Progress and World Wide Problems.
6. Joll, James, Europe Since 1870: An International History (Har-Row, 1973).
7. Langer, W.L., Diplomacy of Imperialism.
8. Langer, W.L., European Alliances and Alignments. (Greenwood, 1977).
9. Lefebvre, Georges, Coming of the French Revolution (Princeton, 1989).
10. Palmer, R.A. and Cotton, Joel, A History of Modern World, 6th ed. (Mcgraw, 1982).
11.Randal,J.G.&David Donald,The Civil War and Reconstruction 2nd rev., ed. (Heath,1969).
12. Rolls, Eric, History of Economic Thought.
13. Rude, George, Revolutionary Europe (1984).
14.. Saboul, A., The French Revolution.
15. Taylor, A.J.P., The Origins of the Second World War.
16. Taylor, A.J.P., The Struggle for Mastery in Europe (OUP, 1954).
17. Thompson, David, Europe Since Napoleon (Penguin, 1957, 1966).
18. Katalbey, Europe in Modern Times (Hindi and English)
19. Hazen, C.D., Modern Europe (Hindi and English)
20. Jain & Mathur, Vishwa Ka Itihas from 1500 to 1950 AD, Jaipur, 1999, 2001
21. Parthasarthi, G., Vuishva Ka Itihas (Delhi, Hindi Directorate, 1983)
22. Khurana & Sharma, Vishva Ka Itihash, Laxmi Narayan Agarwal, Agra, 2007
23. Chauhan, Devendra Singh, Adhunik Europe ka Itihas
24. Katalbey,C.D.M.; Adhunik Kal Ka Itihas(1789 to present time) translated by Vishwa Prakash, S.Chand, Delhi.

SOHS/HIS/C009: Constitutional History of India (C. 1858-to 2000AD) (with landmark Amendments)

Unit 1 -Introduction of Constitutional history of India–
The Government of India Act of 1858; The Indian Councils Acts, 1861&1892.

Unit 2 -Constitutional Development– The Indian Councils Act of 1909, Government of India Act, 1919.

Unit 3 -Government of India Act of 1935

Unit 4 -Cabinet Mission Proposals 1946, The Indian Independence Act of 1947, The Constitution of India, 1950 – Salient Features.

Unit 5 -Landmark Constitutional Amendments – 24th and 25th Amendments, 44th Amendment and 52nd Amendment, Anti Defection Law, 72nd and 73rd Amendments - Panchayat and Nagar Palika Acts.

Recommended Readings:

1. Kapur, A.C., Constitutional History of India.
2.Agarwal, R.C. 1988, Constitutional Development and National Movement of India, S.Chand & Co., New Delhi.17
3. Keith, A.B., The Constitutional History of India
4. Mahajan,V.D., Constitutional History of India
5. Chhabra,.G.S., Constitutional History of India
6. Sharma, Bhadra Dutt; Bharat Ka Samvadhanik Itihas, Shiv lal Agrawal, Agra.

Web Sources:

1. Constitution of India with all amendments:http://indiacode.nic.in/coiweb/welcome.html
2. Making of the Constitution:
http://www.legalserviceindia.com/constitution/const_india1.htm

3. Basic structure:http://www.humanrightsinitiative.org/publications/const/ the_basic_structure_of_the_i ndian_constitution.pdf
4. Extracts from the Constitution:http://mama.indstate.edu/users/india/country/const.html

SOHS/HIS/C010,: Indian National Movement (C.1919-to 1947 AD)

Unit 1- Gandhian Era -Non-Cooperation Movement -Khilafat Movement -Swarajist Party
Unit 2- Simon Commission; Lahore Congress; Civil Disobedience Movement; Quit India Movement.
Unit 3- Impact of World War II -Subash Chandra Bose and the INA
Unit 4- Peoples Movement in Indian Princely States; tribal and trade union movement in India
Unit 5- Rise of Communalism and Partition of India,

Recommended Readings:

1. Bipan Chandra, Nationalism and Colonialism in Modern India.
2. Sumit Sarkar, Modern India.
3. Chaudhary, V.C.P.,Theories on Indian Revolt of 1857.
4. Pandey, B.N., A Contemporary History of the Indian National Congress (Vols. 1,2,3)
5. Pattabi Sitaramaiah, The Indian National Congress.
6. Tara Chand (1972), Freedom Movement in India, (IV Vols), Government of India, New Delhi.
7. Majumdar, R.C., 1962, History of Freedom Movement in India, 3 vols, Calcutta.
8. Aggarwal, R.C., 1988, Constitution Development and National Movement of India, S.Chand & Co., New Delhi.
9. Judith Brown, Modern India.
10. Abel, M., 2005, Glimpses of Indian National Movement, (First Edition), The ICFAI University Press, Hyderabad.
11. Grover, B.L., and Grover, S., 1985, The Evolution of Indian Constitution and Freedom Struggle, S.Chand & Company Ltd, New Delhi. 1947, (First Edition), Indian Council of Historical Research, New Delhi.

SOHS/HIS/C011,: Ecology and Environment in History

Unit 1 **Ecology:** What is Ecology, Scope of Ecology,
Unit 2 **Environment:** What is Environment, Component of Environment, Environmental degradation and its impact on present and future.
Unit 3 **Environmental consciousness in ancient India and Conservation**:
The concept of nature in our spiritual traditions, Ethics of environmental awareness and conservation in ancient culture and literature of India.
Indus valley civilization: Planned urbanization, drainage system, worship of different components of nature, concept of prakriti and purush.
Pre-Vedic and Post-Vedic civilization.
Forest and wild life management in Maurya and Gupta period, small scale industries based on natural resources in ancient India.
Unit 4 **Environmental consciousness in Medieval India**.
Exploration of natural resources for economic development in early Medieval India.
Exploration of natural resources for ecological development in Mughal period. Over exploitation and ecological destabilization during later Mughal period.
Unit 5 **Environmental and Ecological consciousness in Modern India.**
British imperialism and Nature.

Over exploitation of natural resources.
Impact of industrialization on environment.

Unit 6 Environmental Movements in Independent India.
Narmada, Chipko and Aipiko.

Recommended Readings:

1. Agrawal, Arun, Environmentality, Oxford University Press, 2005
2. Arnold, David (ed.), Nature, Culture and Imperalism, OUP, 1996
3. Gadgil,Madhav and Guha, Ramachandra, This Fissured Land, OUP, 1993
4. Grove, Richard, Ecology, Climate and Empire, OUP, 1998
5. Guha, Sumit, Environment and Ethnicity in India, Cambridge University Press, 1999
6. Saberwal, Vasant, and Rangarajan, Mahesh (ed.), Battles over Nature, Permanent Black, 2005.
7. Sivaramkrishnan, K., Modern Forests: State making and Environmental Change in Colonial Eastern India, Stanford University Press, 1990.
8. Skaria, Ajay, Hybrid Histories, OUP, 1999.
9. Vaidyanathan, A., India's Water Resources, OUP, 2006.
10. William P.Cunningham & Barbara Woodworth Saigo, Environmental science, USA, 1990
11. E.P. Odum, W.B. Philadelphia (ed.) Fundamentals of Ecology, Pennsylvania USA-1959
12. Sharma,P.D. Ecology and Environment, Rastogi Publications, Meerut, 1990
13. Chopra, Puri & Das., Social, Cultural and Economic History of India Vol-I, II & III,
14. Mohd. Ahsan, Forest and Wild life Management in ancient India, Looking through the Mauryan Times, Paryavaran Gyan Yagya Samiti, Lucknow.
15. Srivastava, K.C. Prachin Bharat ka Itihas tatha Sanskriti (Hindi),United BookDepot, Allahabad, 2009-10
16. Verma., Harishchandra Madhyakalin Bharat (Hindi directorate, Delhi Uni),
17. Bipin Chandra ,(Hindi) Bharat Mein Arthik Rashtravada Ka Udbhav Aur Vikas,Anamika Publisher and Distributer, Delhi. 1998
18. K.A. Nilkantha Sastri., Nand Maurya Yugin Bharat(Hindi),Delhi, 1969

SOHS/HIS/C012,: Cultural History of Uttarakhand (from Earliest Times to 1949AD)

Unit 1 Sources of Cultural History of Uttarakhand

Unit 2 Society and Economy of Uttarakhand –
Tribes : Bhotia, Tharu, Boxa and Jaunsari
Social Stratification; Trans-Himalyan Trade

Unit 3 Religion in Uttarakhand: Folk and Pauranic-
Shaivite, Vaishnavite, Shakta and Nath Sects.

Unit 4 Religions in Uttarakhand
Buddhism, Jainism, Islam, Sikhism and Christianity.

Unit 5 Pilgrimage tradition in Uttarakhand
Chaturdham yatra ,Kumbha mela, Nanda Jat and Kailash Mansarover

Unit 6 Traditions of Uttarakhand
(ii) Oral Tradition: Songs,Jager,Dance and Drama.
(iii) Fairs and Festivals- Devidhura Bagwal, Bisu festival, Uttarayani, lossar, Jandha mela, Urs of Piran Kaliyar

Unit 7 Salient features of art and architecture of Uttarakhand.

Recommended Readings:

1. Atkinson, E.T., The Himalayan Gazetteer, Vol. II,Pt.I-II, (Hindi translation, Prakash Thapliyal, Dehradun, 2003)
2. Khanduri, B.M., Archaeology of Alaknanda Valley,Book India, New Delhi, 1994'

3. Joshi, M.P., Uttaranchal Sanskriti: RISHI,, Almora,1994
4. Dabral, S.P., Uttarakhand Ka Itihas, Vol.1-17.Dugadda- Kotdwar, 1973-1991
5. Nautiyal, K.P., Archaeology of Kumaon including Dehradun.Varanasi, 1969
6. Nautiyal, K.P.& B.M. Khanduri, Emergernce of Early Culture in Garhwal Himalaya Srinagar, 1991
7. Negi, S.S., Madhya Himalaya Ka Rajnitik Avam Sanskritik Itihas, Delhi,1988
8. Pande, B., Kumaon Ka Itihas, Almora 1996
9. Pande, T., Kumaon Lok Sahitya.
10. PAHAR(Nainital) all Volums
11. Chatak, Govind; Madhya Himalaya Ki Sanskriti, Indus Pub. N.Delhi, 2000
12. Kandari,O.P. & O.P. Gusain(ed.), Garhwal Himalaya: Society, Nature and Culture,Trans Media, Srinagar,2001
13. Sharma, D.D., Uttarakhand Ka Samajik Avam Sanskritik Itihas, Vol. I to V, Ankit Prakashan, Haldwani, 2012
14. Pokhariyal, H.C., Agrarian economy of the central Himalaya,Indus Pub.N.Delhi,1998
15. PAHAR(Nainital) all Volums
16. Naithani, S.P., Uttarakhand Ke Teerth avam Mandir, Srinagar, 1994
17.Agrawal, C.M., Golu Devta, The God of Justice of Kumaon Himalaya, 1992, Shree Almora Book Depot, Almora
18. Sharma, D.D., Uttarakhand Gyan Kosh, Ankit Prakashan, Haldwani, 2012
19. Mukundi Lal; Garhwal Painting,Publication Division, Govt. of India, Delhi, 1968
20. MUHA, Journal of Meerut University.Vols. 5- (Special Issue on Uttarakhand.)
21. Saklani, D.P.; Tribal Cmmunities of Uttarakhand, Indus Pub. Delhi,1995
22. Nautiyal S.N. Garhwal Lokmanas,Gaziabad,1975
23. ---------- Garhwal Loknritya, Gaziabad,1974,
24. Bhatt, M.C. Himalaya Ka Itihas, Parvtiya Ithas Parishad, 1986
25. Valdiya, K.S., (ed.), Kumaon Land and People,gyanodaya Prakashan, Nainital, 1988
26. Singh, Ram, Kali Kumaon, Pahad Pothi, Nainital, 2002
27. Pangti, S.S., Madhya Himalaya Ki Bhotia Janjati, Johar Ke Shaonka, N. Delhi, 1992
28, Guha, ramchandra, Unquit Woods, OUP, Delhi, 2001

Self Study Courses:Student has choose to one paper:

SSo1:- Science & Technology in Ancient India

Unit I

Science & Technology-Meaning, Scope& Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

Unit II

Origins and development of technology in pre-historic period, Beginnings of Agriculture & its impact on the growth of science & technology.

Unit III

Science & Technology during Vedic & Later Vedic times.

Unit IV

An outline of development of concepts: doctrine of five elements, Theory of atomism & attributes of matter in ancient India.

Unit V

Major developments in the history of science & technology from A.D. 1st Century to C-1200.

Recommended Readings:

1. Science, Technology and Medicine in Colonial India, 1999. The New Cambridge History of India.
2.Deepak Kumar, Disease and Medicine in India: A Historical Overview,
2. Deepak Kumar, Science & The Raj, OUP Delhi, 1995.
3. D. Raina and I. Habib, (ed), Situating History of Science: Dialogues with Joseph Needham,
4. Chakravarti D.K., India: An Archaeological History, Oxford University Press, 1999.
5. Dikshit. S.B., Bharatiya Jyotish Shastra, Poona, 1931
6. Kaye G.R., Hindu Mathematics,., Lahore, 1889.
7. Kaye G.R., Hindu Astronomy, Calcutta, 1924.
8. Jaggi, O.P., History of Science, Technology and Medicine in India, Atma Ram, Delhi.
9. Kumar, Anil, Medicine and the Raj,, 1998
10. The British Medical Policy 1835-1911, Sage Pub. New Delhi
11. Arnold, David, Colonizing the body: State Medicine and Epidemic Desease in nineteenth Century India, Berkley, University of California press, 1993
12. Chattopadhyaya, D., Science and Society in Ancient India, Research India Publication, Calcutta, 1977
13. Filliozat, Jean, The Classical Doctrine of Indian Medicine, Munshi Ram Manohar Lal, New Delhi, 1964
14. Keshwani, N.H., The Science of Medicine and Physiological Conception in Ancient and Medieval India, New Delhi, 1974
15. Madhu, D., The Antiquity of Hindu Medicine and Civilization, London, 1930.

SS02: Tribal Histories of India

Unit I

Concept of tribe: Indian and Western Definitions of Tribe,
Discourse on Tribes in Colonial and Post Colonial Times. Tribal Movements

Unit II

Introduction to Historiography of the Little Tradition.
Sources for the Reconstruction of Tribal history(Ethnography, Ethno- history and Oral history, travellers' and administrator accounts and field survey)',

Unit III

Tribe in Historical perspective;
(i)Tribes in Ancient India (ii)Tribes in Medieval India,(iii)Tribes in Modern India.

Unit IV

Tribal Uprisings in the Colonial and Post-Colonial India.

.

Unit V

Tribal Society in the Modern Perspective;
Changing Economic and Political Status of Tribes.
Constitutional safeguards for Tribes, Impact of ITDP.
Globalisation and Tribes.

Recommended Readings:

1. Ennew J.P. Hirst & K., Peasant as an Economic Category, Tribe, The Journal of Peasant Studies, 4(4) 295-322, 1977.

2. Charlton. T.H, Archaeology, Enthnohistory and Ethrology; Interpretative Interfaces, 1980,
3. M.B. Schiffer(ed), Archaeological Method and Theory- 4, Academic Press.
4. Boserup E., The Conditions of Agricultural growth, Chicago Aldine, 1965
5. Singh K.S., People of India Series,
6. Pratap,A.,The Hoe and the Axe; Ethohistory of Shifting Cultivation in Eastern India, 2000
7. Sahlines, M, Tribes men, , Prentice Hall, New York, Jersey, , 1968
8. Madan T.N., Introduction to Social Anthropology,
9. Bradley Birt F.B, Story of an Indian Upland, , London, Smith Elder and Co. 1905
10. Nadeem, Hasnain, Tribal India

M.A. HISTORY -Third Semester

Core/ Compulsory Courses

SOHS/HIS/C0013: Historical Writings: Schools & Historians

Unit1 Origins of Historical narrative, Greek and Latin Historiography: Herodotus, Thucydides, Polybius, Livy, Tacitus, St. Thomas Acquinas, St. Augustine & Church historiography.

Unit 2 Chinese tradition: Ssuma-chian.

Unit 3 Ancient Indian Historical tradition: Kalhana

Unit 4 Islamic Historical tradition: Ibnkhaldum, Al-Beruni, Ziauddin Beruni, Abul Fazal, Khafi Khan

Unit 5 Renaissance: General characteristics, Age of Enlightenment, Romanticism, Voltaire,.

Unit 6 Rise of Modern Historiography: Empirical tradition, Bury; Universalist/Idealist tradition:Toynbee, Spengler; Positivist tradition: August Comte, Ranke; Annales tradition: MarcBloch, Marxist Tradition: E.P. Thompson & E.J. Hobsbawm, Subaltern, Orientalism

Recommended Reading:

1. Buddha Prakash. Itihas Darshan. 1962.
2. Dubey, S.R.(ed.), Contemporary Historiography : Methodology & Trends (English & Hindi).Ujjain. 2001.
3. Pandey G.C. Itihas Swarup Avam Siddhants. Jaipur. 1993.
4. Pathak, V.S. Ancient Historians of India. Gorakhpur. 1984.
5. Philips, C.H. (ed.) Historians of India, Pakistan and Ceylon. London. 1961.
6.Shaikh Ali, B. History : Theory and Method. J.W. Thompson and Bernard Holm, A History of Historical Writing, Vol-I and 2, New York, Macmillan 1942.
7. John cannon, et. al.(ed), The Blackwell Dictionary of Historians, Oxford Basil Blackwell 1988.
8. Stuart Clark, The Annales Historians–Critical Assessment, Vol-I, London, Routledge, 1999.
9. R.G. Collingwood The Idea of History, , Oxford, OUP, 1946.
10.Peter Hardy, Studies in Indo-Muslim Historical Writing, London, 1997
11. Mohibbul Hassan, (ed.) Historians of Medieval India, Meerut, Meenakshi Prakashan, 1968.
12. D.D. Kosambi An introduction to the study of Indian History, Bombay, 1956.
13. R.C. Majumdar, Historiography in Modern India, Bombay, Asia publishing house 1967\

SOHS/HIS/C014,: Historical Tourism

Unit 1 **Introduction to history of tourism-**
Tourist Resources in India — Aims and Objectives. Types of Resources, Natural Land forms – Climate – Flora and Fauna, Water Bodies.

Unit 2 **Cultural and Historical Monuments of tourist interest-**

Caves: Ajanta, Ellora, Badami,
Temples: Sun temple Konark, Khajuraho temples, Balaji temple (Tirupati), Sravanbelgola,
Gurudwara- Amritsar
Dargah-Ajmer Sharif

Unit 3 **Monuments:** Delhi, Agra, Rockmemorial Kanya Kumari, Fatehpur Sikri, Churches of Goa,

Unit 4 **Museums :**National Museum, Delhi, Prince of Wales Museum, Mumbai, Victoria Memorial Museum, Kolkata, Salarjung Museum, Hyderabad

Unit 5 **Chaar Dham Yatra**: Badri, Kedar, Gangotri,Jamunotri,-

NOTE: Visit to Historical sites and Submission of a tour Report is Compulsory, it will be treated one sessional of 20 marks

Recommended Readings:

1. Chris Cooper and Fletcher, Tourism : Principles and Practices.
2. S. Wahab, Tourism Marketing.
3. James W. Morrison, Travel Agent and Tourism.
4. Joun Bakewell, The Complete Traveller.
5. Edword D. Mill's, Design for Holliday's and Tourism.
6. A. K. Bhatia, Toursim : Principles.
7. Dougles Pierce, Tourism Today : A Geographical Analysis.
8. Mujumdar R.C. (Gen. Ed.) for Arts Architecture Culture, Bhartiya Vidya Bhavan's All Volumes on Indian History, Mumbai – 1988.
9. Sinha, R.K., Growth and Development of Modern Tourism.
10. Lajpathi Rai, Development of Tourism in India.
11. Douglas Foster, Travel and Tourism Management.
12. Burbant, A.J., and Medik, S., Tourism, Past, Present and Future**.**
13**.** Lavkush Mishra**,** Religious Tourism in India.
14. Shivaramamurti, Art and Archtecture of India
15. K.S. Fonia,Tourism in Uttarakhand, Dehradun, 1977
16. Kandari OP. etc. ,Garhwal Himalaya-Society and Culture.
17. Archaeological Survey Report on Monuments,

SOHS/HIS/C015: Twentieth Century World (C. 1914 to-1945AD)

Unit 1 **Legacy of the Nineteenth Century**
Liberalism, Socialism, and Nationalism.

Unit 2 **World Order up to 1919**
Paris Peace Conferences and its consequences.

Unit 3 **Emergence of Socialist State**
Causes and impact of the Russian Revolution -establishment of a Socialist State and its impact.

Unit 4 **World between the Two Wars**
Working of the League of Nations and Collective Security; Crisis in capitalism- Great Depression; Ideologies of Nazism and Fascism: Germany, Italy and Japan; Policy of Appeasement.

Unit 5 **Second World War and its Effects**
Background; origin, nature and impact of the War.

Recommended Readings:

1. Schleicher, P., Charles, International Relations Co-Operation.
2. Palmer and Perkins, International Relations, CBS Publication, 1985
3. Schuman,F.L., International Politics, New York, 1969

4. Moon, P.T., Imperialism and World Politics since 1945.
5. Hughes, H.S., Contemporary Europe.
6 .Carr, E.H., International Relations since the peace treaties, MacMillan, 1974
7. Sen, A.K., International Relations since 1919.
8. Prakash Chander and Prem Arora, International Relations.
9. Hill, Christopher, Lenin and the Russian Revolution (Penguin.)
10. Hinsley, F.H. (ed.), Modern History: Material Progress and World Wide Problems.
11. Joll, James, Europe Since 1870: An International History
12. Langer, W.L., European Alliances and Alignments. (Greenwood).
13. Palmer, R.A. and Cotton, Joel, A History of Modern World,(Mcgrew).
14. Parks, H.B.,The History of United States of America.
15. Taylor, A.J.P., The Origins of the Second World War.Penguin, 1964
16. Taylor, A.J.P., The Struggle for Mastery in Europe (OUP).
17. Thompson, David, Europe Since Napoleon (Penguin).
18. Jain and Mathur, Vishwa Ka Itihas 1500 to 1950 AD., Jaipur, 2001
19. Khurana and Sharma, Vishwa Ka Itihas, L.N. Agarwal, Agra,2007
20. Parthsarthy, G., Vishwa Ka Itihas, Hindi Directorate, Delhi.
21. Chauhan, Devendra Singh., Europe Ka Itihas (1789to 1950A.D.).
22. Pushpesh Pant and Sripal Jain.,Anterrashtriya Sambandh
23. Dev, Arjun & Indra Arjun dev, Samkalin Vishwa Ka Itihas 1890-2008, Orient Blachswan, Hyderabad, 2009
24.Dutt,P.P., India's Foreign policy in the Changing World, New Delhi, 1999
25. Lalit man singh &others, Indian Foreign Policy; Agenda for the Twenty first Century, New Delhi, 1997

Web Sources:

Some World history resources.

1. www.hyperhistory.com/online_n2/History_n2/a.html
2. www.historyworld.net/
3. www.history.com/
4. http://www.wadsworth.com/politicalscience_d/special_features/ext/ir/tir/tir_infotrac1
5. International Relations Resource Centre http://www.isn.ethz.ch/
6. Foreign Affairs, http://en.wikipedia.org/wiki/Foreign_Affairs
7. Institute of Peace and Conflict Studies, New Delhi, http://www.ipcs.org/

GROUP A (Ancient India)

Major Elective/Specialised Papers

SOHS/HIS/E001A,: History of Ancient India (From Earliest to 185 BC)

Unit 1 Introduction of ancient Indian history

a. Geographical background and historical sources of ancient India.
b. Brief Outline of Palaeolithic, Mesolithic & Neolithic cultures of India.

Unit 2 Bronze Age, first urbanization

a. Chalcoltihic village societies of the north-west (Baluchistan, Sindh & Rajasthan).
b. Harappan Civilization: Urabanization; Important cities; governance;
c. Post Harappan Cultures, and Urban decline.

Unit 3 Background to the emergence of early Historic India

a. The Early Vedic Polity.
b. The Later Vedic Polity.
c. Iron technology & its' impact on historical process.

Unit 4 Janapadas and Mahajanapadas

a. Early Monarchical states and Gana-rajyasa
b. Political formations: monarchical and republican.
c. Rise of Magadha empire

Unit 5 Towards empire: Mauryas

a. Alexanders' invasion
b. Rise and fall of Mauryan Empire
c. Polity; nature and extent of centralization; and foreign relatios.
d. Kautilya's Arthashastra and Megasthenes' India.

Recommended Readings:

1. Allchin, B. and Allchin, F.R., Rise of Civilization in India and Pakistan (Delhi, Select Book Service Syndicate, 1983).
2. Allchin, Raymond and Bridget, Origins of a Civilization, Delhi, Viking, 1997
3. Chakrabarti, D.K., India: An Archaeological History, Delhi, OUP, 1999
4. Chattopadhyaya, D.P., Indian Philosophy, New Delhi, Popular Publishing House, 1986.
5. Thapar, B.K., Recent Archaeological Discoveries in India (Paris, UNESCO, 1985).
6. Dani, A.H., Recent Archaeological Discoveries in Pakistan, Paris, UNESCO, 1988
7. Jha, D.N. and Shrimali K.M., Prachin Bharat Ka Ithihas, Delhi, Hindi Directorate, 1990
8. Kulke, H, and D. Rothermund, A History of India, London, Routledge,1998
9. Majumdar, R.C. et al., History and Culture of the Indian People, Vols II, III, (Mumbai, Bhartiya Vidya Bhavan Series, 1970, 1979, 1980).
10. Munshi, V.K.M. and R.R. Diwakar, -Indian Inheritance, 3 vols, Bombay, Bhartiya Vidya Bhavan, 1965, 1970
11. Nilkanta Sastri, K.A., A History of South India from pre-historic times to the fall of Vijaynagar, Chennai, OUP, 1983
12. ------ Nand Mauryan Yugeen Bharat(Eng.& Hindi)., Motilal Banarasidas, Delhi, 1969
14. Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India (Delhi, Motilal Banarsidass, 1991) (Revised edition).
15. Sharma, R.S., Ancient Indian History, (Granth shilpi- reprint, 1999)
16. Thapar, Romila, Early India(from origin to AD.1300) penguin Book-2002.
18. ----- ---Ashoka and the Decline of Mauryas (Granth shilpi- reprint, 1999)
----------From Lineage to State, Oxford,1984, seventh ed.2002
---------- Interpreting Early india, oxford press,1992, ninth ed.2005
19. Raychaudhary, H.C., Political History of Ancient India, Delhi, 1996
20. Mookerjee, R.K., Ancient India, 1956
21. Smith, V.A., Early History of India, Oxford, 1924
22. Puri, B.N., India as described by early Greek writers,1939
23. Narain,A.K. The Indo-Greeks, Oxford, 1957
24.. Nilkanta Sastri, K.A., The Pandyan Kingdom,1972
25. Agrawal, D.P., Archaeology of India. New Delhi. 1984.
26. Agrawala,D.P.,& J.S. Kharkwal., Bronze and Iran Ages in South Asia. New Delhi. 2003.
27. Agrawala, D.P. & J.S. Kharkwal, South Asian Prehistory. New Delhi. 2002.
28. Ghosh, A,. The City in Early Historical India. Shimla. 1973.
29. Lal, B.B. and S.P. Gupta (eds), Frontiers of The Indus Civilization, Delhi. 1994.
30. Rapson, E.J., The Cambridge History of India, Vol. I. Cambridge. 1922 repr, delhi, 1955
31. Kosambi, D.D., Introduction to the Study of Indian History, Bombay, 1957
32. ------The Culture and Civilization of Ancient India: An Historical outline, London, 1965

SOHS/HIS/E0O2A,: History of Ancient India (C.BC 185 to 650A.D.)

Unit 1 Reconstructing ancient Indian history

Historical Sources and Historiographical interpretations.

Unit 2 Post Mauryan Dynasties and Polity

a. Sungas and Kanvas: Dynastic history

b. Indo-Greeks, Saka-Pahalavas
c. State formation in Central India and in the Deccan: Satavahanas and Western Kshatrapas.
d. The Kushanas: Political consolidation -extent and structure
e. Sangam age: chiefdoms.

Unit 3 Guptas and Vakatakas

a. Dynastic history of the Guptas: Political consolidation - structure.
b. Administrative organization, provinces and feudatory states.

Unit 4 Hunas

a. Huna and Aulikaras
b. The Dynastic history of Vakatakas

Unit 5 Maukharis and Pushyabhutis

a. Harsha-political consolidation and administrative organisation
b. Chalukyas and Pallavas: Extent of kingdoms and administration.

Recommended Readings:

1. Jha, D.N. and Shrimali K.M., Prachin Bharat Ka Ithihas, Delhi, Hindi Directorate,1990
2. Kulke, H, and D. Rothermund, History of India, Llondon, Routledge,1998
3. Majumdar, R.C. et al., History and Culture of the Indian People, Vols III,IV. Bhartiya Vidya Bhavan Series, 1970, 1979, 1980
4. Munshi, V.K.M. and R.R. Diwakar, Indian Inheritance, 3 vols, Bhartiya Vidya Bhavan, 1965, 1970).
5. Mazumdar, R.C., The Vakataka-Gupta, Vanaras, 1954
6. Gupta, P.L., The Imperial Gupta (2Vols), Vanaras, 1974-79, (Hindi- Gupta Samrajya).
7. Upadhyay, Vasudev. Gupta Samrajya Ka Itihas.
8. Rai, U.N., Gupta Samrat aur Unka Kal.
9. Sharma, B.N. Harsha and his Times.
10. Majumdar, R.C. Ancient India, Motilal Banarasidas, Delhi, 1974
11. Sharma, R.S., Ancient Indian History, Granth Shilpi, 1999
12. Sen, S.N., Ancient Indian History and Civilization, Willey Eastern limited, Delhi,1988
13. Raychaudhary, H.C., Political History of Ancient India, Delhi,1996
14. Mookerjee, R.K., The Gupta Empire, 1969
15. ---------- Harsha
16. Pannikar, K.M., Shri Harsha of Kannauj, 1922
17. Tripathi, R.S., History of Kannauj, 1927
18. Goyal, S.R., A History of Imperial Guptas, Allahabad,1967
19. Devahuti, D., Harsha: A Political Study,London,1970
20. Nilkanta Sastri, K.A., A History of South India from pre-historic times to the fall of Vijaynagar, Chennai, OUP, 1983
21. ---------- (edited by) Comprehensive History of Ancient India, Vol. II,
22. -------A History of South India, 1966
23. ---------- The Cholas, 1955
24. Gopalan, R., History of Pallavas of Kanchi, 1928
25. Venkataramanayya, N., The eastern Chalukyas of Vengi, 1950
26. Chattopadhyaya, S. Early History of Northern India. Delhi. 1976.
27. Mukherjee, B.N. The Kushana Geneology, Calcutta. 1957.
28. Narain, A.K. From Alexander to Kanishka. Varanasi. 1967.
29. Narain, A.K. The Indo Greeks. New Delhi. 1996.
30. Puri, B.N. India Under the Kushanas. Bombay. 1965.
31. Rapson, E.J. Cambridge History of India, Vol. I. Cambridge. 1922.
32. Sharma, R.S. Material Culture and Social Formations in Ancient India. Delhi. 1985.
33. Thapar, Romila, Early India (from origin to AD.1300),Penguin Book-2002.

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SOHS/HIS/E003A,: History of Ancient Nothern India (C. AD 650 to1200AD)

Unit 1 **Interpreting the period**
Historical Sources and Historiographical interpretations.

Unit 2 **Dynasties of Northern and eastern India:**
Gurjar-Pratiharas, Palas and Senas

Unit 3 **Dynasties of Western and central India :**
Parmar, Chandelas,Gaharwal and Chauhanas

Unit 4 **Polity & Administartion:**
Political structure-Central, Provincial and Local administration.

Unit 5 **Emergence of Feudalism in Northern India and struggle for Supremacy**

Recommended Readings:

1. Bhatia, P., The Parmars,Delhi, 1970
2. Bose, N. S., History of the Chandellas, Bombay,1956
3. Ganguli, D. C., History of the Parmar Dynasty,Dhaka Uni. Press, 1933(Hindi)
4. Chattopadhyaya, B.D., The Making of Early medieval India, New delhi, 1994
5. Majumdar, R. C. & Pusalkar, A. D., Imperial Kannauj
6. Ojha, G. H., Rajputana Ka Itihas
7. Pathak, V. N., Uttar Bharat Ka Rajnitik Itihas (Hindi)
8. Puri, B. N., The history of Gurjar-Pratiharas, Bombay, 1957
9. Chaudhary, H. C. Ray, Dynastic History of Northern India. Vol. I and II
10. Niyogi, Roma, History of Gahadwal Dynasty, Calcutta, 1959,.
11. Mittal, A.K., Prachin Bharat ka Rajnitik Avam Sanskritik Itihas
12. Tripathi, R. S., History of Kannauj
13. Sharma, R.S., Indian Feudalism (Hindi 1980) .
14. Verma, H.C., Madhya Kalin Bharat 750-1540 Part I (Delhi, Hindi Directorate, 1983).
15. Srivastava, K.C., Pachin Bharat Ka Itihas Avam Sanskriti, United Book Depot, Allahabad, 2009-10
16. H.C.Ray, Dynastic History of Ancient India, Vol. II
17. Majumdar, A.K., Chalukyas of Gujrat, Bombay, 1956
18. Sharma, D., Early Chauhan Dynasties, Delhi, 1959.

OR

GROUP-B (Medieval India)
Elective /Specialised Papers –

SOHS/HIS/E001B,: History of Delhi Sultanate (C.1192 to 1320AD.)

Unit 1 **Historiography and Contemporary Sources:**
a)Alberuni, b) Minhaz-us-Shiraj, c) Ziauddin Barni, d) Amir Khusro, e) Ibnbatuta

Unit 2 **Foundation and consolidation of Delhi Sultanate:**
a) Northern India on the eve of Turkish Invasion \
b) Causes of the success of Turks against the Rajputs

Unit 3 **Early Turkish Sultans: Problems, Conquests and Achievements**
(i) a) Qutubuddin Aibak, b) Iltutmish, c) Razia,
d) Nasiruddin Mahmud.
(ii) Balban's theory of Kingship

Unit 4 **The Khiljis:**
a) Khilji Revolution
b) Alauddin Khilji's theory of Kingship
c) Alauddin Khiljis rajput and Deccan policy

d) Mangol invasions during 13th Century

Recommended Readings:

1. Pandey, A.B., Early Medieval India, ed. 2nd, Allahabad, Central Book Depot, 1970
2. Rizvi, S.A.A., The Wonder that was India. Vol 2, London 1987, Delhi, Foundation Books, Reprint Paperback, 1993.
3. Sastri, K.A.N., History of South India, Delhi, CUP, 1975
4. Satish Chandra, Medieval India, From Sultanate to the Mughals, Delhi, Har Anand Publications, 1997
5. Stein, Burton, Peasant State and Society in Medieval South India, Delhi, CUP, 1980
7. Qureshi, H., Administration of Delhi Sultanate
8. Nizami, K.A. Comprehensive History of India, Vol. II
10. Elliot and Dowson, History of India as told by its Historians Vol. I, II, III
11. Rizvi, S.A.A., Khilji kalin Bharat
13. Sharma, L.P, Madhya Kalin Bharat
14. Srivastava, A.L., Delhi Sultenat
15. Mehta, J.L, Advanced Studies in Medieval India Vol. I
16. Lal, K.S., History of Khilzis (Hindi trans. Khilzi vansh ka itihas)
17. Singh Pratap, Madhyakaleen Bharat (1206-1526AD)
18. Mohd. Habib and Nizami, K.A. (Ed) Delhi Sultanat, Vol. I, Hindi trans., Nigam, V.P., Vol. I, Delhi, 1977
19. Mahajan, B.D., Madhyakalin Bharat, S.Chand & Co. Ltd, New Delhi, 2000

SOHS/HIS/E002B,: History of Delhi Sultanate (C. 1320 to 1526 AD.)

Unit 1 The Tughlaqs:

a) Ghiyasuddin Tughlaqs' expedition and estimate
b) Muhammad –bin Tughlaq and his plans, Character,, Personality.
c) Firozshah Tughlaq's Expeditions of Bengal, Kangra, Sindh and Katehar, Administrative reforms and Public works.
d) Timur's invasion

Unit 2 The Sayyaid and The Lodhis

a) Khijra Khan estimate,Reign of Mubarak shah
b) Afgan Theory of Kingship, Circumstances leading to the first battle of Panipat

Unit 3 Administration and other Aspects:

a) Central administration
b) Provincial administration
c) Causes of the collapse of Delhi Sultanate.

Recommended Readings:

1. Pandey, A.B., Early Medieval India, ed. 2 (Allahabad, Central Book Depot, 1970).
2. Rizvi, S.A.A., The Wonder that was India. Vol 2, London 1987,Delhi, Foundation Books, Reprint Paperback, 1993.
3. Sastri, K.A.N., History of South India (Delhi, CUP, 1975).
4. Satish Chandra, Medieval India, From Sultanate to the Mughals (Delhi, Har Anand Publications, 1997).
5. Stein, Burton, Peasant State and Society in Medieval South India, Delhi, CUP, 1980
6. Verma, H.C., Madhya Kalin Bharat 750-1540 Part I, Delhi, Hindi Directorate, 1983
7. Qureshi, H., Administration of Delhi Sultanate
8. Nizami, K.A., Comprehensive History of India, Vol. I
9. Hussain, M,. The Tuglaq Empire
10.Elliot and Dowson, History of India as told by its Historians, Vol., I,II,III, reprint, Delhi, 1996

12. ---------- Uttar Tuglaq Kalin Bharat
13. Sharma, L.P, Madhya Kalin Bharat , Agra, 1973
14. Srivastava, A.L., Delhi Sultenat
15. Mehta, J.L., Advanced Studies in Medieval India Vol. I
16. Singh Pratap, Madhyakaleen Bharat(1206-1526AD)
17. Mohd. Habib and Nizami, K.A. (Ed) Delhi Sultanat, Vol. I, Hindi trans., Nigam, V.P., Vol. I, Delhi, 1977
18. Johri, R.C., Feroz Shah Tughlaq

SOHS/HIS/E003B,: History of Mughal India (C. 1526 to 1627AD.)

Unit 1 **Historiography and Contemporary Sources:**

a) Babars' Tuzuk-I-Babri,
b) Gulbadan Begums' Humayunnama,
c) Abbas Kkhan Shervani- Tarikh-I-Shershahi
d) Abul Fazals'-Akbarnamah and Ain-i- Akbari,
e) Abdul Qadir badayunis'-Muntakhab ut- Tawarikh,
f) Tuzuk-I- Jahangiri

Unit 2 **Foundation of Mughal Empire in India:**

a) Babar-Conquests, Character and estimate
b) Humayun-Problems, relations with Sharshah Suri
c) Sharshah Suri- Administration and Military reforms

Unit 3 **Consolidation of Mughal Empire:**

a) Tutelage of Bairam Khan
b)) Relations with Rajputs
c) Mansabdari System
d) Religious policy

Unit 4 **Jahangir's Reign**

a) Role of Noorjahan in the contemporary politics
b) Revolt of Khurram and Mahawat Khan
c) Jahangir relations with rajputs.
d) Character and estimate of Jahangir and Noorjahan

Recommended Readings:

1. Verma, H.C., Madhya Kalin Bharat 750-1540 Part I, II, Delhi, Hindi Directorate, 1983
2. Tripathi, R.P., Rise and Fall of the Mughal Empire, Allahabad, Central Book Depot, 1963, (Hindi trans.. Mughal Samrajya Ka Utthan Avam Patan.)
3. Rizvi, S.A.A., The Wonder that was India. Vol 2, London 1987, Delhi, Foundation Books, Reprint Paperback, 1993.
5. Sastri, K.A.N., History of South India (Delhi, CUP, 1975).
6. Satish Chandra, Medieval India, From Sultanate to the Mughals, Delhi, Har Anand Publications, 1997
7. Stein, Burton, Peasant State and Society in Medieval South India, Delhi, CUP, 1980
8. Habib, Irfan, Agrarian System in Mughal India, OUP, Delhi, 2002
9. Nizami, K.A., A Comprehensive History of India, Vol. II
10. Elliot and Dowson, History of India as told by its Historians Vol. I, II, III, Delhi, 1996
11. Sharma, L.P, Madhya Kalin Bharat
12. Mehta, J.L. Advanced Studies in Medieval India Vol. II
13. Pandey, A.B., Later Medieval India, ed. 2nd, Allahabad, Central Book Depot, 1970
14. Richards, John F., Mughal Empire, New Cambridge History of India,. Delhi, Cambridge, 1993
15. Tripathi, R.P., Some Aspects of Muslim Administration.
16. Ali, Ahtar, The Nobility Uunder Mugal Empire

17. Saran, P., Islamic Polity
18. W.H. Moreland, India at the Death of Akbar,.
19. Khan, Iqtidar Alam,(Ed) Akbar and his Age, Delhi, 1999
20. Habib, Irfan (Ed.) Akbar and India, Delhi, 1999
21. Sharma, Religious policy of Mugham Emperor(Mughal Shasakon Ki Dharmik Niti)
22. Hadar,Mansura, Babur
23, Radhey Shyam, Babur
24 Banerji, S.K, Humayun
25. Srivastava, H.S,. Mughal Samrat Humayun
26. Kanoongo, K.R., Sher Shah and his Time (Hindi trans-SharShah Evam Uska Yug),1965
27. Aziz, Abdul, Mughal Mansbdari System
28. William Irvin, The Army of Indian Mughals
29.Prasad Beni, History of Jahangir.
30. Pant, Chandra, Nurjahan and her family.
31. Vandana, Parashar, Babur Bhartiaya Sandarbh mein

OR

GROUP-C (Modern India)
Specialised Paper: Modern India

SOHS/HIS/E001C,: History of Modern India (C.1757 to1857AD)

Unit 1 **Expansion and consolidation of British power**
Territorial expansion and diplomacy: Anglo –French Rivalry,Conquest of Bengal- Battle of Plessey and Buxar, Anglo-Mysore wars, Anglo-maratha wars.

Unit 2 **Colonial Construction of India: Structures and Institutions**
a. Administrative structure.
b. Arms of the state-police, army, law, civil service.

Unit 3 **British Paramountcy and Indian states**
a. Ring-Fence Policy-1757-1813
b. Subrdinate - Isolation policy-1813-1858

Unit 4 **Resistance to Colonial Rule -I**
a. Nature and forms of resistance.
b. Pre-1857- Peasant, tribal and cultural resistance.-economic complaints.

Unit 5 **Resistance to Colonial Rule -II**
a. Uprising of 1857: Causes and nature; leadership at various levels; people's participation;
b. British repression and response.

Recommended Readings:

1 . Bayly, C.A., Indian Society and the Making of the British Empire, The New Cambridge History of India, Vol. II (Cambridge,1988).
2. Bhattacharji, Sabhyasachi (trans.) Adhunik Bharat ka Arthik Itihas 1850-1947, Delhi, 1990
3. Bipan Chandra, et al., India's Struggle for Independence, 1857-1947, Delhi, Penguin, 1996
4. Brass, Paul, The Politics of India since Independence, Delhi, Foundation Books, 1994
5. Desai, A.R., Social Background of Indian Nationalism,Mumbai, Popular Prakashan, 1986
6. Dharma Kumar & Tapan Raychaudhuri, ed., Cambridge Economic History of India, Vol. II (Cambridge, 1982).
7. Heimsath, Charles, Hindu Nationalism and the Indian Social Reform Movement, Princeton, 1964
8. IGNOU Course Material, EH 1.1 and EH 1.5 (English & Hindi) (1858-1964) (1757-1857).
9. Kulke, H., and D. Rothermund, History of India, Australia, Crook Helms, 1986, D. Routledge,1998

10. Mazumdar, Datta and Ray Chowdhury (eds), Advanced History of India, London, Macmillan,1961
11. Panigrahi, D.N., ed., Economy, Society and Politics in Modern India, Delhi, Vikas, 1985.
12. Shukla, R.L., ed., Adhunik Bharat Ka Itihas, Delhi, Hindi Directorate, reprint 1998
13. Singh, Ayodhya, Bharat Ka Mukti Sangram, Delhi, Prakashan Sansthan, 1992
14. Spear, T.G.P., History of India, Vol. II, London, Penguin 1965
15. Sumit Sarkar, Modern India.
16 Majumdar, R.C .(Ed.) British Paramountcy and Indian Renaissance ,part I,
17. Aggarwal, Constitutional Development of National Movement.
18. Grover Yashpal,Adhunic bharat Ka Adytan Itihas.
19. Gopal S, Britsh Policy in India-1868-1905

SOHS/HIS/E002C, : History of Modern India (C.1858 to 1947AD)

Unit 1 India under the Crown –
a-The aftermath of the revolt
b-The conservative reaction

Unit 2 a) caution: Lytton, Ripon and Dfferin.
b) The apogee of administration- Curzon

Unit 3 a) Imperial policy-_annexation of Burma, relations with Tibet, relations with Afghanistan.
b) Indian Princely state. Policy of Subordinate Union-(1858-1919),

Unit 4 a) Indian Nationalism and British reaction. Debates on nature of Indian nationalism,
b)Gandhi and British administration: Gandhi - Irvin agreement. Gandhi and Government during and after World War II, Post war-politics-Poona pact-third round table.
c)working of provincial government.

Unit 5 Partition of India. Independence of India.

Recommended Readings:

1 . Bayly, C.A., Indian Society and the Making of the British Empire, The New Cambridge History of India, Vol. II (Cambridge,1988).
2. Bhattacharji, Sabhyasachi (trans.) Adhunik Bharat ka Arthik Itihas 1850-1947, Delhi, 1990
3. Bipan Chandra, et al., India's Struggle for Independence, 1857-1947, Delhi, Penguin, 1996
4. Brass, Paul, The Politics of India since Independence, Delhi, Foundation Books, 1994
5. Desai, A.R., Social Background of Indian Nationalism, Mumbai, Popular Prakashan, 1986
6. Dharma Kumar & Tapan Raychaudhuri, ed., Cambridge Economic History of India, Vol. II (Cambridge, 1982).
7. Heimsath, Charles, Hindu Nationalism and the Indian Social Reform Movement (Princeton, 1964).
8. IGNOU Course Material, EH 1.1 and EH 1.5 (English & Hindi) (1858-1964) (1757-1857).
9. Kulke, H., and D. Rothermund, History of India, Australia, Crook Helms, 1986, D. Routledge,1998.
10. Mazumdar, Datta and Ray Chowdhury (eds), Advanced History of India, London, Macmillan,1961
11. Panigrahi, D.N., ed., Economy, Society and Politics in Modern India, Delhi, Vikas, 1985
12. Shukla, R.L., ed., Adhunik Bharat Ka Itihas, Delhi, Hindi Directorate, reprint 1998
13. Singh, Ayodhya, Bharat Ka Mukti Sangram, Delhi, Prakashan Sansthan, 1992
14. Spear, T.G.P., History of India, Vol. II, London, Penguin 1965
15. Sumit Sarkar, Modern India (Hindi-Adhunik bharat, Delhi, 2001)
16 Majumdar, R.C .(Ed.) British Paramountcy and Indian Renaissance ,part I,
17. Aggarwal,A., Constitutional Development of National Movement.

18. Gopal S,Britsh Policy in India-1868-1905
19. Rai Satya ,Bharat mein rashtra vad Evam Upniveshvad.
20.Nautiyal Vikas-Adhunic Bharat ka Iitihas, vasu pub. N. Delhi, 2003-04
21. Pandey, B.N., A Contemporary History of the Indian National Congress (Vols 1,2, and 3)
22. Grover Yashpal,Adhunic bharat Ka Adytan Itihas.

SOHS/HIS/E003C,: India after Independance (C.1947to 2000 AD)

Unit 1 Independent India

a. Vision of new India.
b. Integration of Princely states.
Post- Partition refugee problem

Unit 2 Beginnings of Planned Economy and Progress.

a. Land acquisition and industrial policy.
b. Education; health; science; and technology, Women-Hindu Code Bill

Unit 3 Foreign Policy- non alignment , Pakistan and Kashmir Issue, Indo-China Dispute, War of 1962.Indo-Pak War -1965, Indo-Pak war and liberation of Bangladesh- 1971, Indo-Srilankas relations and tamil Issue.

Unit 4 Indian Parliamentary Democracy-Congress Governments and non Congress Governments, Popular movements--for Statehood.

Unit 5 India and its Neighbors- Nepal- Bhutan- Bangladesh and Sri Lanka –(1972-2000)

Recommended Readings:

28. M.J. Akbar, Riot after Riot: Reports on Caste and Communal Violence in India, Penguin India, 1988.
29. Amrita Basu and Atul Kohli, Community Conflicts and the State in India, Oxford University Press, 1988.
30. Jean Dreze, Meera Samson and Satyajit Singh, The Dam and the Nation, Oxford University Press, 1998.
31. David Ludden, Making India Hindu: Religion, Community and the Politics of Democracy in India, Oxford University Press, 1996.
32. P.V. Narsimha Rao, Ayodhya: 6 December, 1992.
33. Rob Jenkins, Democratic Politics and Economic Reform in India, Cambridge University Press, 1999.
34. Stephen P. Cohen, India: Emerging Power, Oxford University Press, 2001.
35. Jairam Ramesh, Making Sense of Chindia: Reflections on India and China, India Research Press, 2005.
36. Thomas Friedman, The World is Flat: A Brief History of the Globalized World in the 21st Century, Allen Lane, London, 2005.
37. Ramchandra Guha, A Corner of a Foreign Field: The Indian History of a British Sport, Picador, London, 2002.
38. Mukul Kesavan, Secular Common Sense, Penguin, 2001.
39. David C. Potter, India's Political Administrations: From ICS to IAS, Oxford University Press, 1996.
40. Devesh Kapur and Pratap Bhanu Mehta, Public Institutions in India, Oxford University Press, 2004.
41. Panigrahi, D.N., ed., Economy, Society and Politics in Modern India, Delhi, Vikas, 1985
42. Ramchand Guha, India After Gandhi, Picador,India
43. Bipan Chandra and Others, Post Independence India (also in Hindi)
44. Pushpesh Pant and Sri Pal Jain, Antarrashtriya Sambandh.
45. Edwards, Michael, Last Year of British Rule in India
46. Sinha, Manoj, Samkalin bharat: Ek Parichaya, orient Blackswan, 2012

Self Study Courses; Student has choose to one paper:

SS03: Science & Technology in Medieval India

Unit I

Concept of rationality & scientific ideas in India, Interaction with Arab thought & its reception.

Unit II

New developments in technology –Legacy of technology in medieval India, Impact of Arabian development on India with special reference to Persian wheel; gun powder, textiles; bridge building etc. A glimpse of science & technology during medieval period. an overview.

Unit III

Development in medical knowledge & interaction between unani and ayurveda & alchemy.

Unit IV

Astronomy & Mathematics in Medieval India; Interaction of India & Arabic Sciences.

Unit V

State of science & technology at the eve of British conquest.

Recommended Readings:

1. Bansal, J.D., The Social Function of Science, London 1939.
2. Bhargava, K.D.,(ed), Selections from educational records of Govt. of India, Scientific and Technical Education in India, NAI, Delhi, 1968
3. Bisvas, A.K., & K.L. Mukhopadhyaya, Science in India, Kolkata, 1969.
4. Dharmpal, Indian Science and Technology in the Eighteenth Century, Delhi, 1971.
5. Hoodbhoy Pervez, Islam and Science, London, 1991.
6. Ian Inkstem, Science & Technology in History, London, 1991.
7. Krishna, V.V., & S.S. Bhatnagar, Science, Technology and Development, Delhi, 1993.
8. Filliozat, Jean, The Classical Doctrine of Indian Medicine, Munshi Ram Manohar Lal, New Delhi, 1964
9. Keshwani, N.H., The Science of Medicine and Physiological Conception in Ancient and Medieval India, New Dlhi, 1974
10. Madhu, D., The Antiquity of Hindu Medicine and Civilization, London, 1930.
11. Jaggi, O.P., History of Science, Technology and Medicine in India, Atma Ram, Delhi.

SS04: Indian Society-Continuity and Change

Unit-I-

Change in the Indian Society Through the Ages:(i)Ancient (ii)Medieval

Unit-II-

(a) Change in Indian Society during Colonial and Post Colonial rule

(b) Urbanisation in India: In historical perspective

Unit-III-

(a)Process of Tradition and Modernization.

(b)Globalization: Concept and its Implications.

Unit –IV-

(a)Processes of Social Mobility among Castes.

(b)Proces of Sanskritization and Westrnization.

(c)Change in the position of Women in modern India.

Unit-V-

(a)Social Mobility among Scheduled Castes and Scheduled Tribes.

(b)Social Mobility in Indian Islamic Society.

Recommended Readings:

1. Aziz, Abdul, Poverty Alleviation in India: Policies and Programmes, New Delhi: Ashish Publishing, (1994),
2. Desai, Neera and Maithreyi Krishna Raj., Women and Society in India, New Delhi: Ajanta Publishers, (1987)
3. Desai, Neera & Usha Thakkar, Women in India Society, New Delhi: National Book Trust, (2007
4. Dube, S.C. , The Indian Village, New Delhi: National Book Trust, 1967
5. Ghurye, G.S., Caste and Class in India, Bombay: Popular Book Depot, 1957
6. Karve, Irawati, Hindu Society: An Interpretation, Poona: Deccan College, 1961
7. Prabhu, P.H., Hindu Society: An Interpretation, Poona: Deccan College,1979
8. Sharma, K.L., Social Inequality in India, New Delhi: Rawat Publications, (2001
9. Srinivas, M.N., India's Villages. Bombay: Asia Publishing House, 1960
10. Srinivas, M.N., Social Change in Modern India, Berkeley, California: University Press, 1970
11. Srinivas, M.N., India: Social Structure, Delhi: Chaman Offset Printers,1991
12. Mandelbum, D.G., Society in India, Berkeley: University of California Press, Vol. I Parts 24 & 4., 1990
13. Singh, Yogendra, Modernization of Indian Tradition: A Systematic Study of Social Change, New Delhi: Thompson Press, 1983
14. C. Parvathmamma , Scheduled Castes at the Cross Roads.

M.A. HISTORY -Fourth Semester

Core/ Compulsory Courses-

SOHS/HIS/C016: Twentieth Century World (C.1946 to2000AD)

Unit 1 **Emergence of new world order**

U.N.O. and World Peace; Nationalist Movements and Decolonization in-Asia, Middle East and Africa; Communist Revolution in China.

Unit 2 **Cold war and its impact**

Ideological and Political basis of Cold War (1947-1991)- Emergence of Power Blocks; Pacts and Treaties; The New Cold War; Disarmament.

Unit 3 **Disintegration of socialist block and end of cold war**

Socialism in decline-Disintegration of U.S.S.R.

Unit 4 **International associations and concerns**

Non-Aligned Movement; - SAARC, European Union; International concerns on terrorism and environment.

Unit 5 **India and its foreign policy**

India and its Neighbours – Sino-India and Indo-Pak relations

Recommended Readings:

1. Palmer and Perkins, International Relations
2. Schuman, International Politics.
3. Moon, P.T., Imperialism and World Politics since 1945.
4. Hughes, H.S., Contemporary Europe.
5 .Carr, E.H., International Relations since 1919.
6. Sen, A.K., International Relations since 1919.
7. Prakash Chander and Prem Arora, International Relations.
8. Hill, Christopher, Lenin and the Russian Revolution (Penguin.)
9. Hinsley, F.H. (ed.), Modern History: Material Progress and World Wide Problems.
101. Joll, James, Europe Since 1870: An International History
11. Langer, W.L., European Alliances and Alignments. (Greenwood).
12. Palmer, R.A. and Cotton, Joel, A History of Modern World,(Mcgrew).
13. Parks, H.B.,The History of United States of America.
14. Pushpesh Pant and Sripal Jain.,Anterrashtriya Sambandh
15. Taylor, A.J.P., The Origins of the Second World War.
16. Taylor, A.J.P., The Struggle for Mastery in Europe (OUP).
17. Thompson, David, Europe Since Napoleon (Penguin).
18. Jain and Mathur, Vishwa Ka Itihas 1500 to 1950 AD.
19. Khurana and Sharma, Vishwa Ka Itihas (L.N. Agarwal, Agra).
20. Parthsarthy, G., Vishwa Ka Itihas (Hindi Directorate, Delhi).
21. Chauhan, Devendra Singh., Europe Ka Itihas (1789to 1950A.D.).
22. Nanda, B.R., India Forein Policy: The Nehru Years, Delhi, 1976

Web Sources:

Some World history resources.

1.www.hyperhistory.com/online_n2/History_n2/a.html

2. www.historyworld.net/

3.www.history.com/

4.http://www.wadsworth.com/politicalscience_d/special_features/ext/ir/tir/tir_infotrac1

5. International Relations Resource Centre http://www.isn.ethz.ch/

6. Foreign Affairs, http://en.wikipedia.org/wiki/Foreign_Affairs

7. Institute of Peace and Conflict Studies, New Delhi, http://www.ipcs.org/

SOHS/HIS/C017,: History of U.S.A. (C.1865 to 1989AD)

Unit 1 **Civil war and its consequences:**

a) Causes and significance of civil war

b) Administration of Abraham Lincoln and the diplomacy of the civil war.

Unit 2 **Emergence of U.S,.A. as a world power;**

a) Foreign policy of Theodore Roosevelt and Woodrow Wilson.

b) Entry of USA in world war I and formation of League of Nations

c) Great Depression and New Deal programme of F.D. Roosevelt.

Unit 3 a) USA entry into world war II

b)Administration of Harry Truman and beginning of the cold war.

Unit 4 a) Administration of D.D. Eisen Hower. Korean war.

b)Administration of John F. Kannedy and cold war.

Unit 5 a) Lyndon B. Johnson and the beginning of the Vietnam war and its consequences.

b) Richard M. Nixon and end of the Vietnam war.

c) Foreign policy of USA from 1976 to 1989.

Recommended Readings:

1. Harries, Owen (ed.), America's Purpose: New Vision of U.S. Foreign Policy, S.G. Wasani,New Delhi, 1991.
2. La Feber, Walter, America, Russia, and the Cold War, 1945-1990, Mc-Graw Hill Inc., 1991.
3. Robinson, W.I., Promoting Polyarchy: Globalization, US Intervention and Hegemony,
4. Cambridge University Press, Cambridge, 1996.
5. Brewster, C., Seeing American Foreign Policy Whole, S.G. Wasani, Delhi, 1989.
6. Brockhampton, Dictionary of World History, Brockhampton Press, London, 1994

SOHS/HIS/C018 ,: Project work / Dissertation

a) Project Work – 60 marks
b) Sessionals- 20+20=40 marks(Viva, presentation)

GROUP-A (Ancient India)
Elective/Specialised papers

SOHS/HIS/E004A,: History of Ancient Southern India (C. 650 to 1200AD)

Unit 1 **Interpreting the period**
Historical Sources and Historiographical interpretations.

Unit 2 **Dynasties of the Deccan**:
Rastrakutas, Chalukyas of Badami and Kalyani,and Yadavas.

Unit 3 **Dynasties of South India:**
Cholas, Pallavas and Pandyas

Unit 4 **Polity & Administartion:**
Political structure-central, provincial and local administration.

Unit 5 **Emergence of feudalism in southern India and struggle for supremacy**

Recommended Readings:

1. Altekar A. S., Rashtrakutas and their Times, Poona, 1967
2. Majumdar, R. C. & Pusalkar, A. D., Imperial Kannauj
3. Shastri, K. A., Nilkantha, History of South India (also Hindi trans, Bihar Hindi Granth Academy, Patna-1986)
4. Srivastava, Balarama, Dakshin Bharat Ka Itihas (Hindi)
5. Tripathi, R. S., History of Kannauj, Delhi, 1959
6. Yazdari G.,(Ed.), Early History of the Deccan (Hindi, delhi-1960)
7. Sharma, R.S., Indian Feudalism (Hindi)
8. Subramaniam, T.N., South Indian Temple Inscriptions, Vol. I,II,III, 1953-54-55, Madras
9. Aiyenger, Ancient India.
10. Singh Upinder, Ancient and Early mediavel History of India, Delhi, 2000
11. Dubey, H.N., Dakshin Bharat Ka Brihat Itihas, Sharda Pustak Bhavan, Allahabad, 2006
12. Ludden, D., Peasant History of South India, Princeton, 1985
13. Karashima, N., History and Society in South india, reprint, Delhi, 2001
14. Stein, B., Peasant, State and Society in medieval South India, delhi, 1980

SOHS/HIS/E005A,: Society and Culture in Ancient India (Earliest time to 1200AD)

Unit 1 **S**tructure of society-varna system, origin and growth of caste, ashram, purusharthas, sanskaras, slavery system.

Unit 2 Marriage and family life, position of women.

Unit 3 Education system in ancient India.

Unit 4 Religion - Vedic religion - Shrutis & Smritis, devamandal during Vedic period, Upanishadic religious ideas.

Unit 5 Pauranic religion - rise and growth of Vaishanavism, Shaivism, Shaktism and other minor sects, Jainism, Buddhism.

Recommended Readings:

1 Hiriyanna, M., Essentials of Indian Philosophy (Delhi, Motilal Banarsidass, 1995).
2. Jha, D.N. and Shrimali K.M., Prachin Bharat Ka Ithihas (Delhi, Hindi Directorate, 1990).
3. Majumdar, R.C. et al., History and Culture of the Indian People, Vols 4. III, IV and V (Mumbai, Bhartiya Vidya Bhavan Series, 1970, 1979, 1980).
5. Munshi, V.K.M. and R.R. Diwakar, Bharatiya Vidya Bhavan Series -Indian Inheritance, 3 vols (Bombay, Bhartiya Vidya Bhavan, 1965, 1970).
6. Nilkanta Sastri, K.A., A History of South India from pre-historic times to the fall of Vijaynagar (Chennai, OUP, 1983).
7. Stein, Burton, Peasant State and Society in Medieval South India.(Delhi, OUP, 1980).
8. Thapar, Romila, A History of India, Vol. 1 (Pelican, 1966, Penguin, Harmondsworth).
9. ----------, Ancient Indian Social History; some interpretations, Delhi, 1978
10. Jain, K.C., Prachin Bharat ki samajik evam arthik sansthain
11. Om Prakash, Prachin Bharat ka Samajik evam Arthik Itihas, Willey Eastern, Ltd. 1986.
12. Srivastava, K.C., Pachin Bharat Ka Itihas Avam Sanskriti, United Book Depot, Allahabad, 2009-10
13. P.N. Prabhu, Hindu Social Organization, Bombay, 1972
14. A.L. Basham, Cultural History of India, Bombay, 1975
15. A.L. Basham, Aspects of Ancient Indian Culture, Bombay, 1966,
16. ----------The Wonder That Was India, New York, 1954, (Hindi- Adbhut Bharat)
17. U.N. Ghoshal, Studies in Indian History and Culture, Bombay,1975,
18. Thapar, Rolia, Cultural Past, OUP, Delhi, 2000
19. Om Prakash, Prachin Bharat Ka Samajik Avam Arthik Itihas, Willey eastern Ltd, n. Delhi, 1986

SOHS/HIS/E006A, **Economic life in Ancient India (Earliest time to 1200AD)**

Unit 1 Sources-primary & secondary; early stages of economic development.
Unit 2 State and ancient Indian economy.
Unit 3 Economic progress in Maurya and Gupta period, land ownership, irrigation system
Unit 4 Trade and trade routes: internal and external.
Unit 5 Credit and Banking System, business organization- guild system, development of textiles, handicrafts.

Recommended Readings::

1. Adhya, G.l., Early Indian Economics (Kolkata, Asia Publishing House, 1960).
2. Allchin, B. and Allchin, F.R., Rise of Civilization in India and Pakistan (Delhi, Select Book Service Syndicate, 1983).
3. R.C. Majumdar.,Corporate Life in Ancient India,
4. Gopal, L, Economic History of Northern India.. 750-1200 (Varanasi, Motilal Banarsidass, 1965).
5. Gupta, P.L. and T.S. Hardekar, Indian Silver Punchmarked Coins (Nasik, Indian Institute of Research in Numismatic Studies, 1985).
6. Gupta, P.L., Coins: India, the land and People (New Delhi, NBT, 1969).
7. Jha, D.N. and Shrimali K.M., Prachin Bharat Ka Ithihas (Delhi, Hindi Directorate, 1990).
8. Majumdar, R.C. et al., History and Culture of the Indian People, Vols III, IV and V (Mumbai, Bhartiya Vidya Bhavan Series, 1970, 1979, 1980).
9. U.N. Ghosal ,Contribution to the History of Revenue system,.
10. U.N. Ghosal. ,Agrarian System in Ancient India
11. Om Prakash, Prachin Bharat Ka Samajik Avam Arthik Itihas, Willey eastern Ltd, Delhi, 1986
12. Stein, Burton, Peasant State and Society in Medieval South India. (Delhi, OUP, 1980).

13. D.N. Jha. ,Studies in Early Indian Economic History,
14. R.S. Sharma.,Perspective in Social and Economic History of Early India,
15. D.N. Jha., Revenue System in post Maurya and Gupta times,
16. K.D. Bajpeyee., Bharatiya Vyapar ka Itihas (Hindi),
17. P. Niyogi., Economic History of Northern India,
18. Balram Srivastava.,Trade and Economics in Ancient India,
19. S.K. Das.,Economic History of Ancient India
20. Srivastava, K.C., Pachin Bharat Ka Itihas Avam Sanskriti, United Book Depot, Allahabad, 2009-10

OR

GROUP-B (Medieval India)
Elective/ Specialised Papers

SOHS/HIS/E004B, History of Mughal India (C. AD. 1627 to 1757A.D.)

Unit 1 **Historiography and Contemporary Sources:**
- a) Abdul Hamid Lahori- Padshahnama
- b) Khwafi khan-Muntakha-ul-lubab
- c) Bernier- Trevals in the Mughal Empire
- **d)** Manucci- Storia Do Mogur(Translated by W. Irvin)

Unit 2 **Shahjahan's Reign:**
- a) Deccan policy
- b) Central Asian policy
- c) War of succession

Unit 3 **Aurangzeb's Reign:**
- a) Deccan policy
- b) Rajput policy
- c) Religious policy
- d) Character and estimate

Unit 4 **The Marathas:**
- a) Rise of Shivaji
- b) Shivaji and his administration
- c) Shivaji's estimate

Unit 5 **Later Mughals Emperors, Administration and advent of Europeans':**
- a) Court politics and Jagirdari crises during later Mughal period
- b) Advent of European power- French and English.
- c)

Recommended Readings:

1.Gordon, Stewart, The Marathas. 1600-1818,The New Cambridge History of India, Delhi, Foundation Books, 1994
2.Tripathi, R.P., Rise and Fall of the Mughal Empire, Allahabad, Central Book Depot, 1963
4. Sastri, K.A.N., History of South India, Delhi, CUP, 1975
5. Satish Chandra, Medieval India, From Sultanate to the Mughals, Delhi, Har Anand Publications, 1997
6. Elliot and Dowson, History of India as told by its Historians Vol. V-VIII
7. Sharma, L.P., Madhya Kalin Bharat
8. Mehta, J.L,. Advanced Studies in Medieval India Vol. II
9. Pandey, A.B., Later Medieval India, ed. 2nd., Allahabad, Central Book Depot, 1970
10.Richards,John F.,Mughal Empire,New Cambridge History of India, Delhi, Cambridge, 1993
11. ---------- Some Aspects of Muslim Administration.
12. Ali, Ahtar, The Mughal Nobility and Aurangzeb
13. Saran, P., Islamic Polity
14. W.H. Moreland, From Akbar to Aurangzeb

15. Chandra, Satish, Parties and Politics at the Mughal Court (AD. 1707- 1740), Delhi 1982
16. ---------- Uttar Mughal Kaleen bharat.
17.Muzaffar Alam, The crises of Empire in Mughl north India, Delhi, 1986
18. Muzaffar Alam and sanjay Subramanyam, The Mughal state (1526-1750AD.), Delhi, 1998.
19. Saxana, B.P., Shahjahan of Delhi(Hindi Trans- Mughal samrat Shahjahan)
20. Sarkar, J.N., History of Aurangzeb.
21. William, Irvin, Later Mughals.

SOHS/HIS/E005B,: Society and Culture in Medieval India (C.1200 to 1757AD.)

Unit 1 **Indian society during Sultnate and Mughal periods:**
Social stratification, position of women, Customs and traditions.

Unit 2 **Education and Literature:**
Education during Sultnate and Mughal period, Literature during Sultnate and Mughal period: Hindi, Urdu, Persian.

Unit 3 Bhakti Movement. Ramanand, Kabir, Nanak, Chaitanya, Ballabhacharya, Tulsidas & Saints of Maharashtra.

Unit 4 Sufism- definition and growth sufi-silsilas, Chisti; Shuharwardi, Qadri and Naqshbandi

Unit 5 Main features of Architecture under Sultanate and the Mughals. Mughals and Rajput Painting, Cultural synthesis.

Recommended Readings:

1. Rashid, A., Society and Culture in Medieval India.
2. Srivastav, A.L., Medieval Culture
3. Kulkarni, A.R., Medieval Maharashtra, Delhi, Books & Books, 1996
4. Pandey, A.B., Early Medieval India, ed. 2nd, Allahabad, Central Book Depot, 1970
5. ---------- Later Medieval India, Allahabad, Central Book Depot, 1967
6. Richards, John F., Mughal Empire, New Cambridge History of India. Delhi, Cambridge, 1993
7. Rizvi, S.A.A., The Wonder that was India. Vol 2, London 1987, Delhi, Foundation Books,. Reprint Paperback, 1993.
8. Sastri, K.A.N., History of South India, Delhi, CUP, 1975
9. Satish Chandra, Medieval India, From Sultanate to the Mughals, Delhi, Har Anand Publications, 1997
10. Stein, Burton, Peasant State and Society in Medieval South India, Delhi, CUP, 1980
11. Verma, H.C., Madhya Kalin Bharat 750-1540 Part I,&II, Delhi, Hindi Directorate, 1983.
12. K.A. Nizami., Religion and Politics in India during Thirteen Century,
13 RadheyShyam, Madhya Kalin Samajic Avam Arthik Itihas
14. Das Ghanshyam, Madhya Kalin Bhartiy Samjik, Rajnitik Avam Arthik Sansthain
15. Levy, R. The Social Structure of Islam.
16. Carpenter J.E., The Islam in Medieval India,
17. Tarachand. , Influence of Islam on Indian Culture,
18. Yusuf Husain., Glimpses of Medieval India Culture,

SOHS/HIS/E006B,: Economic life in Medieval India (C.1200 to 1757AD.)

Unit 1 **Revenue Administration and Taxation:**

a) Allauddin Khiljis' revenue and economic reforms and market control
b) Sher shah Suri land revenue and currency reforms
c) Akbar's land and revenue reforms
d) Life and condition of farmers and artisans.

Unit 2 **Trade and Commerce and Monitory system:**

a) Inland and Meritime trade
b) Role of Arab and European traders
c) Indian marchents and their commercial practices
d) Medium of exchange, currency and coinage, Banking

Unit 3 **Industries and Production Technology:**

a) Textiles
b) Mughal Karkhan
c) Metal Technology

Recommended Readings:

1. Gordon, Stewart, The Marathas. 1600-1818,The New Cambridge History of India, Delhi, Foundation Books, 1994
2. Karashima, N., Towards A New Formation, South Indian Society under Vijaynagar Rule, Delhi, CUP, 1992
3. Rashid, A. Society and Culture in Medieval India.
4. Srivastav, A.L. Medieval Culture
5. Kulkarni, A.R., Medieval Maharashtra, Delhi, Books & Books, 1996
6. Pandey, A.B., Early Medieval India, ed. 2nd, Allahabad, Central Book Depot, 1970
7. ---------- Later Medieval India, Allahabad, Central Book Depot, 1967
8. Richards, John F., Mughal Empire, New Cambridge History of India, Delhi, Cambridge, 1993
9. Rizvi, S.A.A., The Wonder that was India. Vol 2, London 1987, Delhi, Foundation Books, Reprint Paperback, 1993.
10. Sastri, K.A.N., History of South India, Delhi, CUP, 1975
11. Satish Chandra, Medieval India, From Sultanate to the Mughals, Delhi, Har Anand Publications, 1997
12. Stein, Burton, Peasant State and Society in Medieval South India, Delhi, CUP, 1980
14. Verma, H.C., Madhya Kalin Bharat 750-1540 Part I &II, Delhi, Hindi Directorate, 1983
15. Moosvi, Shireen, The Economy of Mughal Empire : A Statistical Study, Delhi, 1987
16. Habib, Irfan, Agrarian System of Mughal India, OUP, 2002
17.---------- The Economic History of Medieval India : A survey, OUP.
18. Moreland, W.H. Agrarian System of Moslem India, Cambridge, 1920, reprint, Allahabad
19.Gupta, S.P. The agrarian System of Eastern Rajasthan, Manohar, Delhi, 1986
20 RadheyShyam, Madhya Kalin Samajic Avam Arthik Itihas
20. Das Ghanshyam, Madhya Kalin Bhartiy Samjik, Rajnitik Avam Arthik Sansthain

OR

GROUP-C: (Modernl India)
Elective/ Specialised Papers

SOHS/HIS/E004C,: History of Ideas in Modern India

Unit 1 Colonialism & emergence of new political ideas-utilitarianism, liberalism, nationalism, democracy, socialism, communalism, secularism.

Unit 2 Ideas of dissent & protest: constitutional opposition: Dada Bhai Nauroji; G.K. Gokhale; B.G. Tilak.

Unit 3 a) Anti caste movements in south and north India.
b) Mahatma Jyotiba Phule, Ambedkar

Unit 4 Gandhian social philosophy, its source, ideas on religion, civilization, social reform & education, emphasis on villages, women's rights, harijan uplift, struggle against casticism etc.

Unit 5 a) Sarvodaya & Bhoodan; integral humanism & radical humanism.
b)Left Centric Ideas-Naxalism and Maoism

Recommended Readings:

1. Eric Stokes ;The English Utilitarian and India,.
2. G.D. Bearce;British attitudes towards India,
3. M.K. Gandhi; Hind Swaraj,
------ (ed)'Essays on Gandhian politics,
4. Guha, R. C., India after Gandhi
5. Norman Lowe; Mastering world history
6. Gadgil and Guha, This Fissured land
7. Mclaughlin Elizabeth T.; Ruskin and Gandhi, , London, Buckell. Univ. Press 1979.
8. Bhattacharya,G.P.; M.N. Roy and Radical Humanism, Bombay, 1961.
9. Parekh, Bhikku; Colonialism, Tradition and Reforms : An Analysis of Gandhi's Political Discourses, New Delhi, Sage publications 1989.
10. Sudipta Karaj and Sunil Khilnami,(ed)Civil Society: History and Possibilities, New Delhi, Foundation Books 2000.
11. Chatterjee, Partha,; Nationalist Thought and the Colonial World : A Derivative Discourse, Delhi,1986, .
12. Pannikar K.N., Culture, Ideology and Hegemony: Intellectual and Social Consciousness in Colonial India, New Delhi, 1995.

SOHS/HIS/E005C,: Society and Culture in Modern India (C.1757 to 1964AD)

Unit 1 British understanding of Indian society, Christian Missionaries.

Unit 2 a) Indian response' Brahma Samaj, Arya Samaj, Prathana Samaj etc.
b)Theosophical Society & Mrs. Annie Besant,
c) Education-indigenous and modern.

Unit 3 Social reforms policy of East India Company & afterwards; social movement,

Unit 4 Dalit movement and B.R. Ambedkar

Unit 5 a)Rise and growth of the middle Classes.
b)NationalCultural policies: national academy and schools- Art, Drama, Dance, Music and Film

Recommended Readings:

1.Ali, Yusuf, Modern Indian Culture.
2.Chopra, Puri and Das, M.N.,A Social, Cultural and Economic history of India Vol.- II &III.
3. Das, M. N., Economic and Social Development of Modern India.
4. Dutta, K. K., A Survey of Socio-Economic History
5. Forquher, Modern Religious Movement in India
6. Frickenberg,Land Control and Social Structure in Indian History.
7. Gadgil,D.R., The Industrial evolution of India in Recent Time, Delhi, 1973
8. Griffith, The impact of British rule in India
9. Malley, O., Modern India and the West
10 Stokes, Erie, English Utilitarians and India
11. Hiemsath, Charles, Hindu Nationalism and the Indian Social Reform Movement, Princeton, 1964
12. IGNOU Course Material, EH 1.1 and EH 1.5 (English & Hindi) (1858-1964) (1757-1857).
13. Kulke, H., and D. Rothermund, History of India, australia, Crook Helms, 1986, D.

Routledge,1998
14. Mazumdar, Datta and Ray Chowdhury (eds), Advanced History of India, London, Macmillan,1961
15. Panigrahi, D.N.,ed., Economy, Society and Politics in Modern India, Delhi, Vikas, 1985
16. Rao, M.S.A., Social Movements in India, Vol.I, and Vol. II, Delhi, Manohar, 1978
17. Panigrahi, D.N.,ed., Economy, Society and Politics in Modern India, Delhi, Vikas, 1985
18. Rai, Satya. Bharat Mein Upniveshvad Aur Rashtravad, Delhi, 1998
19. B.B. Mishra , The Indian Middle Class,.
20. Charles Heimsath, Indian Nationalism and Hindu reform,
21. W.T. Burry, (ed), Sources of Indian Traditions,
22. Ballhatchet, Kenneth, Social Policy and Social Change in Western India,.
23. Guha, R.C. India After Gandhi, 2006
24. Sarkar, Sumit, Writing Social history, Delhi, OUP, 1997
25. Srinivas, M.N., Adhunik Bharat Mein Samajik Parivartan, New Delhi, 2007

SOHS/HIS/E006C,: Economic Life in Modern India (C.1757 to1964AD)

Unit 1 a)Indian Economy in the middle of 18th Century. The English East India Company and its rule in Bengal, South India and the Saran tic Debts.
b)The Drain of wealth and its mechanism, magnitude and effects**;**
c) Decay of Indian manufacturing.

Unit 2 a) The Permanent Settlement-objectives, operation. Its effects on Zamindars and peasants, official critiques, The Ryotwari Settlement of Madras Presidency, Ryotwari and the Mahalwari systems, consequence.

Unit 3 Trade & Commerce changing nature of external trade. Internal trade, Drain of wealth during the first half of the 19th century.

Unit 4 The Railways Imperialism of free trade, economic and political impulse behind Railway construction, economic consequence of railways.

Unit 5 Rise of modern Indian Industries, rise of cotton textiles industries and impediment to its growth, jute, coal, iron and steel. History of Banking 1757-1947, growth of currency policy and the emergence of Reserve Bank of India.

Recommended Readings:

1**.** Baden Powell,B.H., The Land system of British India,(3 Vols), Oxford, 1978
2.Chopra, Puri and Das, A Social, Cultural and Economic history of India Vol.- II & III.
3. Das, M. N., Economic and Social Development of Modern India.
4. Dutta, K. K., A Survey of Socio-Economic History
5. Forquher, Modern Religious Movement in India
6. Frickenberg,Land Control and Social Structure in Indian History.
7. Gadgil,D.R., The Industrial evolution of India in Recent Time, Delhi, 1973.
8. Griffith, The impact of British rule in India
9. Malley, O., Modern India and the West
10.Stokes, Erie, English Utilitarians and India
11.Dharma Kumar, (ed) The Cambridge Economic History of India, Vol-II, 1984,
12. IGNOU Course Material, EH 1.1 & EH 1.5 (English & Hindi) (1858-1964) (1757-1857).
13. Kulke, H., and D. Rothermund, History of India, Australia, Crook Helms, 1986, D. Routledge,1998
14. Mazumdar, Datta and Ray Chowdhury (eds), Advanced History of India, London, Macmillan,1961
15. Panigrahi, D.N.,(ed.), Economy, Society and Politics in Modern India, Delhi, Vikas, 1985
16. Dutt,R.C.,The Economic History of India, 1908
17. Panigrahi, D.N.,ed., Economy, Society and Politics in Modern India, Delhi, Vikas, 1985
18. Rai, Satya. Bharat Mein Upniveshvad Aur rashtravad, Hindi directorate, N.Delhi, reprint-

1988
19.Bipin Chandra, Bharat Mein Upniveshvad Aur Rashtravad, Delhi,1998
20. Mishra, Girish, Adhunik Bharat ka Arthik Itihas, Granth Shilpi, New Delhi, 1997.

Self Study Cources: Student has to choose one paper

SS05: Science & Technology in Colonial India

Unit I

Science & Empire: Theoretical perspectives: The role and place of STM in the Colonial process. Science & Colonial Explorations- State of Science & Technology on the eve of British conquest; East India Company and scientific exploration; early European scientists; surveyors, botanists, doctors under the Company's service.

Unit II

Growth of techno-scientific Institutions scientific & technical education establishment of engineering and medical college and institutes; teaching of sciences in universities; establishment of scientific institutions; Geological Survey of India and agricultural experimental farms.

Unit III

Indian response to western science. Indian response to new scientific knowledge; interactions and predicaments; science & Indian nationalism; emergence of national science and its relations vis-à-vis colonial science, Mahendra Lal Sarkar, P.C. Ray, J.C. Bose, M.N. Saha.

Unit IV

Science & development discourse: STM for development-Ideas for British government. Mahatma Gandhi and other Indian nationalists; professionalisation of science and their view personnel; Royal Commission and their reports; planning for development; National Planning Committee; Bombay plan; National Planning Advisory Board; and Central Advisory Board of Education; Transition from Dependent to Independent science.

Recommended Readings:

1. Deepak Kumar, Science & Empire, Anamika Prakashan, Delhi, 1991.
2. Deepak Kumar, Bharat Mein Angrejee Rajya Aur Vigyan Granth Shilpy, Delhi (Hindi).
3. Deepak Kumar, Prodyogiki Ewam Bharat Mein Angrejee Rajya, Delhi (Hindi).
4. Deepak Kumar, Science and the Raj, OUP, Delhi, 2000.
5. Deepak Kumar, Technology and the Raj, Sage, New Delhi,1995.
6. Deepak Kumar, Disease and Medicine in India, New Delhi,2001.
7. Dhruv Raina, Image and Context, Historiography of Science in India,OUP, Delhi,2003
8. Dharmpal, Indian Science and Technology in the Eighteenth Century, Delhi, 1971.
9. Ian Inkstem, Science & Technology in History, London, 1991.
10. Madhu, D., The Antiquity of Hindu Medicine and Civilization, London, 1930.
11. Jaggi, O.P., History of Science, Technology and Medicine in India, Atma Ram, Delhi.
12. Krishna, V.V., & S.S. Bhatnagar, Science, Technology and Development, Delhi, 1993.

SSo6: History of Indian Diaspora

Unit I

Diaspora: The concept: origin, evolution and contemporary usage, diasporic identities and their nature.

Unit II -Stages of Migration: A) Pre- Colonial-

(i) Indian; abroad in the days of remote antiquity,

(ii) early. Indian migration; Ceylon and South-East Asia; Central Asia; Iran and Afghanistan,

(iii)Merchants, labour and craftsmen in India; South East Asia, (iv) Indian Ocean trading system; migration of Indians to East Africa, South East Asia, Indonesia and West Asia.

Unit III- B) Colonial Migration

(i) emigration to British plantation colonies Fiji. Surinam, Guyana, Mauritius, Malaysia, Trinidad and South Africa.

Unit IV-C) Migration in the 20th Century:

(i) Migration to Canada and U.S.A. in late19th and early 20th Century

(ii) Migration between 1920's-1947

(iii)Migration of professionals to the United States, Canada, Australia and other nations,

(iv)Migration to the gulf countries.

Unit V

(a)Indian diaspora in host society- with specific reference to their social status, gender, race and ethnicity, economic, business, professional position vis-à-vis other ethnic communities, Political participation, religious cultural and community activities; inter-generational divide.

(b)Indian diaspora and homeland: cultural intellectual, religious economic and political connections; influence on domestic and foreign policy. India in the Diasporic Age: India's policy towards her diaspora.

Recommended Readings:

1. Peter Vander Veer (ed), A Sikh diaspora, contested identific and constructed realities in nation and migration, The politics of space in the South Asian diaspora. Philadelphia, U of Pennsylvania Press, 1995
2. Israel, Milton and N.H. Wagic, (Eds), Ethnicity, litentily and Migration; The South Asian Context, Toronto, U of Toronto Press, 1993.
3. Bates, Crispin, (ed), Community, Empire and Migration: South Asians in Diaspora, London, Macmillan.
4. Mishra, Vijay, "The Diasporic, Imaginary ; Theorizing, The Indian Diaspora" Textual Practices 10,1996.
5. Vertovic Steven, "Three meanings of Diaspora, Exemplified among South Asian Relations" Diaspora . 1997
6. Tinker, Hugh, The Banyan Tree; Overseas Emigrants from India, Pakistan and Bangladesh, Oxford, OUP. 1977.
7. Tinker, Hugh, A new system of slavery; The Export of Indian labour overseas (1830-1920), London, OUP, 1974.
8. Tinker, Hugh, Separate and Unequal; India : The Indians in the British Commonwealth, (1920-1950), London, Hurst, 1976.
9. Jayawardena C., "Migration and Social Change; A Survey of Indian Communities Overseas", Geographical Review 58 (1968).
10. Kondapi, C., Indian Overseas (1838-1949), Bombay, OUP, 1981
11. Jain, Ravindra K., Indian Diaspora, Globalisation and multiculturalism: A cultural analysis,

Historical Research Methods

Unit – I

What is Historical Research? Meaning, Nature and Scope,
Subject matter of History,
Structure and form of History, Historical Sense.

Unit – II

Formation of Research Problem and Design:
Sources; Primary, Secondary, Oral

Unit – III

Techniques of Data Collection: collection of Primary, Secondary, Oral Sources; Library, Archival, Field Survey, Historical Statistics, Linguistice Studies, Historical Mapping and Place Names.

Unit – IV

How to take Note and Arrange Material from Sources.

Unit – V

How to Write Report , Book review, Thesis,
Style and substance system of References and Footnote, Bibliography and Index.

Readings Recommended:

1. Ali, B. Shaikh, History: Its Theory and Methods, MacMillon, 1978
2. Bloch, Marc, The Historians Craft, Vintage Books
3. Carr, E. H., What is History, Penguin, 1961, 1964 (Hindi also-1976)
4. Collingwood,R.G., The Idea of History, Oxford, 1961
5.Jesminy Black and Donald M. Macraild, Studying History, Macmillan 1997.
6.Srinivas, M.N. and A.M. Shah, Fieldworker and The Field, New Delhi:Oxford University Press, 1979
7. Satish Bajaj K., Recent trends in Historiography, New Delhi, Anmol Publication, 1998.
8. E. Leroy Laduses, Times of Feast, Times of Femine: A history of clinate since the year 1,000, Michael Stanford, A Companion to the Study of History, Oxford, Blackwell, 1988.
9. N. Subramanian, Historiography and Historical Methods, Ennes Publications, 1973.
10. Thapar, Romila, The Past and the Prejudices, Delhi, 1975
11. Ahuja, Ram, Reserch Methods, Delhi: Rawat Publications, 2001
12. Blalock, Hubert M., Social Statistics, New York: Tata Mc-Graw-Hill 1970.
13. Gupta, S.P., Statistical Methods, New Delhi: Sultan Chand and Sons Publication,2002
14. Kothari, C.R. (1988), Research Methodology, Willey Publisheres, New Delhi.
15. Verma, Lal Bahadur; Itihas Ke Bare Maen
16. Pande, G. C., Itihas Darshan, Jaipur, 1998
17. Saxena, R. K., Sultnat Kalin Itihaskar
18. Saxena, R. K., Madhya Kalin Itihaskar
19 Khurana and Bansal; Itihas Lekhan, Avdharnaen tatha paddhyatiya, L.N. prakashan, Agra,2005-2006

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – HOME SCIENCE

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

HNB GARHWAL UNIVERSITY

Department of Home Science

School of Sciences

SYLLABUS

(w.e.f. July 2015)

Master of Arts

(Two Year Course – Semester System)

Admission of the Master's Program in Home Science shall be through entrance examination conducted by the University and the program shall be based on credit system in which credit defines the quantum of content/ syllabus prescribed for a course system and determines the number of hours of instruction per week.

The student shall be eligible for admission to a Master's Degree Program in Home Science after she has successfully completed a three year undergraduate degree or earned prescribed number of credits through the examinations conducted by University as equivalent to an undergraduate degree.

Core courses prescribed for every Semester shall be mandatory for all students registered for the Master's Program in Home Science and shall carry minimum 54 credits. Besides this there shall be Elective courses offered in semester III and IV and shall carry a minimum of 18 credits. A self-study course would comprise of maximum 09 credits of which one minimum 03 credits shall be mandatory which shall not be included while calculating grades.

In order to qualify for a two year master's degree, a student must acquire a minimum of 72 credits including a minimum of 18 credits in electives and one qualifying self-study course of minimum 03 credits. In the fourth semester, student has to study three electives. Dissertation is an optional elective. Therefore student has the option of either choosing three theory papers as electives or choosing two theory papers and Dissertation. The dissertation is to be allotted in the beginning of Third Semester and would be submitted during the examination of the Fourth Semester. Minimum

eligibility for Dissertation is 70% aggregate in last examination. University norms laid down in the ordinances of the PG Syllabus must be followed for evaluation of dissertation.

COURSE OUTLINE

First Semester (July to November)	Name of Course	Course Number	Credits	Marks
	Advanced Food Science – I	SOS/HSC/C001	03	100
	Theories of Child Development	SOS/HSC/C002	03	100
	Advanced Clothing Construction	SOS/HSC/C003	03	100
	Extension in Home Science	SOS/HSC/C004	03	100
	Research Methods	SOS/HSC/C005	03	100
	Practical	SOS/HSC/C006	03	100
		Core Credits	**18**	**600**

Second Semester (December to April)	Name of Course	Course Number	Credits	Marks
	Advanced Food Science – II	SOS/HSC/C007	03	100
	Life Span Development	SOS/HSC/C008	03	100
	Fabric Construction	SOS/HSC/C009	03	100
	Advanced Home Management	SOS/HSC/C010	03	100
	Statistics	SOS/HSC/C011	03	100
	Practical	SOS/HSC/C012	03	100
	Adolescence	SOS/HSC/SS01	03	100
	Computers	SOS/HSC/SS02	03	100
		Core Credits	**18**	**600**

Third Semester (July to November)	Name of Course	Course Number	Credits	Marks
	Community Nutrition	SOS/HSC/C0013	03	100
	Dyeing and Printing	SOS/HSC/C0014	03	100
	Practical	SOS/HSC/C015	03	100
	Electives (Any **three** of the following):			
	Advanced Food and Nutrition	SOS/HSC/E01	03	100
	Organization and Management of Early Childhood Education Center	SOS/HSC/E02	03	100
	Consumer Education	SOS/HSC/E03	03	100
	Early Childhood Education	SOS/HSC/E04	03	100
	Traditional Indian Embroidery and Textiles	SOS/HSC/E05	03	100
	Rural Sociology	SOS/HSC/SS03	03	100
	Child Welfare in India	SOS/HSC/SS04	03	100
	Core Credits (09)+Elective Credits (09)	**Total Credits**	**18**	**600**

Fourth Semester (December to April)	Name of Course	Course Number	Credits	Marks
	Food Safety and Preservation	SOS/HSC/C0016	03	100
	Children with Special Needs	SOS/HSC/C0017	03	100
	Practical	SOS/HSC/C018	03	100
	Electives (Any **three** of the following):			
	Guidance and Counseling	SOS/HSC/E06	03	100
	Psychological Testing and Measurement	SOS/HSC/E07	03	100
	Consumer Economics	SOS/HSC/E08	03	100
	Apparel Designing	SOS/HSC/E09	03	100
	Dissertation/Project	SOS/HSC/E10	03	100
	Marriage and Family	SOS/HSC/SS05	03	100
	Gender in Extension	SOS/HSC/SS06	03	100
	Core Credits (09)+Elective Credits (09)	**Total Credits**	**18**	**600**

Grand Total: Core Credits 54 + Elective Credits 18 = 72 Credits
Max. Marks for each paper: 100 (two Sessional Tests of 20 marks each + 60 marks Term-End Examination)

Sessional Tests: Mid-Term Test, Assignments, Classroom Seminars and Laboratory Work

The two-year Master's Programme will have the following components, viz.
(i) Core Course **(C)**: Minimum 54 Credits
(ii) Electives **(E)**: Minimum 18 Credits
(iii) Self study **(SS)**: Maximum 09 credits (one minimum 03 Credits course shall be mandatory but not to be included while calculating the grades)

* 01 Credit = 01 hour of lecture/instructions per week
01 Credit course = 15 hours of lectures per semester
** 03hours of practical work shall be considered equivalent to 01 hour of lecture.

SEMESTER - I: (06 Core Courses)

First Semester	Name of Course	Course Number	Credits	Marks
	Advanced Food Science – I	SOS/HSC/C001	03	100
	Theories of Human Development	SOS/HSC/C002	03	100
	Advanced Clothing Construction	SOS/HSC/C003	03	100
	Extension Education and Communication in Home Science	SOS/HSC/C004	03	100
	Research Methodology in Home Science	SOS/HSC/C005	03	100
	Practical	SOS/HSC/C006	03	100

Paper I (Core): SOS/HSC/C001: Advanced Food Science – I

(Credits: 03; Marks: 100)

Unit -1

Different food groups and their nutritive values

Beverages: Coffee, tea and Cocoa; Soft Drink; Alcoholic beverages

Unit -2

Fruits: Composition and nutritive value

Vegetables: Classification, composition, nutritive value and methods of cooking

Preserved and processed products from fruits and vegetables

Unit -3

Cereals: Breakfast cereals – Uncooked and ready to eat products; Cereal-based products – processed, fermented and baked

Pulses and legumes: Composition and processing; Toxic constituents of Pulses and elimination of toxic factors

Unit -4

Nuts and oilseeds: Use and processing

Fats and oils: Functions of oils and fats in food; Processing of fats

References

1. Amerine MA, Pengborn RM, Roceasier EB (1965). Principles of Sensory Evaluation and Academic Press, New York.

2. Srilakshmi, B. Food Science, 4th Edition, New Age Publishers, New Delhi

3. Food Science and Experimental Foods, M. Swaminathan, Bappco

Paper II (Core): SOS/HSC/C002: Theories of Human Development

(Credits: 03; Marks: 100)

Unit I:

Maslow's self-actualization theory

Freud's psychosexual or psychoanalytic theory

Erikson's psychosocial theory

Unit II:

Skinner's theory of Operant or instrumental conditioning

Pavlov's theory of classical conditioning

Thorndike's Trial and Error Learning

Unit III:

Kohlberg's six stages of moral reasoning

Unit IV:

Piaget's cognitive development theory

References:

1. Morgan, King et al (1999): "Introduction to Psychology", Tata Mc Graw-Hill Edition, Delhi, India
2. Hurlock E (2000): "Child Development", Tata Mc Graw-Hill Edition, Delhi, India
3. Bal Vikas evam Bal Manovigyan, Brinda Singh, Panchseel Prakashan, Jaipur

Paper III (Core): SOS/HSC/C003: Advanced Clothing Construction

(Credits: 03; Marks: 100)

Unit I:

Equipment used in clothing construction
Sewing machine: Parts and attachments; common defects and remedial measures, care and maintenance
Anthropometric Measurements: Need; taking measurements for different garments; precautions and method; tools and materials

Unit II:

Techniques of clothing construction:
Drafting: Meaning and importance; tools, method and precautions; drafting on paper and cloth;
Pattern making: Meaning and importance; parts of pattern; tools required; symbols used and general rules

Unit III:

General principles of clothing construction; Steps in clothing construction: Preparation of fabric for clothing construction; preparing layout; marking of cloth; principles of cutting; principles of stitching; finishing

Unit IV:

Use of construction features in design – seams, darts, tucks, pleats, gathers, placket opening, shirring, smocking
Different types of – necklines, collars, yokes and sleeves
Renovation of clothing

References:

1. Vastra evam Paridhan, Shashi Prabha Jain and Archana Jain, Shiva Prakashan, Indore
2. Parivarik Paridhan Vyavastha, Manju Patni and Sapna Henry,Star Publications
3. Vastra Vigyan ke Mool Sidhanth, G.P. Sherry, Vinod Pustak Mandir
4. Griha Vigyan Vishwakosh, Rama Sharma and M.K Mishra, Arjun Publishing House

Paper IV (Core): SOS/HSC/C004: Extension Education and Communication in Home Science

(Credits: 03; Marks: 100)

Unit 1
Home Science: Concept, objectives, areas and relationship with extension
Home Science Extension Education: Meaning, objectives, principles, process and methods

Unit 2
Qualities of home science extension worker
Extension education methods

Unit 3
Audio Visual aids in Home Science extension education
Agencies (national and international) associated with extension education for rural development

Unit 4
Community development: Organization, principles, characteristics and functions
Role of home scientists in community development

References

1. Griha Vigyan Prasar Shiksha, Manju Patney and U.S Thakur, Shiva Prakashan Indore
2. Communication for Development in the Third World Theory and Practices (1991) . Sage Publication, New Delhi.
3. Chaubey BK (1990) A Handbook of Education Extension, Jyoti Publication, Allahabad
4. Singh , R. (1987)Text Book of Extension Sahitya Kala Prakashan , Ludhiana
5. Extension Education in Community (1961) Ministry of Food and Agriculture, Government of India, New Delhi
6. Extension Programme Planning, Oxford and IBH Publishing Company Pvt. Ltd. New Delhi

Paper V (Core): SOS/HSC/C005: Research Methodology in Home Science

(Credits: 03; Marks: 100)

Unit I:
Methods of acquiring knowledge
Research: Definition, nature, need and steps

Unit II:
Definition and identification of research problem, selection of a problem
Nature, types and functions of hypothesis

Unit III:
Types of researches – Historical, survey and experimental
Research Design – Definition, types, basic principles and purpose

Unit IV:
Population and sample
Probability sampling
Non-probability sampling

Unit V:
Sources of Data
Data gathering instruments and techniques – interview, questionnaire, observation, case study, sociometery and projective techniques
Report writing

References:

1. Gupta, S.P., Statistical Methods, Sultan Chand and Sons, New Delhi, 1994
2. Jain, Gopal Lal, Research Methodology, Methods, Tools and Techniques, Mangal Deep Publications, Jaipur, 1998
3. Kothari, C.R.: An Introduction to Operational Research, Vikas Publishing House Pvt. Ltd, New Delhi, 1994
4. Wright, Susan E., Social Science Stastics Allyn and Bacon Inc., London, 1986
5. Wisniekwski, Mik, Quantitative Methods for Descision Makers, Mcmillan India Ltd., New Delhi,1986.

Paper VI (Core): SOS/HSC/C006: Practical

(Credits: 03; Marks: 100)

Practical:

1. Preparation of theme-based audio-visual aids: Chart, Poster, Flash Card, Pamphlet/Folder and Flannelograph.
2. Construction of darts, pleats, tucks, gathers; basic seams; collars and sleeves.
3. Drafting of adult basic bodice and sleeve block and stitching of blouse and kurta.
4. Understanding and handling of sewing machine: various parts; accessories; care, common defects and remedial measures

SEMESTER - II: (06 Core Courses)

Second Semester	Name of Course	Course Number	Credits	Marks
	Advanced Food Science – II	SOS/HSC/C007	03	100
	Life Span Development	SOS/HSC/C008	03	100
	Fabric Construction	SOS/HSC/C009	03	100
	Advanced Home Management	SOS/HSC/C010	03	100
	Statistics in Home Science	SOS/HSC/C011	03	100
	Practical	SOS/HSC/C012	03	100
	Adolescence	SOS/HSC/SS01	03	100
	Basic Computers	SOS/HSC/SS02	03	100

Paper I (Core): SOS/HSC/007: Advanced Food Science – II

(Credits: 03; Marks: 100)

Unit 1
Evaluation of foods: Visual examination and sensory evaluation (colour, texture, flavor and taste)
Fermented foods, pickles, sauces

Unit 2
Meat: Composition, cooking of meat; Changes produced during meat cooking; Meat substitutes
Fish: Type, composition and cookery, preservation and processing

Unit 3
Egg: Nutritive value and structure; Storage and processing; Effect of heat on egg protein; Egg products; Egg cookery; use of egg as a thickening agent and an emulsifying agent.
Milk: Composition and importance; Milk processing; Milk products; Milk substitute.

Unit 4
Sugar: Different types of sugars; Indian confectionary
Spices and condiments: Role of major and minor spices and their use; active principles in some spices, Adulteration of spices

References:
1. Handbook of Food Science and Experimental Foods, M Swaminathan, Bappco

Paper II (Core): SOS/HSC/008: Life Span Development

(Credits: 03; Marks: 100)

Unit I: Early Adulthood

Characteristics; Sub-stages; Developmental Tasks

Problems: Adjustments, Interests, Vocational, Marital life and adjustments, Divorce, Re-marriage, Unmarried life/singlehood

Unit II: Middle Age

Characteristics; Subdivisions; Developmental Tasks

Problems: Some common problems unique to old age; Physical changes, Health, Changes in interests, Vocational, Changing family pattern, Family adjustments, Loss of spouse

Unit III: Old Age

Characteristics; Subdivisions; Developmental Tasks

Types of Changes during ageing: Physical, Sensory, Sexual, Health, Changes in motor abilities, Changes in mental abilities and cognitive capacities, Changes in interests, Retirement, Loss of spouse; Vocational and Family life hazards of old age; Consequences of ageing

References:

1. Vikasatmak Manovigyan, Rajendra Prasad Singh, Jitendra Kumar Upadhyay, Rajendra Singh; Motilal Banarsidas, New Delhi.
2. Baal Vikas evam Baal Manovigyan, Vrinda Singh, Panchsheel Prakashan, Jaipur
3. Hurlock B Elizabeth (1981), Developmental Psychology – A Life Span Approach, Tata Mc Graw Hill
4. Hurlock B Elizabeth (1978), Child Growth and Development, Tata Mc Graw Hill
5. Hurlock B Elizabeth (1997), Child Development, Tata Mc Graw Hill
6. Papalia E Diane & Olds Wendkos Sally (1975), A Child's World – Infancy through Adolescence, Mc Graw-Hill Book Company
7. Berk E Laura (2000), Child Development, Allyn and Bacon

Paper III (Core): SOS/HSC/009: **Fabric Construction**

(Credits: 03; Marks: 100)

Unit I

Yarn construction – mechanical and chemical spinning; Different stages of yarn construction; Types of yarn – simple, textured and spun; simple – simple, ply, cord; novelty; ply, cable, double and novelty; yarn numbering and yarn twist

Blends – meaning, types, process and reasons for blending, difference between blends and mixed

Unit II

Methods of fabric construction: from solutions – film method, foam method, felting, non-woven method, from yarn – braiding, knitting, lace method and weaving

Non-woven fabrics – meaning, types, methods and uses

Felting – meaning, types and process

Unit III

Knitting technology: Definition, classification, material and equipments; Methods of knitting – weft knitting and warp knitting; Uses and disadvantages of knitted fabrics

Unit IV

Weaving technology: Definition, main operations; Characteristics of woven fabrics; Selvedge – types; Types of weaves

Loom – Parts of loom; Classification and types of loom; Motions of the loom

References:

Vastra Rachna evam Chappai Takneek, Jain and Gupta, Shiva Prakashan, Indore

Vastra Vigyan evam Paridhan Parichay, Patni, Agarwal evam Gupta; Shiva Prakashan, Indore

Vastra Vigyan ke Siddhanth, Reena Khanuja, Agarwal Publications

Vastra Vigyan evam paridhan vyavastha – Manju Patni, Star Publications

Paper IV (Core): SOS/HSC/010: Advanced Home Management

(Credits: 03; Marks: 100)

Unit 1

Management in family living, characteristics of management in home, role of home management, misconceptions regarding home management

Roles and responsibilities, characteristics and functions of a home manager

Unit 2

Values – Concept, characteristics, classification and factors influencing values

Goals – Concept, types, factors influencing goals

Standards – Concept, classification of standards

Interrelatedness of values, goals and standards

Unit 3

Management process: Planning, organizing, leading, controlling and evaluating

Decision making: Concept, steps, factors affecting, kind

Resources: Meaning and definition, role, characteristics, classification

Unit 4

Time Management: Tools – peak loads, work curves, rest periods and work simplification

Energy Management: Classification of efforts used in home making, fatigue – types and causes

Work simplification: Techniques – pathway chart, operation chart, micro-motion film analysis and path process chart

Unit 5

Money Management: Budgeting – Definition, importance and steps in planning a budget

Account keeping – importance, types of account systems, methods of handling money, family financial records

References:

1. An Introduction to Family Resource Management, Premavathy Seetharaman, Sonia Batra and Preeti Mehra, CBS Publishers and Distributors

Paper V (Core): SOS/HSC/011: Statistics in Home Science

(Credits: 03; Marks: 100)

Unit I

Meaning and uses of statistics, classification and tabulation of data

Construction of frequency distribution table

Unit II

Diagrammatic representation of data – single dimensional diagrams (line and bar), two dimensional diagram (pie)

Graphical representation of data – graphs of frequency distribution (histogram, frequency polygon, frequency curve)

Unit III
Measures of central tendency – mean, median, mode
Measures of dispersion – standard deviation

Unit IV
Analysis of data
Writing a research report

Paper VI (Core): SOS/HSC/012: Practical

(Credits: 03; Marks: 100)

1. Preparation of recipes from different Indian states
2. Preparation of low cost high nutritive value recipes
3. Drafting and lifting plan of different weaves on graph paper and glaze paper
4. Visit to a cloth weaving unit and report writing
5. Hand knitting samples/articles

Paper VII (Self Study): SOS/HSC/012: Adolescence

(Credits: 03; Marks: 100)

Unit 1
Puberty and Adolescence – definition and characteristics
Physical changes during puberty and adolescence and their impact on adolescent and family
Developmental tasks of adolescence

Unit 2
Social and emotional development during adolescence
Factors affecting social and emotional development
Role of parents, teachers, peers and society

Unit 3
Friendship patterns and social groupings during adolescence
Process of socialization
Development of interests and attitudes

Unit 4
Problems of adolescence – drop out from education system, juvenile delinquency – causes and prevention, addiction and alcoholism
Problems of adjustment, identity crisis

References:
Kishore-awastha, Vivah evam Parivarik Jeevan, Alka David, Shiva Prakashan, Indore

Paper VIII (Self Study): SOS/HSC/012: Basic Computers (Credits: 03; Marks: 100)

Unit I
Overview about computers – Definition, parts of computer system, working and functions of computer, history of computers, Generations of computers – First, Second, Third, Fourth and Fifth

Unit II
Characteristics of computer, applications of computers in various fields, classification of computers, types of Personal Computers
Components of a computer – Organization of computer, main parts of computer – CPU, Input devices, Output devices, memory

Unit III
Input devices – Meaning and their examples
Output devices – Meaning, types of presentation of output – text, graphic, sound; Types – Video Display Screen or Monitor, printer, plotter

Unit IV
Memory – Primary memory and its types; Secondary Memory and its examples
Hardware, Software, Skinware and Liveware

References:
Computer ka Parichay – Gaurav Agarwal, Shiva Prakashan, Indore

SEMESTER - III: (03 Core Courses + 03 Electives)

Third Semester	**Name of Course**	**Course Number**	**Credits**	**Marks**
	Community Nutrition	SOS/HSC/C013	03	100
	Dyeing and Printing	SOS/HSC/C014	03	100
	Practical	SOS/HSC/C015	03	100
	Electives (Any **three** of the following):			
	Advanced Food and Nutrition	SOS/HSC/E001	03	100
	Organization and Management of Early Childhood Education Center	SOS/HSC/E002	03	100
	Consumer Education	SOS/HSC/E003	03	100
	Early Childhood Education	SOS/HSC/E004	03	100
	Traditional Indian Embroidery and Textiles	SOS/HSC/E005	03	100
	Rural Sociology	SOS/HSC/SS003	03	100
	Child Welfare in India	SOS/HSC/SS004	03	100

Paper I (Core): SOS/HSC/C013: Community Nutrition (Credits: 03; Marks: 100)

Unit-I
Prevalence, etiology, biochemical and clinical manifestation and preventive measures for:
Protein Calories Malnutrition- Kwashiorkar and Marasmus

Unit II:
Prevalence, etiology, biochemical and clinical manifestation and preventive measures for:
Iron deficiency, Iodine deficiency; Fluorine Deficiency and Toxicity

Unit III:
Prevalence, etiology, biochemical and clinical manifestation and preventive measures for
Vitamin A deficiency; Beri-beri, Pellagra; Scurvy; Rickets, Osteomalacia and Osteoporosis

Unit IV:
Nutritional assessment and surveillance – Meaning, need, objectives and importance
Anthropometry – Need, importance, types, standards for reference
Biochemical methods – Biophysical or Radiological assessment, functional assessment, laboratory and biochemical assessment
Clinical assessment – Need, importance, identifying signs of deficiency diseases
Diet surveys – Need, importance, methods

Paper II (Core): SOS/HSC/C014: Dyeing and Printing

(Credits: 03; Marks: 100)

Unit I:
Dyes – Definition and classification of dyes
Different types of dyes: Natural dyes – Vegetable, animal and mineral; Synthetic dyes – direct, acid, basic, reactive, vat, sulphur, mordant, disperse, pigments
Suitability of various dyes to different fibres

Unit II:
Dyeing methods at different stages of processing – fibre, yarn, piece, union and cross
Colour fastness characteristics – washing, sunlight, crocking, and perspiration
Domestic methods of dyeing

Unit III:
Printing – Significance, methods – block, stencil, screen, roller
Faults in printing
Advantages and disadvantages of different printing methods

Unit III:
Preparation of printing paste, use of various ingredients and thickeners
Preparation of cloth for printing
After-treatment of printed goods

Printing of cellulosic fabric with pigments, azoic, direct, vat and reactive dyes
Printing of wool and silk with acid and reactive dyes

References:
Vastra Rachna evam Chappai Takneek, Jain and Gupta, Shiva Prakashan, Indore

Paper III (Core): SOS/HSC/C015: Practical **(Credits: 03; Marks: 100)**

1. Familiarize students with methods of assessment of nutritional status and conduct single person case study to assess and evaluate nutritional status or carry out a survey using anthropometric measurements.
2. Construction of articles using different types of printing and dyeing techniques

Paper IV (Elective): SOS/HSC/E001: Advanced Food and Nutrition
(Credits: 03; Marks: 100)

Unit 1
Dietary Nutrients in foods: Types, Functions, requirement, and sources; Digestion, absorption & Utilization of Nutrients; Energy – Requirements and B.M.R

Unit 2
Nutrition during different life cycles: infancy pre-school, pregnancy, lactation, old-age etc.

Unit 3
National nutrition policy and supplementary feeding programmes
National and international agencies in the field of nutrition
Therapeutic Nutrition: Definition, importance and scope, adaptation of normal diet for therapeutic purposes (Soft diet, full fluid diet, bland diet etc.)

Unit 4
Etiology, causative factors, preventive measures and planning of diets in febrile conditions (acute fever, typhoid, tuberculosis); gastro-intestinal disorders (diarrhea, constipation, peptic ulcers); kidney diseases (acute and chronic nephritis); diabetes mellitus, cardio-vascular diseases (hypertension, coronary heart diseases)

Reference
1. Cherley H (1982). Food Science (2nd edition), John Wiley & Sons, New York.
2. Gopalan C. (eds.) (1993) Recent Trends in Nutrition, Oxford University Press.
3. International Child Health: A Digest of Current Information.
4. Jallinek G (1985). Sensory Evaluation of Food Theory and Practice, Ellis Harwood Chicester.
5. Jelliffe DE and Jelliffe EFP (1989). Community Nutritional Assessment, Oxford University Press.

Paper V (Elective): SOS/HSC/E002: Organization and Management of Early Childhood Education Center **(Credits: 03; Marks: 100)**

Unit 1: Minimum requirements of Early Childhood Education Center:
Building requirements – physical structure and facilities; indoor space – size and arrangement of rooms; outdoor space; Equipment and Play Materials **–** Outdoor Play Equipment; Indoor Play equipment; Selection of Equipment and Play materials; Maintenance and display of materials; Safety requirements; Age for admission, Admission procedure. ECE programme – timings, content and methodology**;** Records in ECE center

Unit 2: Staff, Family and Community
Staff structure, qualifications; Essential Qualities (Personal and Professional) of ECE teacher; Role and Responsibilities of Pre-School teacher; Need and Importance of involving family and community; Methods of Involving Parents; Community Participation

Unit 3: Planning the Curriculum
Need for Planning ECE Curriculum; Principles in Developing Daily Schedules; Stages in Curriculum Planning – Planning of Long Term Goals, Planning of Short Term Goals, Identifying Play Activities, Formulating Daily and Weekly Schedules;

Unit 4: Evaluation
Concept and Purpose of Evaluation; Evaluating Play Activities; Evaluating Children; Tools for Evaluating Children; Evaluating ECE center

Paper VI (Elective): SOS/HSC/E003: Consumer Education

(Credits: 03; Marks: 100)

Unit 1:
Consumer – definition, meaning, characteristics and types
Consumer behavior – meaning, factors influencing, consumer and sales techniques
Steps in decision-making by the consumer

Unit 2:
Rights and responsibilities of the consumer
Problems of the Indian consumer
Consumer protection – meaning, definition, need, measures

Unit 3:
Consumer and Law
Consumer welfare
Consumer protection services

Unit 4:
Approaches for consumer education

Standard and standardization – meaning, definition, advantages and disadvantages, problems and obstacles

References:

1. Upbhokta Arthshashtra, Karuna Sharma, Manju Patni and Deepak Agarwal, Shiva Prakashan Indore
2. Parivarik Vit evam Upbhokta Shiksha, Karuna Sharma, Sandhya Sharma and Deepak Agarwal, Shiva Prakashan Indore

Paper VII (Elective): SOS/HSC/E004: Early Childhood and Education

(Credits: 03; Marks: 100)

Unit I: Historical perspective of early childhood education

Contribution of various thinkers (their ideology, applications and limitations)

Western: John Amos Comenius, Johann Heinrich Pestalozzi, John Locke, Friedrich Wilhelm Froebel, Jean Jacques Rousseau, Maria Montessori

Indian: Rabindranath Tagore (1861 – 1941), Gijubhai Badeka, M.K Gandhi, Tarabai Modak

Unit II: Principles of Early Childhood Education

Objectives; Need and significance; Basic Principles; The Playway Method; Early Childhood education services in India - Government Sector – ICDS, NIPCCD, NCERT etc; Voluntary Sector – ICCW, Balwadi, Mobile Creche´s, ECCE centers etc.; Private Sector (Nursery, Pre-Primary etc)

Unit III: Early Childhood Years (3 – 6 Years)

Children in the Early Childhood Years – Developmental Characteristics**;** Developmental needs**;** Interests**;** Significance of First Five Years of Life

Unit IV: Play

Concept of Play; Play and Learning; Role of play in development; Play as a means of understanding children's development; Different types of play among preschool children (unoccupied behaviour, onlooker, solitary independent play, parallel activity, associative play, cooperative or organized supplementary play)

References:

1. NCERT (1991), A Guide for Nursery School Teachers, NCERT, New Delhi
2. Seth Kanta, Ahuja Kavita (1996), Minimum Specifications for Pre-Schools, NCERT, New Delhi
3. Kohn Ruth (2003), The Exploring Child – A Handbook for Pre-Primary Teachers, Orient Longman, Delhi
4. Chowdhury D Paul (1995), Child Welfare/Development, Atma Ram & Sons, Delhi
5. Certificate Course in Organizing Child Care Services, IGNOU, (Block 1 to 6)
6. Grewal J S (1998), Early Childhood Education – Foundations and Practice, Har Prasad Bhargava, Agra

7. Kaul Venita (1991), Early Childhood Education Programme, NCERT, New Delhi
8. Mina Swaminathan, Bacchon Ke Liye Khel Kriyaen, UNICEF, New Delhi

Paper VIII (Elective): SOS/HSC/E005: Traditional Indian Embroidery and Textiles

(Credits: 03; Marks: 100)

Unit I

Historical background of traditional Indian embroidery
General embroidery techniques; Hand embroidery–knowledge of basic hand embroidery stitches

Unit II

Study of traditional embroideries of India: Texture, design and colour
Chikankari of Uttar Pradesh, Kantha of Bengal, Kasuti of Karnataka, Kutch Kathiawar of Gujarat, Phulkari of Punjab, Sindhi embroidery

Unit III

Traditional Textiles of India: Texture, design and colour
Woven (in design) – Patola, brocade, chanderi, paithani, pochampalli, ikat, maheshwari
Printed woven fabric – dacca muslin, tassar, kota doris
Printed – Sanganeri, kharhi print of Gujarat
Painted – kalamkari, madhubani
Resist dyed – bandhej of Gujarat and Rajasthan

Unit IV

Khadi: Significance – National and economic; Revolution in Khadi
Handloom: Definition, role in national economy and some chief handloom clothes of India

References

1. Parivarik Paridhan Vyavastha – Sapna Henry and Manju Patni, Star Publications
2. Vastra evam Paridhan – Shashiprabha Jain and Archana Jain, Shiva Prakashan, Indore

Paper IX (Self Study): SOS/HSC/S002: Rural Sociology

(Credits: 03; Marks: 100)

Unit I:

Rural sociology: Meaning, definition, need to study, scope and importance
Difference between rural and urban society

Unit II:

Characteristics of rural life
Caste system in rural society

Unit III:

Physical structure of rural society
Social organization of rural society

Unit IV:
Rural leadership – meaning, principles of leadership, types of leaders, qualities of leader, selection of rural leader

References:

1. nslkbZ ,- vkj Hkkjrh; xzkeh.k lekt"kkL, University Book House, Jaipur.
2. Doshi S. L. Rural Sociology, University Book House, Jaipur.
3. Ahuja Ram Social Problems in IndiaUniversity Book House, Jaipur.
4. Aggrwal G. K. xzkeh.k lekt"kkL= % vkxjk % lkfgR; Hkou
5. izlkj f'k{kk] gjiykuh] LVkj ifCyds'kUl] vkxjk
6. izlkj f'k{kk ,oa lkeqnkf;d fodkl] ikVuh ,oa Bkdqj] f'kok izdk'ku] bUnkSj

Paper X (Self Study): SOS/HSC/S004: Child Welfare in India (Credits: 03; Marks: 100)

Unit I: Child Welfare in India
Concept and historical perspective, Need and relevance
Historical evolution of Child welfare
Rights of children; Protection of Child rights; Convention on the rights of the child
Child in the Constitution of India

Unit II: Profile of child in India
Demographic: Total population, Child population, Sex ratio, Infant Mortality Rate (IMR), Literacy, School enrolment rate

Unit III: Children at Risk
Children in especially difficult circumstances, Children in emergency situation, Disabled child, Destitute child, Street child, Delinquent child, Working child
Social problems related to children – female foeticide (pre-birth and pre-conception elimination), juvenile delinquency, child labour, child abuse and child marriage, discrimination against girl child

Unit IV: Policies and Legislations for Child Welfare
National Children's Board, The National Policy for the Child, The National Children's Fund, Child Labor Cell
Child Labour Act; PC-PNDT Act; Child Marriage Act, The Children's Act, Juvenile Justice Act, Right to Education Act

Unit V: Child Welfare agencies and programmes in India
International, national and local agencies – governmental and non-governmental (UNICEF, ICCW, Mobile Creches, Bal Bhwan)
Welfare programs – ICDS, Mid-day Meal Programme, Universal Immunization Programme, etc

References:

1. Baig, T.A. (1979): Our Children. New Delhi: Ministry of Information and Broadcasting, Govt. of India
2. Chowdhry, D.P. (1980): Child Welfare and Development. Delhi: Atma Ram

SEMESTER - IV: (03 Core Courses + 03 Electives)

Fourth Semester	Name of Course	Course Number	Credits	Marks
	Food Safety and Preservation	SOS/HSC/C016	03	100
	Children with Special Needs	SOS/HSC/C017	03	100
	Practical	SOS/HSC/C018	03	100
	Electives (Any **three** of the following):			
	Guidance and Counseling	SOS/HSC/E06	03	100
	Psychological Testing and Measurement	SOS/HSC/E07	03	100
	Consumer Economics	SOS/HSC/E08	03	100
	Apparel Designing	SOS/HSC/E09	03	100
	Dissertation	SOS/HSC/E10	03	100
	Marriage and Family	SOS/HSC/S05	03	100
	Gender in Extension	SOS/HSC/S06	03	100

Paper I (Core): SOS/HSC/C016: Food Safety and Preservation

(Credits: 03; Marks: 100)

Unit 1

Food sanitation and hygiene

Food borne diseases

खाद्य स्वच्छता और स्वच्छता खाद्य जनित रोग खाद्य स्वच्छता और स्वच्छता खाद्य जनित रोग

Unit 2

Food Adulteration and Consumer Protection

Food laws and standards

खाद्य मिलावट और उपभोक्ता संरक्षण खाद्य कानून और मानक

Unit 3

Causes of food spoilage

Food preservation – Principles and methods

Home scale methods of food preservation

Unit -4

Fortification of foods with vitamins and minerals

Novel and processed supplementary foods

Enzymes in food processing

References:

1. Fundamentals of Foods and Nutrition, S.R. Mudambi and M.V. Rajagopal, New Age International (P) Ltd. Publishers
2. A Textbook of Foods, Nutrition and Dietetics, M.R. Begum, Sterling Publishers Pvt. Ltd.

3. Cherley H (1982). Food Science (2nd edition), John Wiley & Sons, New York
4. Gopalan C. (eds.) (1993) Recent Trends in Nutrition, Oxford University Press
5. Handbook of food and nutrition, M. Swaminathan, Bappco

Paper II (Core): SOS/HSC/C017: Children with Special Needs

(Credits: 03; Marks: 100)

Unit I:
Children with special needs: Definition, characteristics, classification according to types of impairment
Special education for children with special needs

Unit II:
Mental retardation: definition and levels, causes, identification, educational provisions
Gifted and creative children: definition, characteristics, special needs, identification and educational provisions

Unit III:
Visually handicapped children: Classification, identification and educational provisions
Hearing impaired: Classification, identification, causes and educational provisions

Unit IV:
Children with orthopaedic impairments: Definition, classification, causes, educational provisions and rehabilitation
Children with behaviour disorders: autism and aggressive behaviour

References:

1. Bhargava M. (1994)–Introduction to Exceptional Children, Sterling Publishers, New Delhi.
2. Kar Chintamani (1996)– Exceptional Children: Their Psychology and Education, Sterling Publishers, New Delhi.
3. Sahu B.K. (1993) – Education of the Exceptional Children, Kalyani Publishers, New Delhi.
4. Vishisht Avashyakta wale bacchon ki shiksha tatha nirdeshan evam paramarsh, Vinay Rishivar, Agarwal Publications
5. Vishisht Balak, Abha Rani Bisht and Swati Saxena, Agarwal Publications
6. Vishesh Avakshyataon waale Bacche Part I and II, DECE-3, Bacchon ke liye sewayen evam karyakram, IGNOU
7. Vishisht Baalak – Shiksha evam Punarwaas, Mahesh Bhargava, H.P. Bhargava Book House, Agra

Paper III (Core): SOS/HSC/C018: Practical **(Credits: 03; Marks: 100)**

1. Simple physical tests and chemical tests for detection of food adulterants
2. Home scale food preservation – preparing jam, pickle, chutney, sauce, syrup etc
3. Study of food label of processed foods available in the market
4. Case study/Report writing of a child with special needs/ a visit to an institution for children with special needs
5. Preparing an educational game or teaching aid for a child with special needs

Paper IV (Elective): SOS/HSC/E06: Guidance and Counseling

(Credits: 03; Marks: 100)

UNIT I

Guidance – Meaning, Aims, Scope, Need
Organs of guidance process
Foundations of guidance – philosophical, psychological and socio-cultural
Types – Educational, Vocational, Personal

UNIT II

Counseling – Meaning, Definition, Objectives, Need
Types of Counseling, Meaning, Characteristics, Steps, Advantages, Limitations
Relationship and difference between guidance and Counseling

UNIT III

Role of testing techniques in guidance, use of psychological tests, personality tests and aptitude tests in guidance
Non-testing techniques in guidance – interview, observation, case-study, cumulative record, sociometry

UNIT IV

Counselor – Qualities and Functions
Guidance and counseling during adolescence – vocational, choosing life-partner, marriage, parenthood and family life

References:

Kishore-awastha, Vivah evam Parivarik Jeevan, Alka David, Shiva Prakashan, Indore

Paper V (Elective): SOS/HSC/E07: Psychological Testing and Measurement

(Credits: 03; Marks: 100)

Unit I:

Introduction to psychological testing: Need, meaning, objectives, uses and design
Difference between testing and measurement
Criteria of a good psychological test; reliability, validity and standardization

Unit II: Measurement of intelligence and creativity

Intelligence: Meaning, types of intelligence tests; some standardized intelligence tests
Creativity: Meaning, some standardized tests of creativity

Unit III: Measurement of aptitude and attitude
Aptitude: Meaning, types of aptitude tests
Attitude: Meaning, attitude scales

Unit IV: Assessment of personality
Behavioural methods of personality assessment
Personality inventories
Projective techniques

References:

1. Adhunik Manovaigyanik Parikshan evam Maapan, Mahesh Bhargava, H.P. Bhargava Book House, Agra
2. Psychological Testing, Urbina Anastasi

Paper VI (Elective): SOS/HSC/E08: Consumer Economics (Credits: 03; Marks: 100)

Unit 1
Consumption – meaning, definition, characteristics and importance
Standard of living and measure of consumption
Needs – definition, classification, factors affecting and characteristics

Unit 2
Income and expenditure of consumer
Family budget – definition, importance, types and steps in planning a budget

Unit 3
Consumer buying habits
Advertisements – meaning, definition, types, advantages, disadvantages, techniques
Consumer credit – meaning, need, types and sources

Unit 4
Introduction to tax and their kinds
Main taxes in India
Income tax – meaning, characteristics, definition and importance

Paper VII (Elective): SOS/HSC/E09: Apparel Designing (Credits: 03; Marks: 100)

Unit 1
Design – Meaning, types (structural and decorative), patterns

Introduction to principles of design in relation to apparel designing

Unit 2
Introduction to elements of art in relation to apparel designing
Colour in relation to apparel designing – definition, dimensions, principles and schemes

Unit 3
Fit – Definition, Recognizing correct fit using structural lines, balance and ease to evaluate fit. Common problems encountered and remedies for fitting defects.

Unit 4
Fashion: Definition and principles
Sources of fashion
Factors favouring and retarding fashion
Some terms related to fashion industry

Paper VIII (Elective): SOS/HSC/E10: Dissertation (Credits: 03; Marks: 100)

Paper IX (Self Study): SOS/HSC/S03: Marriage and Family (Credits: 03; Marks: 100)

Unit I
Family – Definition, functions and types (with reference to family life cycle), characteristics of family, structure of family
Unit II
Marriage – Meaning, marriage as an institution, goals of marriage, Selection of life partner, Changes in marriage and their causes

Unit III
Marital adjustment – factors contributing to difficulties in marital adjustment, adjustment to life partner, sexual adjustment, economic adjustment, adjustment to in-laws, adjustment to parenthood

Unit IV
Marriage guidance and counseling – Meaning of counseling, factors causing tension in married life, importance of marriage guidance and counseling, areas in marriage requiring guidance

References:
Manav Vikas – Shashiprabha Jain, Shiva Prakashan, Indore
Manav Vikas Parichay – Shashiprabha Jain, Shiva Prakashan, Indore

Paper X (Self Study): SOS/HSC/S06: Gender in Extension (Credits: 03; Marks: 100)

Unit -1

Concept of gender and gender roles
Status of women: Gender-based discrimination – Dowry, female foeticide and infanticide, domestic violence, rape and sexual assault, harassment and exploitation, portrayal of women in mass media etc; discrimination in health, nutrition, education etc.

Unit -2
Empowerment of women: Concept and areas
National Policy for Empowerment of women

Unit -3
Laws protecting women: Crime against women and the law, women and personal/family law, laws relating to property and work

Unit -4
Role and functions of the Department of Women and Child Development, Central Social Welfare Board, State Social Welfare Boards, National Commission for Women
Programs for women

References:

1. Bhartiya Mahilaayen: Ek Samajik Adhyayan — Nishant Singh — Omega
2. Bhartiya Baalak: Samajik Arthik Drishtikon — D Arya — Omega
3. Bharat mein Upbhokta Shiksha — M Tripathi — Omega
4. Bhartiya Samaaj mein Naari — Sharma, Mishra — Arjun
5. Mahilaaon ke Kanuni, dharmik, samajik adhikar — Sharma, Mishra — Arjun
6. Mahila Sashaktikaran — Sharma, Mishra — Arjun
7. Bhartiya Nari: Vartman Samasyaen Bhavi Samadhan — Sharma, Mishra — Arjun
8. Mahilaon ke Maulik Adhikaar — Sharma, Mishra — Arjun
9. Gramin Vikas evam Mahila Vikas Karyakram — KS Srivastava — Discovery
10. Stree Sashaktikaran ke Ayam — Kavita Sharma — Rajat
11. Stree Vikas ki Aetihasik Ruprekha — Kavita Sharma — Rajat

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – HORTICULTURE

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Syllabus for Ph.D. Entrance Examination Horticulture, 2025

Plant Propagation and Nursery Management

Introduction, life cycle in plants,cellular basis for propagation, apomixis, polyembrony, germination process and environmental factors affecting it, quality of seeds, seed dormancy, treatments to facilitate germination, seed testing, diseases control during germination. Clone and phase variation, genetic variation in asexually propagated plants, production and maintenance of pathogen free clones, cutting- anatomical, physiological and biochemical aspects of root initiation in cuttings, types of cuttings, use of bio-regulators, mist systems of rooting cuttings, planting and care, layering- principles and methods. Reasons for grafting and budding, categories of root-stock, formation of graft and bud union, factors influencing the healing of graft union, limits of grafting, graft incompatibility, scion-stock relationship, techniques of grafting, budding and layering. Micro propagation: Introduction, objectives, merits and demerits, facilities and equipments, aseptic techniques and use of antibiotics, media preparation, micro propagation techniques- clonal propagation, direct organogenesis, embryogenesis, meristem culture, micro grafting, hardening, packing and transport of micro-propagules. Nursery Management: types of nursery, location, components planning and layout of a commercial nursery,structures, media mixtures, nursery management practices.

Advances in Orchard Management

Importance and scope of orchard management, constraint in fruit production, concept of high density planting. Orchard soil management systems, water requirement of fruit trees, factors affecting water requirement, classification of soil moisture, effect of soil moisture on fruit trees, disorders due to excess and deficient moisture, various factors affecting moisture supply to plants, drip and sprinkler irrigation, fertigation, multistory cropping, drainage systems, organic manures, fertilizers and bio fertilizers, role of elements in fruit production, disorders due to excess and deficiency of elements, evaluating need for nutrients/tissue analysis; integrated nutrient management(INM). Recent techniques of training and pruning, fruit thinning, splitting of fruits, pre-harvest fruit drop, rejuvenation of old orchards. Internal and external factors of unfruitfulness, practices to induce flowering; irregular bearing of fruit trees. Hardiness, winter killing, injuries and their protection, IPM, protection from important insects and diseases.

Systematic Horticulture

Introduction, importance and scope, botanical terminology. Plant classification history and systems- artificial, natural and modern systems. Nomenclature: importance, binomial classification and its salient features. Morphological description of (vegetative, floral and fruit features) of the following important families of fruits, vegetables and ornamental crops: Anacardiaceae- Mango, Cashewnut; Rutaceae- Citrus,Murrayas, Kamini; Musaceae- Banana; Myrtaceae- Guava, Bottle brush; Rosaceae- Apple, Pear, Plum, Peach, Apricot, Loquat, Rose; Apocyanaceae- Karonda, Kaner, Chandini; Vitaceae- Grapes; Sepindaceae- Litchi; Caricaceae- Papaya; Brassicaceae- cauliflower, cabbage, Radish, Turnip; Cucurbitaceae- Cucurbits; Solanaceae- Brinjal,Tomato, Chillies, Potato, Rat-ki-rani; Leguminaceae- Peas, Beans, Kachnar, Ashok, Cassia; Malvaceae- Bhindi, Hibiscus; Euphorbiaceae- Achalipha, Poinsettia, Croton; Nyctaginaeceae-Bougainvillea; Rubiaceae- Hamelia, Mussanda, Ixoraparviflora; Ramnaceae- Ber; Amaryllidaceae- Onion, Garlic.

Advances in Pomology: Tropical and Subtropical Fruits

Introduction, prospects and scope, constraints of fruit industry. Origin and distribution, area and production, taxonomy, classification and description of important cultivars, nutrition, bearing habit, pollination and fruit set, use of bio-regulators, special problems and physiological disorders in the production of the following fruits: Tropical and subtropical fruits- Mango, Citrus fruits, Banana, Guava, Grape, Litchi, Papaya, Pine-apple, Jack-fruit. Minor fruits- Ber, Aonla, Pomegranate, Loquat, Sapota, Phalsa, Bael, Karonda,

Advances in Medicinal, Aromatic and Spices Crops

Introduction, prospectus and scope, opportunities and constraints in the cultivation and maintenance of medicinal, aromatic and spices in India. Origin and distribution, area and production, taxonomy, classification and description of cultivars, use of bio-regulators, seed production, specific problems and physiological disorders of the following: Medicinal Plants: Withania, periwinkle, Rauvolfia, Dioscorea, Isabgol, opium poppy, Belladonna, Cinchona, Pyrethrum and other species relevant to local conditions. Aromatic Plants: Citronella grass, khus grass,flag (baje),lavender, geranium, patchouli, mentha, occimum and other species relevant to the local conditions. Spices crops: Pepper,cardamom, ginger, turmeric, clove, nutmeg, cinnamon, coriander, fenugreek, and other species relevant to local conditions.

Statistical Methods and Experimental Designs

Sampling theory- introduction, simple random sampling, estimates of sampling variance, stratified random sampling, two stage sampling, systematic sampling, estimate of proportions. Test of hypothesis- introduction, one sample t-test and two sample t- test. Chi-square test- properties, testing significance of properties, testing independence of tributes Bartlett test, (F- Test). Correlation- coefficient of correlation, test of significant, Fisher's Z- transformation, rank correlation, intra-class correlation. Regression- regression curve, fitting of line regression. Need for an experiments, designing of an experiment, experimental error, principles of experimental design, analysis of designed experiments- analysis of variance, mathematical details, assumptions, transformation and ANOVA table, pair-wise comparisons and specific comparisons of treatments. Completely randomized design- layout, application, merits and demerits, analysis of equal and unequal observations. Randomized block design- layout, application, merits and demerits, analysis, efficiency of blocking. Latin square design- layout, application, merits and demerits, analysis, change over design. Analysis of covariance for reduction of experimental

error in CRD, RBD and L. S. designs. Split plot and related designs layout, application, merits and demerits, analysis, efficiency, variants of split plot design, strip plot design. Factorial experiments- concept of factorial treatments, definition of main effects and interrelations, analysis of series using Yates method.

Advances in Temperate-Zone Pomology

Introduction, scope, area and production, temperate regions, contour planting, rest period and chilling requirement. Origin and distribution, area and production, taxonomy, classification and description of important cultivars, clonal rootstocks, training techniques, bearing habit, pollination and fruit set, use of bio-regulators, special problems and physiological disorders of the following fruits: Pome Fruits- Apple and Pear, Stone Fruits- Peach, Plum, Apricot, Cherry and Almond, Nut Fruits- Walnut, Pecannut, Hazelnut and Pistachio etc, Berries- Strawberry, Raspberry, Gooseberry, Kiwi fruit. Exposure to wild fruits of Uttarakhand hills.

Advances in Olericulture

Introduction, types of vegetable farming, vegetable forcing, bio-regulators in vegetable production, principles of vegetable seed production. Origin and distribution, area and production, taxonomy, classification and description of cultivars, use of bio-regulators, seed production, specific problems and physiological disorders of the following vegetables: Solanaceous Vegetables- Potato, Tomato, Brinjal, Chilli, Capsicum, Root Vegetables- Radish, Turnip, Carrot, Cole Vegetables- Cauliflower, Cabbage, Knol-khol, Legume Vegetables- Peas and French bean, Bulb Vegetables- Onion, Garlic, Cucurbits- Cucumber, Water melon, Bottle gourd, Sponge gourd, Musk melon, Pumpkin, Leafy Vegetables- Spinach, Amaranthus, Okra and Sweet Potato

Canopy Management in Fruits Crops

Canopy management - importance and advantages; factors affecting canopy development. Canopy types and structures with special emphasis on geometry of planting, canopy manipulation for optimum utilization of light. Light interception and distribution in different types of tree canopies. Spacing and utilization of land area - Canopy classification; Canopy management through rootstock and scion. Canopy management through plant growth inhibitors, training and pruning and management practices. Canopy development and management in relation to growth, flowering, fruiting and fruit quality in temperate fruits, grapes, passion fruits, mango, sapota, guava, citrus and ber.

Biotechnology of Horticultural Crops

Harnessing bio-technology in horticultural crops, influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture. Callus culture– types, cell division, differentiation, morphogenesis, organogenesis, embryogenesis. Use of bioreactors and in vitro methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues, ex vitro, establishment of tissue cultured plants. Physiology of hardening - hardening and field transfer, organ culture – meristem, embryo, anther, ovule culture, embryo rescue, somaclonal variation, protoplast culture and fusion. Construction and identification of somatic hybrids and cybrids, wide hybridization, in vitro pollination and fertilization, haploids, in vitro mutation, artificial seeds, cryopreservation, rapid clonal propagation, genetic engineering in horticulture crops, use of molecular markers. In vitro selection for biotic and abiotic stress, achievements of biotechnology in horticultural crops.

Advances in Breeding of Fruits and Plantation Crops

Importance, objectives of fruit breeding; principles, prospects and problems, methods of improvement- introductions, clonal selection, hybridization, mutation, polyploidy, heterosis and back cross. Centre of diversity, germplasm resource, breeding objectives, early development, inheritance of characters, problems and advances made in the following fruits and plantation crops: Fruits- Mango, Citrus fruits, Jackfruit, Grape, Apricot, Apple, Cherry, Banana, Litchi, Peach, Almond, Papaya, Guava, Aonla, Pomegranate, Plum and Strawberry. Plantation crops- Tea, Coffee, Coconut, Arecanut, Cocoa, Rubber and Cashewnut

Biodiversity and Conservation of Horticultural Crops

Biodiversity and conservation; issues and goals, primary and secondary centers of genetic diversity; centers of origin of cultivated horticultural crops.Present status of gene centers; exploration and collection of germplasm; conservation of genetic resources; *in situ* and *ex situ* conservation. Inventory of germplasm, GIS and documentation of local biodiversity,introduction of germplasm, detection of genetic constitution of germplasm and maintenance of core group. Plant quarantine. Germplasm Conservation- cryopreservation, problem of recalcitrance, cold storage of scions, tissue culture, pollen and seed storage. Intellectual property rights with focus on Geographical indication with reference to available germplasm of horticultural crops of the region. Regulatory horticulture. Biodiversity and conservation of following crops: fruits and plantation crops- Mango, Citrus, Guava, Banana, Papaya, Grapes,Aonla, Apple, Pear, Peach, Plum, Litchi, Nuts, Coffee, Tea, Rubber, Cashew, Coconut. Vegetable crops- Potato, Tomato, Brinjal, Radish, Carrot, Cauliflower, Cabbage, Peas, French bean, Onion, Cucurbits and okra. Ornamental Plants- Rose, Marigold, Jasmine, Chrysanthemum, Bougainvillea, Carnation, Dahlia, Gerbera, gladiolus and orchids.

Advances in Post- Harvest Technology and Management of Fruits and Vegetables

Introduction, post harvest physico-biochemical changes; causes of post harvest losses, control of post harvest losses- proper cultural operations, pre-storage treatments, transportation, storage, environmental control, ionizing radiation, post harvest chemical treatments, storage of fresh fruits and vegetables, factor affecting storage quality, storage disorders, marketing of fruits and vegetables and their products. History, objectives and scope of fruit and vegetable preservation, spoilage of fruits and vegetables, principles of preservation- temporary and permanent; vitamins and other nutrients in

preserved products, food additives and their use in preservation. Principles and guidelines for establishing processing unit. Containers: Types, merits and demerits, composition and manufacturing of tin and glass containers, failures in glass containers, general principles and procedures of canning and bottling, spoilage of canned products. Principles and methods of jam, jelly and marmalade; theories of jelly formation, failures of jelly; unfermented fruit and vegetable beverages, juice extraction equipments, general methods of preparation and preservation, preservation of unfermented beverages. General methods of making preserve and candy from some suitable fruits and vegetables, preparation of pickles, chutneys, sauces, ketchup, soup and cocktail from suitable fruits and vegetables, causes of spoilage. Vinegar- quality standards, types, material processing and fermentation, methods of preparation, post-production processes, spoilage; pectin preparation. Sun drying- merits and demerits, procedure; mechanical dehydration of fruits and vegetables, home and commercial dehydrators, packing and storage. Preservation by freezing- objectives, freezing and growth of micro-organisms, freezing process, storage of frozen products; exposure on preservation by radiation. Government policies, regulation and specifications for fresh and processed products.

Protected Cultivation of Horticultural Crops

Introduction, history, present status, importance, problems and prospects of protected cultivation. Types and designs of protected structures and their management. Environment control in protected structures. Growing media and sterilization. Soilless cultivation, hydroponics and aeroponics. Irrigation and fertigation. Integrated insect pest and disease management. Vegetable seedlings production under protection. Protected cultivation of crops (media, bed preparation, varieties, planting, irrigation and fertigation, harvesting, specific operation for different crops and economics) rose, carnation, gerbera, orchids, anthurium. lilium, chrysanthemum, capsicum, tomatoes, exotic vegetables, potted ornamental plants. Post harvest management of flowers and vegetable (sorting, grading, packing, storage, transportation and marketing).

Advances in Floriculture and Landscaping

History, importance and scope, problems and prospects, styles of gardening, formal garden and its important parts. Landscaping- general principles, planning and designing, important elements, landscaping public buildings, educational institutions, factories, historical places. Bio-aesthetic planning, bonsai culture, flower forcing, role of colour in floriculture, exhibition, post harvest management. Origin and distribution, area and production, taxonomy and morphological features, classification and description of some important cultivars, propagation, special practices and problems, use of bio-regulators: Rose, Gladiolus, Carnation, Tuberose, Marigold, Gerbera, Chrysanthemum, Dahlia, Baugainvillea and Jasmines.

Growth and Development of Plants

Introduction- terminology, importance and scope, growth and its phases, growth curve, growth regions, environmental affecting growth, apical organization and meristems in growth, apical dominance. Seed germination, seed dormancy- types and causes, growth substances and seed dormancy, environmental controls, breaking dormancy; bud dormancy- hormonal control, morphological aspects; juvenility and vegetative growth. Study of Auxin, Gibberellins, Cytokinins, Ethylene, Inhibitors (ABA) under the following heads: (i) Origin and history (ii) Natural and synthetic forms(iii) Biosynthesis and chemical nature(iv) Extraction and identification(v) Mode of action(vi) Transport of growth regulators (vii) Functions or effects on plants. Flower initiation and development: photo-periodism and its effects, florigen concept; vernalization-kinetics, response, types, vernalization stimulus, devernalization; physiology and chemical induction of flowering, sex expression and alteration; tuber, bulb and corm formation. Pollination and fruit-set, growth and development of fruits, parthenocarpy and seedlessness, maturity and ripening. Climacteric and non-climacteric fruits. Senescence- chemical changes, causes, plant and organ senescence, regulating system in senescence; abscissions. Tropism: phototropism and geotropism.

Advances in Breeding of Vegetable Crops

History, principles, problems and prospects of vegetable improvement. Biodiversity and conservation. Introduction, selection including clonal selection and hybridization, mutation breeding, polyploidy and heterosis breeding for specific purposes like productivity, resistance to biotic and abiotic stresses and processing. Recent advances in breeding including biotechnological approaches. Cytogenetics, breeding objectives, inheritance, early achievement and advances made in the following vegetables: Solanaceous, cole crops, legumes, bulb crops, root vegetables, tuber crops, leafy vegetables and cucurbits.

Dry Land Horticulture

Definition, importance and limitations of dry land horticulture, present status and future scope. Constraints encountered in dry lands. Agro-climatic features in rain shadow areas, scarce water resources, high temperature, soil erosion, run-off losses etc. Techniques of development and management of dry land horticulture. Watershed development. Soil and water conservation methods - terraces, contour bunds etc; methods of control and impounding of run offwater - farm ponds, trenches, macro catch pits etc; in-situ water harvesting methods – micro-catchments, different types of tree basins etc. Methods of reducing evapo-transpiration - use of shelter belts, mulches, anti-transpirants, growth regulators etc. Water use efficiency - need-based, economic and conjunctive use of water, micro systems of irrigation etc. Selection of plants/crops having drought resistance/ tolerance characteristics. Special techniques of planting and after care - use of seedling races, root stocks, in situ grafting, deep pitting/planting, canopy reduction etc.

Biotic and Abiotic Stress Management in Horticultural Crops

Stress – definition, classification, stresses due to water (high and low), temperature (high and low), radiation, wind, soil conditions (salinity, alkalinity, ion toxicity, fertilizer toxicity, etc.). Pollution - increased level of CO_2, industrial wastes, impact of stress in horticultural crop production, stress indices, physiological and biochemical factors associated with stress, horticultural crops suitable for different stress situations. Crop modeling for stress situations, cropping system, assessing the stress through remote sensing, understanding adaptive features of crops for survival under stress, interaction among different stress and their impact on crop growth and productivity. Greenhouse effect and methane emission and its relevance to abiotic stresses, use of anti transpirants and PGRs in stress management, mode of action and practical use, HSP inducers in stress management techniques of soil moisture conservation, mulching, hydrophilic polymers. Rain water harvesting, increasing water use efficiency, skimming technology, contingency planning to mitigate different stress situations, cropping systems, stability and sustainability indices.

Advances in Breeding of Ornamental Crops

Principles-Evolution of varieties, origin, distribution, genetic resources, genetic divergence- Patents. Genetic inheritance of flower colour, doubleness, flower size, fragrance, post harvest life.

Breeding methods suitable for sexually and asexually propagated flower crops and ornamental plants-- introduction, selection, domestication, polyploid and mutation breeding for varietal development, Role of heterosis, Production of hybrids, Male sterility, incompatibility problems, seed production of flower crops. Breeding constraints and achievements made in commercial flowers - rose, jasmine, chrysanthemum, marigold, tuberose, crossandra, carnation, dahlia, gerbera, gladioli, orchids, anthurium, aster, heliconia, liliums, nerium. Breeding constraints and achievements made in ornamental plants – petunia, hibiscus, bougainvillea, Flowering annuals (zinnia, cosmos, dianthus, snap dragon, pansy) and ornamental foliages– Introduction and selection of plants for waterscaping and xeriscaping.

Organic Horticulture

Organic horticulture–definition, synonyms and misnomers, principles, methods, merits and demerits.Organic farming systems, components of organic horticultural systems, different organic inputs,their role in organic horticulture, role of biofertilizers, biodynamics and the recent developments.EM technology and its impact in organic horticulture, indigenous practices of organic farming, sustainable soil fertility management, and weed management practices in organic farming, biological/natural control of pests and diseases, organic horticulture in quality improvement. GAP - Principles and management, HACCP exercise, certification of organic products and systems, agencies involved at national and international levels, standards evolved by different agencies. Constraints in certification, organic horticulture and export, IFOAM and global scenario of organic movement, post-harvest management of organic produce.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – INFORMATION TECHNOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Syllabus for Entrance Examination for Ph.D. Admission in Information Technology Department of Information Technology

Section 1: Propositional and first order logic, Sets, relations, functions, Monoids, Groups, Graphs, connectivity, matching, coloring, Combinatorics, Linear Algebra, Matrices, eigenvalues and eigenvectors, Probability and Statistics, Random variables, Uniform, normal, exponential, poisson and binomial distributions, Mean, median, mode and standard deviation, Digital Logic Boolean algebra, Combinational and sequential circuits, Minimization, Number representations and computer arithmetic.

Section 2: Programming and Data Structures, Computer Programming, Programming in C, JAVA and Python, Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs. Searching, sorting, hashing, Asymptoitc Notation, Time and space complexity, Algorithm design and analysis, Graph traversals, minimum spanning trees, Prims, Kruskal algorithm.

Section 3: Computer Networks, OSI/TCP Model, IPv4/IPv6, routers and routing algorithms, Ethernet, error detection, Flow, error and access control, circuit and virtual circuit-switching, framing, , Medium Access Control, Ethernet bridging, Routing protocols, shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, ARP, DHCP, ICMP, Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Wireless network, GSM, 3G/4G/5G, cryptography, Cellular Wireless Networks, Wireless Access Techniques, Wireless Systems and Standards, Mobile communication, Mobile and Wireless Security, network security.

Section 4: Operating System, System call, Processes, process scheduling and management, threads, inter-process communication, concurrency, and synchronization, Mutual exclusion, Deadlock, CPU and I/O scheduling, Memory management and virtual memory, File systems, UNIX, UNIX commands. Databases, ER-model, Relational model, relational algebra, tuple calculus, SQL, Integrity constraints, Normal forms, File organization, indexing, and concurrency control. Databases ER-model, Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms, File organization, indexing, Transactions and concurrency control.

Section 5: Artificial Intelligence and Machine learning, Knowledge representation and reasoning, Neural Networks, Expert Systems, Deep learning , Virtualization, Cloud Services, Cloud Security, Cloud Storage, Cloud Computing Standards, SaaS, PaaS, IaaS, Virtualization, Virtual machine, CloudSim, Cloud security, Big Data Management, Hadoop, Map Reduce, Big Data Analytics, Data Modeling, Data Measure Techniques.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – INSTRUMENTATION ENGINEERING

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Department of Instrumentation Engineering
H. N. B. Garhwal University Srinagar Garhwal

Syllabus of subject specific component of entrance examination for admission in Doctor of Philosophy (Ph.D.) programme in Instrumentation Engineering

Section 1: Electrical Circuits and Machines

Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, inductor, mutual inductance and capacitor; transient analysis of RLC circuits with dc excitation. Kirchoff's laws, mesh and nodal analysis, superposition, Thevenin, Norton, maximum power transfer, reciprocity, and Millman's theorems. Peak, average and rms values of ac quantities; apparent, active and reactive powers; phasor analysis, impedance and admittance; series and parallel resonance, realization of basic filters with R, L and C elements. One-port and two-port networks, driving point impedance and admittance, z, y, h and ABCD two-port network parameters.

DC and AC machines: Constructing features and principles of operation of DC generator and DC motor; separately excited, shunt and compound types of DC field excitations; torque-speed characteristics of separately excited, shunt, series and compound motors; starting, speed control and braking of DC motors. Equivalent circuit, phasor diagram, open circuit and short circuit tests of transformer, regulation, losses and efficiency of transformer. Principle of operation, types, performance, torque-speed characteristics, equivalent circuit, starting, and speed control of single-phase induction motor.

Section 2: Signals and Systems

Periodic, aperiodic and impulse signals; Laplace, Fourier and z-transforms; transfer function, frequency response of first and second order linear time invariant systems, impulse response of systems; convolution, correlation. Discrete time system: impulse response, frequency response, pulse transfer function; DFT and FFT; basics of IIR and FIR filters.

Section 3: Control Systems

Feedback principles, signal flow graphs, transient response, steady-state-errors, Bode plot, phase and gain margins, Routh and Nyquist criteria, root loci, design of lead, lag and lead-lag compensators, state-space representation of systems; discontinuous, continuous and composite controller modes, on-off, P, PI, PID controllers, electronic controllers, tuning of PID controllers, cascade, feed forward, and ratio controllers, control valve characteristics, types, sizing of control valves, cavitations and flashing.

Section 4: Analog Electronics and Signal Conditioning

Characteristics and applications of diode, Zener diode, BJT and MOSFET; small signal analysis of transistor circuits, feedback amplifiers. Characteristics of ideal and practical operational amplifiers; applications of op-amps: adder, subtractor, integrator, differentiator, difference amplifier, instrumentation amplifier, precision rectifier, active filters, oscillators, signal generators, voltage-controlled oscillators and phase locked loop, sources and effects of noise and interference in electronic circuits.

Section 5: Digital Electronics and Programmable Devices

Combinational logic circuits, minimization of Boolean functions. IC families: TTL and CMOS. Arithmetic circuits, comparators, Schmitt trigger, multi-vibrators, sequential circuits, flip-flops, shift registers, timers and counters; sample-and-hold circuit, multiplexer, analog-to-digital (successive approximation, integrating, flash and sigma-delta) and digital-to-analog converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADC and DAC (resolution, quantization, significant bits, conversion/settling time); basics of number systems, Embedded Systems: Microprocessor and microcontroller applications, memory and input-output interfacing; basics of data acquisition systems, basics of distributed control systems (DCS) and programmable logic controllers (PLC).

Section 6: Measurements

Systematic and random errors in measurement, expression of uncertainty - accuracy and precision, propagation of errors, linear and weighted regression. Bridges: Wheatstone, Kelvin, Megohm, Maxwell, Anderson, Schering and Wien for measurement of R, L, C and frequency, Q-meter. Measurement of voltage, current and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling, instrument transformers, timer/counter, time, phase and frequency measurements, digital voltmeter, digital multimeter; oscilloscope, shielding and grounding.

Section 7: Sensors and Industrial Instrumentation

Resistive, capacitive, inductive, piezoelectric, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (variable head, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters), temperature (RTD, thermistor, thermocouple, pyrometer), humidity and moisture, viscosity and consistency, density and specific gravity, and liquid level measurement.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – JOURNALISM & MASS COMMUNICATION

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Syllabus of Ph.D. Entrance Examination

(JOURNALISM AND MASS COMMUNICATION)

Unit -1

Introduction to Journalism and Mass Communication

Concept of Journalism and mass communication, mass communication in India.

History, growth and development of print and electronic media. Major landmarks in print and electronic media in Indian languages. Media's role in formulation of states of India.

Media criticism and media literacy, Press Council and Press Commissions of India, status of journalism and media education in India. Media policies of the Government of India since Independence.

Models and theories of mass communication, normative theories, administrative and critical traditions in communication, media and journalism studies. communication and theories of socio-cultural, educational and agricultural change. Technological determinism, critique of Marshall McLuhan's views on media and communication and Marxist approaches. Information and knowledge societies.

Indian traditions and approaches to communication from the Vedic era to the 21st century. Western and Eastern philosophical, ethical and aesthetic perceptions of communication - Aristotle and Plato, Hindu, Buddhist and Islamic traditions.

Media and culture - framework for understanding culture in a globalised world. Globalisation with respect to politico-economic & socio-cultural developments in India.

Unit -2

Communication for Development and Social Change

Understanding Development: Development and social change: Historical perspectives - Issues and post-colonial conceptions, Growth vs. Development, Development indicators, Gap between developed and developing Societies,

International and National agencies, Role of UN agencies in the development, Development in the age of globalization.

Development Communication: Meaning, concept, definition and origin. C4D, Development Support Communication, Behavioral Change Communication, Human Communication, Participatory communication and empowerment, Communication planning and rural development in India, Communication policy and national development in India.

Dominant Paradigms and Theories of Development Communication: Modernisation paradigm, Dependency paradigm, Alternative development, Diffusion of innovation, Magic Multiplier, Localized Approach, Social Learning Theory, ICT for development, Digital divide and development, Sustainability and development communication, Sustainable strategies in Development Communication.

Media and Development: Role and Responsibility of Media in Development, Media and Advocacy, NGOs and development, Corporate social responsibility (CSR), Development Journalism, Solution Journalism, Analysing and writing for Development Schemes, Analysing Communication Plans, Success stories, Planning and Drafting development campaigns.

Unit -3

Reporting and Editing

News : definition, concept, elements, values, sources, lead writing, kinds; reporting : crime, weather, city life, speech, accident, disaster, court, election, riots, war/ conflict/ tensions.
Interviewing - kinds, purposes, techniques.
Interpretive reporting - purposes, techniques; Investigative reporting - purposes, sources, styles, techniques; columns - development, criticism, reviews, feature writing, news analysis, back grounding.
political reporting, Legislative reporting, court reporting, sports reporting.
Scoop and exclusive and specialized reporting - science, sports, economic, development, commerce, gender and allied areas reporting for magazines.
Editing and Presentation techniques for print, television and digital media

Writing for print, electronic and digital news media
Journalism as profession, ethics of reporting

Unit -4

Advertising and Public Relations

Advertising: Definition, concept, functions, types, evolution of advertising, standards and ethics in advertising. Theories and models of communication in advertising.
Regulatory Aspects of Advertising-Apex Bodies in Advertising-AAAI, ASCI and their codes
Consumer Behaviour, Analysing Human Behaviour, Consumer in Economic Theory, Market Segmentation, The Mechanics of the Market, Brand Management.
Advertising management – agency - role, structure and function, client-agency relationship, media planning and budgeting.
Advertising and creativity, Advertising campaign.
Digital and Social Media Advertising-- Role and scope of Digital media, Advertising on Digital Media, Evolution of Digital Media Advertising, Digital Advertising in India, Social Media in Brand Building
Advertising research.

Public Relations and Corporate Communication - Definition, concept and scope.

Publicity, Propaganda, Public opinion, Public Affairs and lobbying, PR Communication and Process, PR Tools and Strategies, Internal and External Publics, Structure of PR department in state, public, private and non-government sector, Duties, responsibilities and qualities of a PRO
Media Relations-- Understanding Media relations, Benefits of Media Relations, Tools and Techniques of Media Relations, Organizing Press Conferences, Writing Press Releases

Ethics of Public Relations.

PR and Crisis Communication-- Defining 'Crisis', Kinds of Crisis, Role of PR in Crisis Management and Communication, Preparing a Crisis Management Plan.
PR Agencies and Apex Bodies-- PR Agencies, Structure and Functions of PR Agency, Client Servicing, Apex bodies, IPRA, PRSI Community

Unit -5

Media Laws and Ethics

Freedom of the press and the Constitution- Article 19(1)(a) of the Indian Constitution-Freedom of speech and expression, Article 19(1)2 reasonable restrictions to freedom of the press, Directive principles of state policy, Provisions of declaring emergency and their effect on freedom of media.

History of Press Laws in India (Before and after Independence), First Press Commission and Second Press Commission after Independence, The Press Council: Composition, role, powers, guidelines and functions
Press laws: Contempt of Courts Act 1971- civil and criminal law of defamation-relevant provisions of Indian Penal Code with reference to sedition, Official Secrets Act 1923, Press and registration of Books Act 1867. Working Journalists and other newspapers employees (Conditions of service and Miscellaneous Provisions) Act, 1955, Role and functions of the Registrar of Newspapers, Intellectual Property Rights, Copyright Act 1957
Right to Information Act 2005.
Electronic and New Media Laws: The AIR Code Act, The Commercial Code of AIR & Doordarshan, Prasar Bharati Act, Cable Television Act and Rules, Cinematograph Act 1953, Information Technology Act 2000.

Media laws and the State, Citizens, Judiciary, Legislature and Parliament: Sedition-incitement to violence (section 121 IPC) IPC 121 read with 511 inflammatory writing (IPC 353), Defamation (IPC (499) 500) civil and criminal defamation-libel, slander, Parliamentary privileges / Articles 105 (Parliament) Article 194 (State Legislation), Contempt of Court, Covering and reporting court proceedings (Article 361A).

Media Ethics, Cyber Laws and Ethics: Types of Cybercrimes and Regulatory Laws in India. Code of Conduct for Journalists, Editors Guild of India, Advertising Council of India, PRSI, ASCI, NBA.

Unit -6

Media Management

Media Management–Meaning and Scope; media as an Industry and Profession; Ownership Patterns of Mass media in India: sole proprietorship, partnership, Private limited companies, public limited companies, trusts, co-operatives, religious institutions (societies) and franchisees (chains).

Media Industry: Issues & Challenges Media industry as manufacturers-Manufacturing Consent, news and Content Management. Market Forces, Performance Evaluation (TAM, TRP, BARC and HITS) and Market shifts Changing Ownership patterns

Structure of News media organizations in India. Role responsibilities & Hierarchy, Workflow and Need of Management Shift Patterns, Circulation & Guidelines

Management in media industry post liberalization, Foreign Equity in Indian Media (including print media); Globalization: Economic, Social and Cultural effects on Mass Media

Unit -7

Information Communication Technology (ICT) And Media

ICT and media-definition, characteristics and role. Effect of computer-mediated communication(CMC). Impact of ICT on mass media. Digitisation. Multimedia- Meaning, scope and importance of multimedia, Multimedia Terminologies

Traditional vs Digital Media: Digital Media and Interactivity, Types of Digital Media, Difference between Traditional, Electronic & Digital Media, Impact of New/Digital Media on Old/Traditional Media, Media Convergence, Understanding social media, Social Media Optimization, Social Media Influencers, social media and Product Promotion, Social Media Strategies

Digital Community and Public Sphere: Public Sphere, Convergence and Impact, Digital Culture, Information Society, Networked Society, Virtual Community, Digital Media and Activism. E-Governance, Digital Divide

Digital Content: Planning, Creating and Managing Social Media Content, Users Generated Communication, Writing Blog, Vlog, Reel, Writing for online media. Digital Storytelling, Creating Interactive Content.

Cyber Journalism – On-line edition of newspapers-management and economics; cyber newspapers-creation; online editing, e-publishing; security issues on Internet; social, political, legal and ethical issues related to IT and Computer technology.

Unit -8

Film and Visual Communication

Film and television theory
Film and identity in Indian film studies, leading film directors of India before and after Independence. Indian cinema in the 21st century.
Approaches to analysis of Indian television.

Visual Communication, Visual analysis
Visual Composition: Shots and Angles, Visual Design, Elements of Visual Design, Principles of Visual Design, Rules of Composition.

Basics of film language and aesthetics, the dominant film paradigm, evolution of Indian cinema-commercial and 'non-commercial'genres, the Hindi film song, Indian aesthetics and poetics (the theory of Rasa and Dhvani).

National cinema movements: Soviet Montage cinema, German Expressionistic cinema, Italian Neo-Realistic cinema, French New Wave cinema, British New Wave cinema, Indian New Wave cinema, Period cinema. Cinema in the new millennium.

Unit -9

International and Intercultural Communication

International Communication- basic concepts nature and scope, historical background, Global communication, political, economic and cultural dimensions of international communication. Communication and information as a tool of equality and exploitation. Media at the time of war.

Global News Agencies and Media Organizations and their role in International Communication. Issues in international communication, imbalance in the international flow of information, domination transaction, Mc Bride commission's report. NWICO. Nonaligned news pool. Recent changes and developments in the global information and communication order. Current trends. Media Technology and Globalization, Cultural imperialism, skyvasion, digital divide. Universal declaration of human rights and communications.

Culture - Meaning, definition, types. Communication and culture, culture as an institution, eastern and western perspective, High and Low Culture, intercultural communication –meaning, definition process. Philosophical and functional dimension. Mass media as an instrument of intercultural communication. Barriers of Inter-cultural communication.

Intercultural Relationships, Culture, Communication and Conflict, Linguistic and regional aspects of intercultural Communication- verbal and nonverbal messages – perception and miss understanding. folk media as a vehicle of intercultural communication.

Unit -10

Communication Research

Definition, concept, constructs and approaches to communication research process. Research Designs - types, structure, components, classical, experimental and quasi experimental, variables and hypotheses; types and methods of research; basic, applied, descriptive, analytical, historical, case study, longitudinal studies.

Research in journalism, Public Relations, advertising, cinema, animation and graphics, television, Internet, social media practices, magazines, children's media. Communication, journalism and media research in India.

Levels of measurement: sampling-probability and non-probability, tests of validity and reliability, scaling techniques. Methods and tools of data collection-interviews, surveys, case studies, obtrusive and non-obtrusive techniques, ethnography, schedule, questionnaire, dairy, and internet based tools, media specific methods such as exit polls, opinion polls, telephone, SMS surveys and voting with regard to GEC (general entertainment content).

Data analysis, testing, interpretation, application of statistical tests-parametric and non- parametric, tests of variance-univariate, bivariate and multivariate, tests of significance, computer mediated research.

Ethical considerations in communication, media and journalism research, writing research reports, plagiarism.

Director
Centre for Journalism and
Mass Communication
H.N.B. Garhwal University
Srinagar (Garhwal)

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – LAW

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

H.N.B. Garhwal University (A Central University) Srinagar, Garhwal, Uttarakhand
School of Law/Department of Law
PROPOSED COURSE STRUCTURE- LL.M. (TWO YEAR)
(Course of Study, w.e.f. 2022-2023)

CONSTITUTIONAL LAW GROUP

Ist Semester

Course Code	Course Name	Credit	Category
101161	Legal Theory	4	Mandatory
101162	Law and Social Transformation-I	4	Mandatory
101163	Judicial Process-I	4	Mandatory
101164	Legal Education	4	Mandatory
101165	Communication and Computer Skills	2	Skill Paper
101166	Research Writing and Ethics	2	Mandatory

IInd Semester

Course Code	Course Name	Credit	Category
102161	Legal Concepts	4	Mandatory
102162	Law and Social Transformation-II	4	Mandatory
102163	Judicial Process-II	4	Mandatory
102164	Law and Justice in a Globalizing World	4	Mandatory
102165	Alternate Dispute Resolution	2	Skill Paper
102166	Basic Research Methods	2	Mandatory

III[rd] Semester

Course Code	Course Name	Credit	Category
103161	Comparative Public Law	4	Mandatory
103162	Mass Media Law	4	Mandatory
103163	National Security, Public Order and Rule of Law	4	Specialization/ Group
103164	Administrative Process and Judicial Control	4	Specialization/ Group
103165	Seminar Paper-I	4	Presentation Skill

IVth Semester

Course Code	Course Name	Credit	Category
104161	Indian Constitutional Law-The New Challenges	4	Mandatory
104162	Civil and Political Rights	4	Mandatory
104163	Constitutionalism: Pluralism & Federalism	4	Specialization/ Group
104164	Union State Relations and Constitutional Governance	4	Specialization/ Group
104165	Dissertation and Viva-Voce	4	Mandatory

LL.M.-I

SEMESTER

LL.M. SEMESTER - I

Paper-I

Course Name: Legal Theory **Maximum marks: 100**

Course Code: 101161 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To understand the historical evolution of legal thought and legal theory.
2. To acquaint students with the growth and development of law in different countries under different social and political conditions.
3. To acquaint students with the theories, attitude and insights of various jurists.
4. To make them understand the importance of the course as a foundation upon which the supra structure of the legal regime is constructed.

Outcomes of the Course

Students will be able:

1. To understand, define and explain the jurisprudential understanding of the legal concepts.
2. To identify, explain, distinguish the diverse origins and conceptualizations of law and develop a keen sense of objectivity while dealing with various laws.
3. To critically analyse various legal theories and to distinguish them into broader history of thought.
4. To put in practice the acquired knowledge and will use logical, analytical and decision-making ability to deal with contemporary challenges.

Contents of the Course

Unit-I: Law and Jurisprudence- A study in interrelationship, nature and scope of Jurisprudence and Legal theory, Importance of the study of Jurisprudence and legal theory

Natural Law: History, Characteristics, Classical Natural Law, Natural law during the medieval period, Decline and Revival of Natural Law

Philosophical School

Unit-II: Analytical Positivism: Reasons for emergence of Positive thoughts

Pure Theory of Law

Historical School

Unit-III: Sociological School- The social origin of law and legal institution. Impact of law on society. The task of law in society. Social criterion of the validity of law. Social engineering

Realist School-American Realism and Scandinavian Realism

Unit-IV: Marxist School of Thought

Feminist Jurisprudence

Suggested Readings

1. B.N. Mani Tripathi, Jurisprudence (The Legal Theory), Allahabad Law Agency,2012
2. N.V. Paranjape, Studies in Jurisprudence and Legal Theory, Central Law Agency, 2013
3. Nomita Aggarwal, Jurisprudence, Central Law Publication,2010
4. S.N. Dhyani, Fundamentals of Jurisprudence (The Indian Approach), Central Law Agency,2004
5. Michael Doherty, Jurisprudence: The Philosophy of Law, Old Balley Press,2003
6. P.J. Fitzgerald, Salmond on Jurisprudence, Thomson Sweet & Maxwell Universal, 2008
7. R.W.M. Dias, Jurisprudence, Lexis Nexis (Indian Edition)2013
8. Suri Ratnapala, Jurisprudence, Cambridge University Press (First South Asian Edition)2009
9. W. Friedmann, Legal Theory, Universal Law Publishing Co.,2008
10. Bodenheimer, Jurisprudence-The Philosophy and Method of Law, Universal Delhi,1996

LL.M. SEMESTER - I

Paper-II

Course Name- Law and Social Transformation in India-I **Maximum marks: 100**

Course Code- 101162 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To understand the social change through law and legal system.
2. To understand the role of religion, language and caste as a divisive factor.
3. To explore the law and legal institutions as a means to achieve development within the framework of law.
4. To make students aware of the role law has played and has to play in the contemporary Indian society.

Outcomes of the Course

Student will be able:

1. To understand the concept of language, religion and its relationship with the law.
2. To critically analyse the Law as an instrument of social change and product of tradition and culture.
3. To gain an understanding about barriers of society and impact of law to mitigate these issues.
4. To analyse the different approaches of Law and Justice.

Contents of the Course

Unit-I: Law and social change

Law as an instrument of social change
Law as the product of traditions and culture
Sociological school and its applicability in India
Principles of social legislation

Unit -II: Religion and the law

Religion as a divisive factor
Secularism as a solution to the problem
Freedom of religion and non-discrimination on the basis of religion
Religious minorities and the law

Unit- III: Language and the law

Language as a divisive factor: formation of linguistic states
Constitutional guarantees to linguistic minorities
Language policy and the Constitution: Official language; multi-language system
Non-discrimination on the ground of language

Unit -IV: Community and the law

Caste as a divisive factor
Non-discrimination on the grounds of caste.
Acceptance of caste as a factor to undo past injustices.
Protective discrimination: Scheduled castes, tribes and backward classes
Reservation: Statutory Commissions, Statutory provisions

Suggested Readings

1. Malik and Raval, Law and social transformation, Allahabad Law Agency, 2014
2. Indian Law Institute, Law and Social Change: Indo-American Reflections, Tripathi, 1988
3. Marc Galanter (ed.), Law and Society in Modern India, Oxford University Press, 1977
4. Robert Lingat, The Classical Law of India, Oxford, 1998
5. U. Baxi, The Crisis of the Indian Legal System. Vikas, New Delhi, 1982
6. U. Baxi (ed.), Law and Poverty Critical Essays, Tripathi, Bombay,1988
7. Duncan Derret, The State, Religion and Law in India, Oxford University Press, New Delhi, 1999
8. H.M. Seervai, Constitutional Law of India, 1996
9. D.D. Basu, Shorter Constitution of India Prentice Hall of India (P) Ltd., New Delhi, 1996
10. P. Ishwara Bhat., Law and Social Transformation, Eastern Book Company, 2012

LL.M. SEMESTER - I

Paper-III

Course Name- Judicial Process-I **Maximum marks: 100**

Course Code- 101163 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To understand the nature of judicial process with instrument of social ordering.
2. To understand the legal development and creativity through judicial process.
3. To understand the concept of justice with theories of justice.
4. To understand the relationship between law and justice.

Outcomes of the Course

Students will be able:

1. To exhibit analytical and conceptual understanding of Judicial Creativity.
2. To study the nature of judicial process as an instrument of social ordering.
3. To understand the new emerging trend in the judicial process and Independence of judiciary.
4. To appreciate the role of judges in the judicial activism and the tools and techniques applied by them.

Contents of the Course

Unit-I: Nature of Judicial Process

Judicial process as an instrument of social ordering. Judicial process and creativity in law- Legal reasoning and growth of law. The tools and techniques of judicial creativity and precedent. Legal development and creativity through legal reasoning under statutory and codified system

Unit-II: Special Dimensions of Judicial Process in Constitutional Adjudications

Notions of judicial review. Role in constitutional adjudication-various theories of judicial role. Tools and techniques in policy making and creativity in constitutional adjudication. Problems of accountability and judicial law making

Unit-III: The Concept of Justice

The concept of justice and Dharma in Indian thought. Dharma as the foundation of legal ordering in Indian thought. The concept and various theories of justice in the western thought. Various theoretical bases of justice- the liberal contractual tradition, the liberal utilitarian tradition and the liberal moral tradition

Unit-IV: Relation between Law and Justice

Equivalence theories- Justice as nothing more than the positive law of the stronger class. Dependency theories- justice depends on law, but justice is not as the law. The independence of justice theories - The relationship in the context of the Indian constitutional ordering

Suggested Readings

1. Julius Stone, Legal System and Lawyer's Reasonings, Universal, New Delhi,1985
2. Cardozo, Nature of Judicial Process, Universal, New Delhi,1995
3. Henry J. Abraham, The Judicial Processes, Oxford,1998
4. W. Friedman, Legal Theory, Stevens, London,1960
5. M.P. Jain, Indian Constitutional Law, Lexis-Nexis, Year,2015
6. S.K. Chaturvedi, Judicial Process, Thompson Reuters, Year, 2021

LL.M. SEMESTER - I

Paper-IV

Course Name- Legal Education **Maximum marks: 100**

Course Code- 101164 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To familiarize the students with the contours of legal education system.
2. To study the legal education system of England, US and India.
3. To study the evolution of Indian legal system.
4. To deliberate upon the various teaching methodologies in law.

Outcomes of the Course

Students will be able:

1. To understand the various aspects of legal education.
2. To appreciate different legal education systems introduced in India, U.S. and U.K.
3. To demonstrate different teaching methods used in the legal education.

Contents of the Course

Unit-I: Introduction to Legal Education

Foundation of legal education- Meaning, object and domain of legal education

Unit-II: Legal education system in India, USA and UK

History of Legal Education in India- Ancient Period, Muslim Period, British Period
Development of Legal Education in India
Legal Education System in U.S. & U.K.

Unit-III: Legal Education in India

Reforms in legal education, Report of Knowledge Commission
Restructuring of Legal education
Clinical Legal Education-Concept and concerns
Legal Aid, Legal Literacy, Legal Survey

Unit-IV: Law Teaching

Lecture Method
The Problem Method
Discussion Method and its suitability at post graduate level teaching
Seminar Method of teaching
Clinical method of teaching

Suggested Readings

1. Albert J.Harno, Legal Education in United States, The Law Book Exchange Ltd.33, Terminal Avenue**,** Clark, New Jercy,2004
2. Stacey Steel and Kathryn Taylor, Legal Education in Asia: Globalization, Change and Contexts-, New York, Routledge,2010
3. Paul Maharg, Transforming Legal Education: Learning and Teaching the Law in the early Twenty First Century,2007
4. G. Mohan Gopal, N.R. Madhava Menon's Reflection's on Legal and Judicial Education, Universal Law Publishing Co. Pvt. Ltd., Delhi, 2009
5. N.R. Madhava Menon, Clinical Legal Education, Eastern Book Co., Lucknow,2006
6. Sushma Gupta, History of Legal Education, Deep and Deep pub. New Delhi,2006
7. S.K. Agrawal, Legal Education in India, Tripathi, Bombay,1973

LL.M. SEMESTER - I

Paper-V

Course Name: Communication and Computer Skills **Maximum marks: 100**

Course Code: 101165 **Semester Examination:60**

Credit:2 **Sessional Examination: 40**

Objectives of the Course

1. To create a basic understanding of computer, internet and ICT.
2. To understand the basic ethics of the use of internet and electronic communication.
3. To develop an understanding and application of MS-Word, MS-Excel and MS-Power Point.
4. To Understand the basics of communication, principles of communication and official communication.
5. To explore different aspects of non-verbal communication.
6. To understand and interpret the non-verbal codes of communication.

Outcomes of the Course

Students will be able:

1. To understand the basics of computers and computer networks as well as internet.
2. To apply the basics of internet and ICT for a better and effective use of internet.
3. To make use of the MS-Word, MS-Excel and MS-Power Point for creation of official and professional communications.
4. To understand the basics of communication by understanding the various principles of communication vis-à-vis official communications.
5. To gain an understanding of non-verbal codes and their effects on managing interaction, forming impressions, developing and maintain relationships.
6. To effectively apply the different concepts of non-verbal communication.

Contents of the Course

Unit- I: Basics of Computer and Internet

Computer-Meaning, Types and Importance

Basic Applications of Computers

Concept of Data, Computing and Information

ICT- Meaning, Uses, Advantages and Disadvantages

Basics of Internet and e-mailing- Computer Networks-LAN, WAN, PAN, Ethics of browsing and emailing

Word Processing

Basics of Word Processing, Text Creation and Formatting of Text, Table Handling, Spell Check, Language setting and Thesaurus

Spread Sheets

Basics of Spreadsheets, Manipulation of Cells, Formulas and Functions, Editing of Spreadsheets and Printing of spreadsheets

Presentation Software

Creating Presentation, Preparation and presentation of slides and slide shows

Unit-II: Fundamentals of Communication

Communication-Meaning, Nature, Characteristics, Types, Barriers and Effective classroom communication

Role and Importance of Communication- 7C's of Communication

Official Communication- Letters, Note taking, Memo, Notice, Circulars and Report Writing

Non-Verbal Communications

Para Language Communication

Place and Time Codes- Environment, artifacts and Chronemics

Contact Codes- Haptics and Proxemics

Visual and Auditory Codes-Kinesics, Physical Appearance and Vocalics

Object Language

Suggested Readings

1. Introduction to Computers, Peter Norton, Mc Graw Hill Education, 2017
2. Using Information Technology, Brian K Williams, Stacey Sawyer, McGraw- Hill Education, 2006
3. Learning MS-Word and MS-Excel, Rohit Khurana, APH Publishing Corporation, 2010
4. Microsoft Word, Excel and Power Point: Just for Beginners, Dorothy House, Outskirts Press, 2015
5. Business Communication, V.K. Jain and Omprakash Biyani, S. Chand Company Ltd., 2007
6. Non-verbal Communication, Judee K Burgoon, Valerie Manusov, Laura K. Guerrero, Routledge, 2021

LL.M. SEMESTER - I

Paper-VI

Course Name: Research Writing and Ethics **Maximum marks: 100**

Course Code: 101166 **Semester Examination:60**

Credit:2 **Sessional Examination: 40**

Objectives of the Course

1. To provide students with the fundamental knowledge of basics of philosophy of science and ethics, research integrity, publication ethics.
2. To conduct sessions to furnish information to identify publication misconduct and predatory publications.
3. To understand Indexing and citation databases, open access publications, research metrics (citations, h index, Impact Factor etc).
4. To present plagiarism tools for a valid and ethical research report.

Outcomes of the Course

Students will be able :

1. To demonstrate fundamentals of research and publication ethics.
2. To identify publication misconduct and predatory journals.
3. To apply various tools available for plagiarism check.
4. To utilize various indexing and citation database.
5. To maintain academic integrity of the Institution.

Contents of the Course

Unit-I: Theory

Philosophy: definition, nature and scope, concept, branches.
Ethics: definition, moral philosophy, nature of moral judgments and reactions.
Scientific conduct: Ethics with respect to science and research,
Intellectual honesty and research integrity.
Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP).
Redundant publications: duplicate and overlapping publications, salami slicing.
Selective reporting and misrepresentation of data
Publication ethics: definition, introduction and importance

Unit-II: Practice

Open access publishing: SHERPA/ROMEO online resource to check publisher copyright & self-archiving policies

Software tool to identify predatory publications developed by SPPU

Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Publication misconduct: Definition, concept, problems that lead to unethical behaviour and vice versa, types, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals, Use of plagiarism software like Turnitin, Urkund and other open-source software tools

Databases and Research metrics:

Databases- Indexing databases, Citation databases: Web of Science, Scopus, etc.

Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.

Metrics: h-index, g index, i10 index, alter metrics

Suggested Readings

1. Miro Todorovich; Paul Kurtz; Sidney Hook The Ethics of Teaching and Scientific Research,
2. Barbara H. Stanley, Joan E. Sieber, Gary B. Melton, Research Ethics, A Psychological Approach
3. Jeffrey A. Gliner, George A. Morgan Lawrence Erlbaum Associates Research Methods in Applied Settings, An Integrated Approach to Design and Analysis, 2000
4. Joel Lefkowitz Lawrence Erlbaum Associates, Ethics and Values in Industrial-Organizational Psychology, 2003

LL.M.-II

SEMESTER

LL.M. SEMESTER – II

Paper-VII

Course Name: Legal Concepts **Maximum marks: 100**

Course Code: 102161 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To provide understanding of a number of concepts which are important when considering the nature of law.
2. To demonstrates understanding of the relationship between particular concepts and the law.
3. To evaluate and analyse the key concepts relevant to law.
4. To apply the concepts in further learning context and to find out the potential areas of research.

Outcomes of the Course

Students will be able:

1. To develop an understanding of a number of concepts which are important when considering the nature of law.
2. To analyse and evaluate the key concepts relevant to law.
3. To develop a reasoned argument which demonstrates understanding of the relationship between particular concepts and the law.
4. To reflect and develop their learning to apply them in further learning contexts.

Contents of the Course

Unit- I: Sources of Law

Custom- Definition, Nature, Requisites of a valid custom, Relation between custom and prescription, Theories regarding transformation of custom into Law

Precedent- Precedent as a source of law, Nature of judicial precedent, Kinds of precedents, Ratio Decidendi Obiter Dicta, Doctrine of Stare Decisis, Prospective overruling, Merits and Demerits
Legislation- Supreme & Subordinate Legislation, Kinds of subordinate legislation, Delegated legislation, control of delegated legislation, Codification of laws

Unit- II: Rights and Duties-Theories of legal rights, Essential elements Classification and categorization of rights, Types of rights, Correlation of rights with duties, Generation of rights, The basis of rights. Obligation and duty.

Unit- III: Legal Personality- Origin & Concept, Definition, Kinds, Liability, Theories
Possession- Nature, Meaning, Roman law, English law, Elements, Kinds, Acquisition
Ownership- Definition, Characteristics, Acquisition, Kinds, Ownership & possession
Title - Definition and Nature, Classification

Unit-IV: The concept of justice- Meaning, nature and varieties of justice-Marx, Austin, Allen. The basis of justice- the liberal contractual tradition, the liberal utilitarian tradition, the liberal moral tradition, the socialist tradition
Law and morality

Suggested Readings

1. B.N. Mani Tripathi, Jurisprudence (The Legal Theory), Allahabad Law Agency,2012
2. N.V. Paranjape, Studies in Jurisprudence and Legal Theory, Central Law Agency, 2013
3. Nomita Aggarwal, Jurisprudence, Central Law Publication,2010
4. S.N. Dhyani, Fundamentals of Jurisprudence (The Indian Approach), Central Law Agency,2004
5. Michael Doherty, Jurisprudence: The Philosophy of Law, Old Balley Press,2003
6. P.J. Fitzgerald, Salmond on Jurisprudence, Thomson Sweet & Maxwell Universal, 2008
7. R.W.M. Dias, Jurisprudence, Lexis Nexis (Indian Edition)2013
8. Suri Ratnapala, Jurisprudence, Cambridge University Press (First South Asian Edition)2009
9. W. Friedmann, Legal Theory, Universal Law Publishing Co.,2008
10. Bodenheimer, Jurisprudence-The Philosophy and Method of Law, Universal Delhi,1996

LL.M. SEMESTER - II

Paper-VIII

Course Name: Law and Social Transformation in India-II **Maximum marks: 100**

Course Code: 102162 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To understand various crimes against women and children.
2. To understand gender injustice and its various forms.
3. To understand various Constitutional and other legal provisions for empowerment of women and children.
4. To develop thought process of the students regarding the modernization in laws so that positive changes in the society can be brought.
5. To equip the students with the basic concepts of Gandhi's *sarvodaya,* Marxists' view.
6. To trace the reason for development of Naxalite movement.

Outcomes of the Course

Student will be able:

1. To analyse various issues faced by women in our country and their constitutional guarantees.
2. To demonstrate the major contribution of Vinoba Bhave; Jayaprakash Narayan for movement of Sarvodaya; Fabien the importance of Gram *Nyayalayas.*
3. To exhibit modernization and its impact on the law.
4. To analyse different approaches of Law and Justice.
5. To evaluate the reason for the development of Naxalite movement.

Contents of the Course

Unit-I: Constitution and Social Transformation

Constitutional text as a mechanism for social change

The constitutional amendments and social transformation-Basic structure theory

The role of Governmental organs for social transformation
Constitutional interpretations as an effective tool for social transformation

Unit -II: Women, Children and the law

Crimes against women
Gender injustice and its various forms
Women's Commission
Empowerment of women: Constitutional and other legal provisions
Child abuses- Different forms of violence, Child labour, Sexual exploitation and Child trafficking
Children and education

Unit- III: Modernization and the law

Modernization as a value: Constitutional perspectives reflected in the fundamental duties.
Modernization on family laws
Reform of court processes

i. Criminal law: Plea bargaining; compounding and payment of compensation to victims
ii. Civil law: (ADR) mediation and conciliation; *Lokadalats*
iii. Democratic decentralization and local self-government

Unit -IV: Alternative approaches to law

The jurisprudence of *Sarvodaya*---Gandhiji, Vinoba Bhave; Jayaprakash Narayan--- Surrender of dacoits; concept of grama *nyayalayas*
Socialist thought on law and justice: An enquiry through constitutional debates on the right to property
Indian Marxist critique of law and justice
Naxalite movement: causes and cure

Suggested Readings

1. Malik and Raval, Law and Social Transformation, Allahabad Law Agency, 2014
2. Indian Law Institute, Law and Social Change: Indo-American Reflections, Tripathi, 1988
3. H.M. Seervai, Constitutional Law of India, 1996
4. P. Ishwara Bhat, Law and Social Transformation, Eastern Book Company, 2012
5. Sunil Deshta and Kiran Deshta, Law and Menace of Child Labour, Anmol Publications, Delhi, 2000
6. Savitri Gunase Khare, Children, Law and Justice, Sage, 1997
7. J.B. Kripalani, Gandhi: His Life and Thought, Ministry of Information and Broadcasting, Government of India, 1970
8. Flavia Agnes, Law and Gender Inequality: The Politics of Women's Rights in India, Oxford University Press,1999
9. Manushi, A Journal About Women and Society
10. D. D. Basu, Shorter Constitution of India Prentice – Hall of India (P) Ltd., New Delhi, 1996

LL.M. SEMESTER - II

Paper-IX

Course Name: Judicial Process-II **Maximum marks: 100**

Course Code: 102163 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1.To understand the new norms of relationship between the nature of judicial process and Indian judiciary.
2.To make students aware of the various aspects of the judicial process including changing norms of the society.
3. To explore the importance of judicial review with judicial process.
4.To understand the role played by Supreme Court of India in justice delivery system.

Outcomes of the Course

Students will be able:
1. To Understand judicial process and new challenges before the Indian judiciary.
2. To appreciate the role of judges in the judicial activism and the tools and techniques applied by them.
3. To exhibit the origin of indigenous system of Uttarakhand and will be able to apply the learnings of the course in practice.

Contents of the Course

Unit-I: Judicial Process in India- Indian debate on the role of Judges and on the notion of judicial review. New challenges before the Indian judiciary
Unit-II: Independence of judiciary and the nature of judicial process. Attitude of judicial confrontation with the legislature and executive. Appointment and transfer of judges and its effect on independence of judiciary

Unit-III: Judicial activism. Reasons in defence of judicial activism. Constitution of India and Judicial activism. Role played by the Supreme Court of India. The tools and techniques of the judicial activism. Need for care and caution

Unit-IV: Decision making in the Supreme Court of India. Nature of participation- dissent, concurrence, unanimity and voted with majority. Indigenous legal system of Uttarakhand- concept, evolution, prospect and challenges

Suggested Readings

1. A. Lakshminath, Judicial Process and Precedent, EBC, Fourth Edition, 2016
2. Cardozo, Nature of Judicial Process, Universal, New Delhi,1996
3. Henry J Abraham, The Judicial Processes, Oxford,1998
4. W. Friedman, Legal Theory, Stevens, London,1960
5. M.P. Jain, Indian Constitutional Law, Lexis Nexis, Year 2015
6. John Rawls, A Theory of Justice, Universal, New Delhi,2000
7. S.K. Chaturvedi, Judicial Process, Thompson Reuters, Year 2022

LL.M. SEMESTER – II

Paper-X

Course Name- Law and Justice in a Globalizing World **Maximum marks: 100**

Course Code- 102164 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To enable the students to understand the process of globalization and its impact on law and justice.
2. To enable the students to critically analyze the concept of global justice and the mechanisms designed to achieve it.
3. To enable the students to appreciate the demands for change raised by different groups to the international legal order and institutions in the light of globalization.

Outcomes of the Course

Students will be able:

1. To understand the process of globalization and its impact on international as well as municipal law.
2. To analyze the concept and emerging issues of Law and Justice in a globalizing world.
3. To evaluate the effect of globalization on law and justice nationally and internationally.

4. To suggest reforms in international law and working modalities of international institutions.

Contents of the Course

Unit- I: Introduction

Relationship of Law and Justice: Justice as Function and Purpose of Law
Globalization and different dimensions of Globalization: Social, Political, and Economic
Emergence of Transnational Law in a Globalizing World
Globalization and Sovereignty of States

Unit- II: Globalization and Justice

Concept of Global Justice
Global Poverty
Globalization and Social Justice/ Global Distributive Justice
Displacement for Development
Role of international institutions to control armed conflicts, environmental pollution and terrorism

Unit- III: Impact of Globalization and Free Market

Impact of globalization on welfare state
Impact on Natural Resources and Environment
Impact on Human rights
Impact on Trade and Investment law
Impact on Intellectual Property Rights

Unit- IV: Emerging Concepts of Justice in Globalization

Amartya Sen's Idea of Justice: Its relevance in the light of Justice and World.
Special Economic Zone (SEZ): Need of Law and Challenges
Environmental Jurisprudence and Millennium Development Goals (MDGs) to
Sustainable Development Goals (SDGs)
Accountability and Transparency in Governance

Suggested Readings

1. John Rawls, Theory of Justice, Universal publications,2001
2. A. Anghie, Imperialism, sovereignty and the making of international law, Cambridge University Press,2007
3. T. Pogge, World poverty and human rights: Cosmopolitan responsibilities and reforms, Cambridge Polity,2002
4. B. Rajagopal, International law from below: Development, social movements and third world resistance, Cambridge University Press,2003
5. A. Sen, The idea of justice, Harvard University Press,2009
6. N. Fraser, Scales of justice: Reimagining political space in a globalizing world, Cambridge University Press,2010
7. A. Buchanan, Justice, legitimacy, and self-determination: Moral foundations for international law, Oxford University Press,2004
8. U. Baxi, The Future of Human Rights, Oxford University Press,2008

9. Anthony McGrew, David Held, Governing Globalization: Power, Authority and Global Governance, Polity Press, 2002.
10. Jean-Marc Coicaud, Michael W. Doyle, The Globalization of Human Rights, United Nations University Press, 2003
11. John Baylis, Steve Smith, The Globalization of World Politics: An Introduction to International Relations, Oxford University Press, 2008
12. Karl-Heinz Ladeur, Public Governance in the Age of Globalization,2004
13. Laura Valentini, Justice in a Globalizing World: A Normative Framework, Oxford University Press, 2011
14. Simon Coney, Justice Beyond Borders: A Global Political Theory, Oxford University Press, 2005

LL.M. SEMESTER - II

Paper-XI

Course Name- Alternate Dispute Resolution **Maximum marks: 100**

Course Code- 102165 **Semester Examination:60**

Credit:2 **Sessional Examination: 40**

Objectives of the Course

1. To appreciate the importance of alternative dispute resolution mechanism as mode of dispute resolution.
2. To encourage students to play an active role in the construction of their own knowledge and in the design of their own learning strategies.
3. To inculcate the practical approaches through the case study on Domestic Arbitration and International Arbitration.
4. To developed the practical approaches, participation and report writing skills through the participation in *Lok Adalats* and Legal Awareness Camps.

Outcomes of the Course

Students will be able :

1. To understand various modes of ADR with procedure and practice.
2. To evaluate the sophisticated understanding of ethical and legal issues surrounding dispute

resolution models and practice including case study.

3. To formulate the modalities and techniques of resolution of disputes through outside court settlement.

Contents of the Course

Unit-I: Introduction & General Concept of Alternative Dispute Resolution and Arbitration

Meaning, Nature and Scope of ADR, Arbitration- Definitions with related Sections description, New York Convention and Geneva Convention, Indian Council of Arbitration (ICA) – Its system and working

Unit -II: Other Modes of Alternative Dispute Resolution and Report Writing

Conciliation, Mediation, Negotiation, Section 89 of the Civil Procedure Code, 1908 and Plea Bargaining, Reports on participation in Legal Awareness Camps organized by department and/or with other institutions, Reports on participation in Lok *Adalats*

Suggested Readings

1. Avtar Singh, Law of Arbitration & Conciliation and Alternative Resolution Systems, Eastern Book company,2021
2. K.V. Satyanarayana, Law of Arbitration and Conciliation in India, Asia Law House,2021
3. Madsudan Sahary, Text book on Arbitration and Conciliation with Alternative Dispute Resolution, Universal Law Co.Pvt.Ltd.,2017
4. N.V. Paranjpe, Law relating to Arbitration & Conciliation in India, Central Law Agency,2016
5. Rohit M. Subramanium, Eastern Book Co., 2021
6. Anirban Chakraborty, Law & Practice of Alternative Dispute Resolution in India, LexisNexis, 2016
7. S.M. Jhunjhunwala, Law of Arbitration and Conciliation, Snow white Publications Pvt. Ltd., 2021
8. Shashank Garg, Alternative Dispute Resolution, Oxford,2018

LL.M. SEMESTER - II

Paper-XII

Course Name- Basic Research Methods **Maximum marks: 100**

Course Code- 102166 **Semester Examination:60**

Credit:2 **Sessional Examination: 40**

Objectives of the Course

1. To make the students understand the fundamentals of research.
2. To help students identify legal research goals.
3. To make them familiar with problems being faced by researchers in India.
4. To help them understand mechanics of report writing.

Outcomes of the Course

Students will be able:

1. To conduct effective doctrinal as well as empirical legal research by using fundamental tools of legal research.
2. To learn the proper ways of citation.
3. To design and execute research problem.
4. To develop a research proposal to write dissertation.

Contents of the Course

Unit- I: Research

What is Research? Meaning and Objectives
Legal Research - Meaning, scope and purpose. Relation between law and society
Types/kinds:

a. Doctrinal and Non-Doctrinal (empirical)
b. Applied Research
c. Fundamental Research
d. Library Research
e. Analytical Research
f. Participatory and Non–Participatory

g. Comparative and Historical
h. Socio-legal Research
i. Quasi disciplinary and Inter-disciplinary (multi- disciplinary) Research
j. Quantitative and qualitative Research
k. Research for Legal Reform

Unit- II: Research Methods

Research Design
Various Steps in Research: Research Process
Research Problem: Identification and Formulation
Hypothesis
Use of Library
Use of Modern Technology/ Computer Assisted Research
Tools and Techniques for Collection of Data

a. Primary and Secondary Sources
b. Literature Review
c. Observation Method
d. Questionnaire
e. Interview
f. Case study
g. Sampling
h. Jurimetrics

Analysis and Interpretation of Data

a. Use of Deductive and Inductive Methods in Research
b. Preparation of Research Report and Writing of Research report
c. Budgeting of Research
d. Ethical and Legal Issues: Plagiarism and Copyright Violation

Suggested Readings

1. M.O. Price, H. Binter and Bysiewiez, Effective Legal Research,1978.
2. Pauline V. Young - Scientific Social Survey and Research,1962.
3. William J. Grade and Paul K. Hatt, Methods in Social Research, Graw-Hill Book Co.
4.H.M.Hyman, Interviewing in Social Research, 1965
5. Payne, The Art of Asking Questions,1965
6. Morris L. Cohan- Legal Research in Nutshell, West Publishing Co.,1996
7. Harvard Law Review Association- Uniform System of Citations
8. Indian Law Institute Publication- Legal Research and Methodology

LL.M.-III

SEMESTER

LL.M. SEMESTER - III

Paper-XIII

Course Name- Comparative Public Law **Maximum marks: 100**

Course Code- 103161 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To understand the term public law by contrasting with the realm of private law and the relationship between the two streams of law.
2. To identify the basic concepts of public law framework and the emerging concepts in administrative law and criminal law.
3. To provide a comparative analysis about the structure of government, legislative process and the role of the judiciary to have better understanding of the Indian polity.

Outcomes of the Course

Students will be able:

1. To understand and appreciate a particular legal system in the wider socio-political context in which it operates.
2. To apply the concepts and laws appropriately in the course of professional performance.
3. To identify the potential areas of research.

Contents of the Course

Unit- I: Public Law and its Role in Governance

Nature of Public Law
Distinction between public and private law
Scope of Public law – Constitutional law, administrative law and Criminal law
Basic concepts of Public Law
Principles of Accountability and Public Law

Unit- II: Comparative Constitutional Law

Presidential and Parliamentary forms of Government
Federal and Unitary Governments
Forms of Governments
Federal and Unitary Forms
(a) Features, Advantages, and Disadvantages
(b) Model of Federalism and Concept of Quasi-Federalism
(c) Role of Courts in Preserving Federalism

1. Supremacy of Legislature in Law Making
2. Rule of Law

(a) Dicey's Concept of Rule of Law
(b) Modern Concept of Rule of Law
(c) Social and Economics Rights as Part of Rule of Law
Separation of Powers
(a) Concept of Separation of Powers
(b) Checks and Balances
(c) Separation of Powers or Separation of Functions

Unit-III: Comparative Administrative Law
French concept of Separation of Powers and Administrative Courts
Droit Administratiff
Administrative courts in France
Councel d' etat
Scope of Judicial Review in UK
Scope of Judicial Review in US
Public Interest Litigation in India and US

Unit-IV: Comparative Criminal Law

Domestic Violations-International, National
Provisions relating to Rape
Plea Bargaining-USA, India
White Collar Crimes
Juvenile Justice

Suggested Readings

1. Christopher Forsyth, Mark Elliott, Swati Jhaveri, Effective Judicial Review: A Cornerstone of Good Governance, Oxford University Press, 2010
2. D.D. Basu, Comparative Constitutional Law,2nd ed., Wadhwa, Nagpur
3. David Strauss, The Living Constitution, Oxford University Press, 2010
4. Dr. Subhash C. Kashyap, Framing of Indian Constitution, Universal Law, 2004
5. Elizabeth Giussani, Constitutional and Administrative Law, Sweet and Maxwell, 2008
6. Erwin Chemerinsky, Constitutional Law, Principles and Policies ,3rd ed., Aspen, 2006
7. M.V. Pylee, Constitution of the World, Universal, 2006
8. Mahendra P. Singh, Comparative Constitutional Law, Eastern Book Company, 1989
9. Neal Devins and Louis Fisher, The Democratic Constitution, Oxford University Press, 2010
10. S.N. Ray, Judicial Review and Fundamental Rights, Eastern Law House, 1974
11. Sudhir Krishna Swamy, Democracy and constitutionalism in India – A Study of the Basic Structure Doctrine, Oxford University Press, 2009
12. Sunil Khilnani, Vikram Raghavan, Arun Thiruvengadam, Comparative Constitutionalism in South Asia, Oxford University Press, 2013
13. Vikram David Amar, Mark Tushnet, Global Perspectives on Constitutional Law (Oxford University Press, 2009
14. Zachery Elkins, Tom Ginsburg, James Melton, The Endurance of National Constitutions, Cambridge University Press, 2009

LL.M. SEMESTER - III

Paper-XIV

Course Name- Mass Media Law **Maximum marks: 100**

Course Code- 103162 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To equip the students with fundamental knowledge of Media law.
2. To understand constitutional and legal framework of media law.
3. To introduce students to the major legal, ethical and policy issues related to the mass media.
4. To explain in broad context, existing media law and policy and be able to critique and analyse future laws and policies.

Outcomes of the Course

Students will be able:

1. To critically analyze the legal and regulatory restrictions on freedom of speech and expression and their impact on freedom of press.
2. To explain and apply the legal principles in practice.
3 To develop the research-oriented understanding in the field of mass media law.

Contents of the Course

Unit-I: Media and the Constitution

History of Media Law in India, Constitutional Rights of Media & Limitations on Freedom of Speech and Expression

Media & Other Constitutional Estates

- Legislature: Breach of Privileges
- Judiciary: Contempt of Court
- Executive: Official Secrets Act, Central Civil Service Conduct Rules
- Issues relating to reporting Legislature and Judiciary

Unit-II: Media and the Law

Media & Criminal Law

- Defamation
- Sedition
- Obscenity

Media and Civil wrongs (Torts)

- Defamation
- Breach of privacy
- Negligence

Media & Copyright issues
Right to Information Act 2005: New tool for Press Freedom
Media and Journalists: Working Journalists Act and Press Council & Human Rights
Trial by Media: Influence on Adjudicators

Unit-III: Advertisement and the Law

Basis of Advertisement: Constitutional Freedom of Commercial Speech
Drug and Magic Remedies (Objectionable Advertisements) Act and other Laws regulating Advertisements
Content of Advertisements: Civil and Criminal liability
Unfair Practices through Advertisements and Consumers Rights
Advertising Standards Council of India: A Self- Regulatory Organization
Misleading Advertisements

Unit-IV: Electronic Media and Regulatory Law

Convergence of New Media in the Internet: Cinema, Social Media
Expansion of Electronic Media: Broadcast sector – TV and Radio
Autonomy of Public Sector Broadcaster: Prasar Bharti Law
Freedom of Private Broadcasting: Broadcasting Regulation Bill and Cable TV Network Regulation Act
Cinematography Act, Pre-censorship, Indecent Representation of Women (Prohibition) Act and Young Persons (Harmful Publications) Act
Information Technology Act 2000

Suggested Readings

1. H.M. Seervai, Constitutional Law of India, 1991
2. M.P. Jain, Constitutional Law of India, 1994
3. John B. Howard, The Social Accountability of Public Enterprises, 1980
4. Rajeev Dhavan, On the Law of the Press in India, 26 JILI 288 (1984)
5. Soli Sorabjee, Law of Press Censorship in India, 1976
6. E.S. Venkaramiah, Freedom of Press: Some Recent Trends, 1984
7. D.D. Basu, The Law of Press of India, 1980
8. Rajeev Dhavan, Legitimating Government Rhetoric: Reflections on Some Aspects of the Second Press Commission, 26 JILI 391, 1984

LL.M. SEMESTER - III

Paper-XV

Course Name-National Security, Public Order and Rule of Law **Maximum marks: 100**

Course Code- 103163 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objective of the Course:

1. To understand the importance of rule of law as the base of true democratic system.
2. To understand the grave threats faced by the state to its existence arising from extra ordinary circumstances created by war or external aggression or armed rebellion.
3. To analyze the different aspects of such emergency powers and scrutinizing intellectual attitude towards such powers.

Outcomes of the Course

Students will be able:

1. To demonstrate the threats faced by the state to its existence arising from extra ordinary circumstances created by war or external aggression or armed rebellion.
2. To analyse the protection of national security and maintenance of public order that results into expansion of the powers of the state and its agencies.
3. To evaluate the maintenance of balance between national security, public order on the one hand with the rule of law on the other.

Contents of the Course

Unit-I: National Security, Public Orders and Rule of Law: Emergency Detention in England-Civil Liberties, Subjective satisfaction or objective assessment? Pre-Independence law.

Unit-II: Article 22 of the Constitution, Preventive Detention and Safeguards, Declaration of Emergency, 1962, 1965 and 1970 Emergencies, 1975 Emergency

Unit-III: Exceptional Legislations: COFEPOSA and other legislation to curb economic offenders, TADA -The Draconian Law, Comments of NHRC, Special courts and Tribunals, Due process and special legislation, Martial law, Provisions in English, Provisions in the Constitution.

Unit-IV: Civil Liberties and Emergency: Article 19, Meaning of 'Security of State', Meaning of 'Public Order', Suspension of Article 19 Rights on Declaration of Emergency, President's Right to suspend right to move any court, Article 21-Special importance-its non-suspend ability, Suspendability-44th Amendment.
Access to Courts and Emergency: Article 359-ups and downs of judicial review, Constitution (44th) Amendment Act, 1978, Constitution (59th) Amendment Act, 1988

Suggested Readings

1. G.O. Koppell, The Emergency, The Courts and Indian Democracy 8 JILI 287 (1966)
2. H.M. Seervai, The Emergency, Future Safeguards and the Habeas Corpus, 1978
3. International Commission of Jurists, Status of Emergency and Human Rights, 1984
4. N.C. Chatterji and Parameshwar Rao, Emergency and the Law, 1966
5. M.P. Jain, Indian Constitutional Law, Lexis-Nexis,2018

LL.M. SEMESTER - III

Paper-XVI

Course Name-Administrative Process and Judicial Control **Maximum marks: 100**

Course Code- 103164 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To understand the new norms of relationship between the administrative process and judicial control.
2. To explain the nature of administrative process and examine the judicial review of administrative action in India.
3. To demonstrate the importance of limits of judicial review, separation of power, and to control and check scope of the administrative actions.
4. To apprise of the legal framework governing public administration and the principles to control executive power to avoid arbitrariness and promote equity, justice and good conscience.

Outcomes of the Course

Students will be able:

1. To understand and interpret administrative processes to explore the various functional aspects of administrative body.
2. To explain various principles governing the judicial control over the administrative power.
3. To examine the new emerging trades in the administrative process and judicial regulation of the same.
4. To develop the enquiry of understanding the latent aspects of administrative process that imbibe in a power-liabilities dynamics, and its scope of judicial review on the administration action.

Contents of the Course

Unit-I: Administrative process: Nature and Meaning, the role of civil service, the role of administrative agencies, Constitutional standards: Doctrine of Police Power, Doctrine of Eminent Domain, Taxing power, Responsibility and accountability.

Unit -II: Judicial Review of Administrative action in India: Historical development, power of Supreme Court, Powers of High Courts, Role of Subordinate Courts. Jurisdiction: Finality Clause, Conclusive evidence Clauses, Law Fact distinction, Exclusionary Clause. Ground of Judicial Review: Doctrine of Ultra vires, Unreasonable discretionary power: From Liversidge to Padfield, discretion and Justifiability, violation of fundamental rights, Extraneous consideration and /or irrelevant ground, delegation acting under dictation, Mala fides and Bias, Lack of rationality and proportionality, oppressing decision.

Unit-III: Limits of Judicial Review: Locus standi and PIL, Laches, Res-judicata, alternative remedies, Remedies Writs, injunction and declaration.

Unit-IV: Tortuous and contractual liability, emerging liability-Personal accountability, compensatory jurisprudence and right to live, accountability under consumer protection law, Promissory Estoppels: Legitimate expectation and Constitutional dimensions.

Suggested Readings

1. I.P. Massey, Administrative Law, EBC, 2020
2. M.P. Jain, Administrative Law, Lexis Nexis ,2017
3. C.K. Takwani, Lectures on Administrative Law, EBC, 2021
4. S.P. Sathe, Administrative Law, Lexis Nexis, 2010
5. A. Lakshminath, Judicial Process & Precedent, EBC ,2009
6. Paul Craig, Administrative Law, Sweet & Maxwell, 2018
7. H.W.R. Wade& C.F. Forsyth, Administrative Law, Oxford, 2014
8. B. P. Banerjee, Judicial Control of Administrative Action, Lexis Nexis, 2012
9. Stephen P. Robbins, Administrative Process, Prentice Hall, 1976

LL.M. SEMESTER - III

Paper-XVII

Course Name-Seminar Paper **Maximum marks: 100**

Course Code- 103165 **Semester Examination:60**

Credit:2 **Sessional Examination: 40**

Seminar papers are transacted in courses and are graded on the basis of the student's research paper, report, and presentation. At the postgraduate level, the seminar paper is an important part of developing research direction. Students will be exposed to work in a contemporary area of law through the Seminar paper at the postgraduate level, and they will be able to demonstrate their understanding through extensive written submissions and presentation. This will also allow students to voice their unique ideas, which will be backed up by solid background study, in order to develop alternative solutions to current legal concerns. Students will also be able to create research work worthy of publication in reputable journals or book chapters under the assistance of faculty mentors and this mandatory paper will also nurture and hone presentation skills of the students. Students are encouraged to follow the University's Academic Integrity Policy when working on projects or writing papers for publication. "Academic Integrity" refers to the activity of intellectual honesty that results in the development of intellectual property and involves a student.

LL.M.-IV

SEMESTER

LL.M. SEMESTER - IV

Paper-XVIII

Course Name-Indian Constitutional Law: The New Challenges **Maximum marks: 100**

Course Code- 104161 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To explore Constitution as a living and composite document and to address the emerging issues and challenges.
2. To acquaint students that the Constitution being the fundamental law, an insight into its new trends is essential for a meaningful understanding of the legal system and processes.

Outcomes of the Course

Students will be able:

1. To understand and interpret Constitution to address the emerging complex issues.
2. To explore the various Constitutional principles working in the backdrop and its interplay with the emerging issues.
3. To explore the potential area of research.

Contents of the Course

Unit -I: Indian Federalism

Creation of new states and need for widening the definition in the wake of liberalization
Allocation and share of resources - distribution of grants in aid
The inter-state disputes on resources
Rehabilitation of internally displaced persons
Centre's responsibility and internal disturbance within States
Directions of the Centre to the State under Article 356 and 365
Federal Comity: Relationship of trust and faith between Centre and State
Special status of certain States
Tribal Areas, Scheduled Areas

Unit-II: Emerging Regime of New Rights

Reading Directive Principles and Fundamental Duties as Fundamental Rights
Right to education; Commercialization of education and its impact; and Brain drain by foreign education market

Religious freedom and right of minorities to establish and administer educational institutions of their choice
Implementation of International Obligation: Human Rights, Environmental protection and International trade
Empowerment of Women
Freedom of Press and Challenges of new scientific development
Rights of Third Gender

Unit-III: Institutional Dynamics
Overview of functioning of three organs of the State in post-independence era
Separation of powers and theory of checks and balance
Privileges and Immunities of legislature and their members
Judicial Activism and Judicial Accountability
Contempt of Courts
Political Morality and effect of Anti-Defection Law

Unit-IV: Democratic Process
Nexus of politics with criminals and the business
Election: Status of election commission, electoral reforms
Coalition government: stability, durability, and corrupt practice
Grass root democracy.

Suggested Readings

D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2019
H.M. Seervai, Constitutional Law of India, Universal Book Traders 1996
M.P. Jain, Indian Constitutional Law, Wadhwa and Co., 2003
Granville Austin, Indian Constitution-Cornerstone Nation, Clarendon Press, 1999

LL.M. SEMESTER - IV

Paper-XIX

Course Name-Civil and Political Rights: Comparative Study **Maximum marks: 100**

Course Code- 104162 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To impart knowledge and understanding of the civil and political rights enshrined in the Constitution of India.
2. To understand the comparative study of Civil and Political Rights.
3. To have an insight into the working of American Constitutional System.
4. To analyse the Electoral Process and Laws of India and US.

Outcomes of the Course

Students will be able :

1. To develop a deep and comprehensive understanding of the civil and political rights enshrined in the constitution of India.
2. To understand and comprehend comparative analysis of civil and political rights.
3. To exhibit knowledge of the First Amendment of the American Constitution.
4. To explore the potential area of research.

Contents of the Course

Unit-I: Constitutional basis for protection of Individual rights

Balance between individual liberty and social needs

Availability and suspension of rights

Protective discrimination with special references to emerging judicial response to the problems of group inequalities

Unit-II: Right to Equality and Freedom of Speech and Expression

Right to Equality: General principles, Protective discrimination with special reference to emerging judicial response to the problems of group inequalities. Comparative study of the decisions of the Indian and American courts

Freedom of Speech and Expression: Liberty of Press as interpreted by the Indian Supreme Court and to the interpretation of the freedom guaranteed by the First Amendment of the American Constitution

Unit-III: Right to Life and Freedom of Religion

Expansive interpretation of Article 21
Nature, scope and meaning of terms "Personal Liberty", and "Procedure established by law" in Indian Constitution, Nature, scope and meaning of terms "Liberty" and "Due Process" in American Constitution
Freedom of religion: profess, practice, propagation and administration of religious institutions
Freedom of religion: judicial interpretation of the freedom under the Constitution of India and of the United States

Unit-IV: Elections and the Emerging Electoral Rights

Adaptability of the Constitutional law to the changing needs of the society
Power and Procedure for amendments of these rights under the American and Indian constitution
Constitutional foundation of the right to vote
The voting rights Acts.
Judicial supervision of Elections
Role of Election commission

Suggested Readings

H.M. Seervai, Constitution of India, Universal Publication,2020
M.P. Jain; Indian Constitutional Law, LexisNexis, 2018
Jenny Schultz, Melissa Castan, and Sarah Joseph, The International Covenant on Civil and Political Rights, Cases, Materials, and Commentary, Oxford University Press,2014

LL.M. SEMESTER - IV

Paper-XX

Course Name-Constitutionalism: Pluralism & Federalism **Maximum marks: 100**

Course Code- 104163 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To introduce students the various models of pluralism and forms of constitutional government and federal structures.

2. To study federal forms of government from various jurisdictions.

3. To understand the federal form of government prescribed under the constitutional scheme in India.

Outcomes of the Course

Students will be able:

1. To understand various contours of federal form of governance.

2. To analyse the ideas of pluralism and equality under the constitutional scheme.

3.

Contents of the Course

Unit-I: Constitutionalism

What is Constitution? Limitation on Government parts
Democracy/Authoritarianism/ Dictatorship
Separation of Powers. Rule of Law-concept and new horizons
Conventions of constitutionalism - law and conventions
Fundamental rights, Human rights, Human rights-International conventions

Unit-II: Federalism

What is federal Government? Difference between confederation federation and unitary
Conditions required for federalism. Patterns of Federal Governments: USA, Australia, Canada, India
New trend in Federalism –Cooperative Federalism full faith and credit, Inter-State Council, Zonal Councils
India: Central control v. State Autonomy**.** Political factors influencing federalism. Judicial review- for federal umpiring

Plural aspects of Indian federalism-Jammu &Kashmir, Punjab and Assam. Dynamics of federalism

Unit-III: Pluralism

What is pluralist society? Ethnic, Linguistic, cultural, Political Pluralism
Individual rights – Right to dissent. Right to self-determination
State intervention for protection of human rights
Rights of religious and linguistic minorities in India
Compensatory discrimination for backward classes
Freedom of association and Freedom of religion

Unit-IV: Equality in Plural Society

Right to equality and reasonable classification
Women-Right to equality and right to special protection in India
Abolition of untouchability and position of SC, ST and OBC in India
Tribal groups and equality
Prohibition of discrimination on ground of religion, caste, sex language
Secularism- Constitutional principles

Suggested Readings

1. U. Baxi, Law, Democracy and Human Rights, 5 Lokayan Bulletin 4,1987
2. V.M. Danekar, Unitary Elements in a Federal Constitution, 22 ,EPW
3. M.A. Fazal, Drafting a British Bill of Rights, 27 JILI 423(1985)
4. Rhett Ludwikowski, Judicial Review in the socialist Legal Systems-Current Development, 37 ICLD 89-108, (1988)
5. Jagat Narain, Judicial Law Making and the Place of the Directive Principles in the Indian Constitution, JILI198 (1985)
6. K.C. Wheare, Federal Government, Greenwood, 1980
7. D.D. Basu, Commentary on the Constitution of India, LexisNexi,s 2015
8. M.P Jain, Indian Constitutional Law, Lexis Nexis, 2018

LL.M. SEMESTER - IV

Paper-XXI

Course Name-Union State Relation & Constitutional Governance **Maximum marks: 100**

Course Code- 104165 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Objectives of the Course

1. To analyze the origin and historic evolution of the concept of federalism in India.
2. To familiarize students with the relationship between union and state under the constitutional mechanism.
3. To develop an understanding among the students about the constitutional provisions with respect to the services under the Union and States.
4. To familiarize the students with the emergency provisions incorporated in the Constitution of India which regulates the relationship between the Centre and States during emergency.

Outcomes of the Course

Students will be able:

1. To develop an understanding of the constitutional governance under the scheme of our constitution.
2. To analyse the relationship between Centre and State with special reference to emergency provisions.
3. To demonstrate the federal and unitary features under the constitutional provisions.

Contents of the Course

Unit-I: Concept of Federalism

Financial System under the British Rule- Lord Mayo's Financial Reform, Lord Lytton's Provincial Contracts of 1877-78, Financial System under the Government of India Act 1919, Financial Relation under the Government of India Act 1935

Unit-II: Taxing powers

Taxing Powers of the Union, Taxing Powers of the States, Concurrent Taxing Powers, Residuary Taxing Power, Tax and fee, Restrictions on taxing powers

Distribution of Revenue: Exclusively Union Taxes, Central Taxes shared with States, Central taxes assignable to States

Unit-III: Directive Principles of State Policy

Significance of fundamental rights and fundamental duties vis-a-vis Directive Principles of State Policy

Fundamental Duties: Meaning, nature, scope, evolution and its relations with fundamental duties.

Nature, scope and justifiability of Directive Principles of State Policy

Economic Rights: Social security and welfare provisions

Unit-IV: Service under the Union and the States

Recruitment and regulations applicable on conditions of services

Doctrine of pleasure- Restrictions on Doctrine of Pleasure

Constitutional safeguards to civil servants

Public Service Commission- Appointment of member of Public Service Commission and functions of Public Service Commission

Suggested Readings

1. K.C. Wheare - Federal Government, Greenwood, 1980
2. Anirudh Prasad, Centre-State Relations in India, Deep Publishers ,1985
3. H.M. Seervai - Constitutional Law of India, Universal, 2015
4. D.T. Lakdawala - Union State Financial Relations, Anmol 2004
5. D.D. Basu - Commentary on the Constitution of India, LexisNexis 2015
6. Subhash C. Kashyap, Commentary on Constitution of India, Vitasta Publishers, 2019
7. Glanville Austin, The Indian Constitution: Cornerstone of a Nation, OUP 2021
8. M.P Jain, Indian Constitutional Law, LexisNexis, 2018
9. G.S Pande, Constutional Law of India, University Book, 2019

LL.M. SEMESTER - IV

Paper-XXII

Course Name-Dissertation and Viva-Voce **Maximum marks: 100**

Course Code- 104166 **Semester Examination:60**

Credit:4 **Sessional Examination: 40**

Selecting the topic of the dissertation, prior permission of the Head of the Department will be essential and the topic will be related to the subjects / papers which are studied in any one of the semesters. The dissertation shall be supervised by the regular teacher. The dissertation shall be evaluated by external examiner. The viva-voce shall be conducted by an external and an internal examiner. The candidate must have secured 40 percent of marks separately in dissertation and viva-voce and 50% in aggregate. The candidate must be present in viva-voce, otherwise he will be declared fail in viva-voce and the candidate will have to reappear in the viva-voce examination and will have to deposit the fee as required by the university. The dissertation shall be submitted before the commencement of IVth semester examination.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – MATHEMATICS

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

(Revised Syllabus PG w.e.f. 2024-25)

H.N.B. Garhwal University Srinagar (Garhwal)

M.A/M.Sc. Mathematics Course Structure

Semester–I

Core Course

Paper- I –	Discrete Structures	SOS/Math/ C001
Paper -II –	Abstract Algebra- I	SOS/Math/C002
Paper- III –	Numerical Methods	SOS/Math/C003
Paper- IV –	Complex Analysis	SOS/Math/C004
Paper -V –	Operations Research -I	SOS/Math/C005
Paper -VI-	Viva-Voce	SOS/Math/C006

Semester-II

Core Course

Paper- VII	Abstract Algebra- II	SOS/Math/C007
Paper- VIII	Fluid Dynamics	SOS/Math/C008
Paper- IX	Operations Research- II	SOS/Math/C009
Paper- X	Real Analysis	SOS/Math/C0010
Paper- XI	Metric Spaces	SOS/Math/C0011
Paper -XII	Viva- Voce	SOS/Math/C0012

Semester-III

Core Course

Paper- XIII	Topology	SOS/Math/C0013
Paper -XIV	Differential Equations	SOS/Math/C0014

Elective Course (Choose any three):

Paper -XV	Differential Geometry	SOS/Math/E001
Paper- XVI	Mathematical Statistics	SOS/Math/E002
Paper- XVII	Calculus of Variations	SOS/Math/E003
Paper- XVIII	Computer Fundamentals and Data Structures	SOS/Math/E004
Paper- XIX	Algebraic Coding Theory	SOS/Math/E005

Core Course

Paper- XX	Viva-Voce	S0S/Math/C0015

Semester-IV

Core Course

Paper- XXI	Measure and Integration	SOS/Math/C0016
Paper –XXII	Functional Analysis	SOS/Math/C0017

Elective Course (Choose any three):

Paper- XXIII	Linear Integral Equations	SOS/Math/E007
Paper- XXIV	Integral Transforms	SOS/Math/E008
Paper- XXV	Fuzzy Set Theory	SOS/Math/E009
Paper- XXVI	Mathematical Modeling	SOS/Math/E0010
Paper- XXVII	Number Theory	SOS/Math/E0011

Self- Study Course

Paper –XXVIII **(Choose any one):**

(a) Mathematical Methods	SOS/Math/ E006 (a)

(b) Tensor Analysis & Special Theory of Relativity SOS/Math/E006 (b)

(c) Financial Mathematics SOS/Math/E006(c)

Or: The Project Work

The Project Work is approved optionally in place of Self-Study Paper with the condition that the project is assigned to those students who have obtained at least 7.5 CGPA in MA/MSc (I + II Semesters) and the Project Work is also optional for these candidates. The rest of the students will opt Self Study paper.

A topic of project will be assigned to the students by the concern teacher and the students will submit a report at the end of Semester IV. The marks will be awarded based on the Project Report, these marks are splitted in two parts the first internal of 40 marks and second is external of 60 marks based on Evaluation by the committee. The committee will be as follows:

For University Campuses:

(i) Head of the Department
(ii) Supervisor of student
(iii) Internal member from the Department.

For Affiliated Colleges:

(i) Head of Department of concern college
(ii) Supervisor of student
(iii) External member nominated by the Convener of BoS.

The passing percentage in the Project paper shall be 50%.

Core Course

Paper- XXIX Viva-Voce SOS/Math/C0018

Note:

1- In Semester- I all papers are compulsory.
2- In Semester- II all papers are compulsory.
3- In Semester III, papers - XIII, XIV & XXI are compulsory and choose any three papers out of the Elective Papers-XV , XVI, XVII, XVIII & XIX.
4- In Semester-IV, papers -XXII, XXIII, & XXIX are compulsory and choose any three out of the Elective Papers- XXIV, XXV, XXVI, XXVII & XXVIII.
5- Each paper carries 100 marks, which includes two sessional tests (each of 20 marks) and main examination of 60 marks.

Viva-Voce: In this paper evaluation will be based on the students' performance in viva voce (based on the papers of concerned semester), comprehensive test and presentation /seminars on any current topic in Mathematics.

SEMESTER- I

PAPER- I DISCRETE STRUCTURES SOS/Math/C001

I. Recurrence relations, Linear homogeneous recurrence relations, Non-homogeneous recurrence relations, Solutions of recurrence relations.

II. Partially ordered sets, Different type of lattices, Sub-lattices, Direct product, Ideal Lattice, Modular and distributive lattices.

III. Boolean algebra, Ideals in Boolean algebra, Boolean rings, Boolean functions, Karnaugh maps, Application of Boolean algebra to switching theory.

IV. Graphs, Direct graphs, Undirected graphs, Relations and graphs, Path and circuits, Eulerian and Hamiltonian graphs, Planner graphs, Connected graphs.

TEXT/REFERENCE BOOKS

1. Element of Discrete Mathematics: C. I. Liu, Mcgraw Higher Edu. ,2012.
2. Discrete Mathematical Structures : H. G. S. Rao, Galgotia Pub. Pvt. Ltd.
3. Lattice and Boolean Algebra: V. K. Khanna, Vikash Pub. House.
4. Discrete Mathematics: R. Johnsonbaugh , Pearson Edu. Ltd., 2014.

SEMESTER- I

PAPER-II ABSTRACT ALGEBRA- I SOS/ Math/C002

I. Simple groups, Conjugacy, Normalization, Centre of a group, Class equation of a group and its consequences, Theorems for finite groups, Cauchy's theorem, Sylow's theorem.

II. Homomorphism, Endomorphism, Automorphism, Inner automorphism, Kernel of a homomorphism, Fundamental theorem on homomorphism of group, Group ofautomorphisms , Results on group homomorphism.

III. Maximal subgroups, Compositionseries, Jordan-Holder theorem, Solvable groups, Commutator subgroups, Direct products

IV. Ideals, Algebra of ideals, Principal ideal ring, Units and associates, Polynomials ring, Division and Euclidean algorithm for polynomials, Unique factorization theorem

TEXT/REFERENCE BOOKS

1. Contemporary Abstract Algebra:JosephA. Gallian, NarosaPub.House P. Ltd.
2. A First course in Abstract Algebra:John. B. Fraleigh, Pearson Edu. Inc. , 2003.
3. Abstract Algebra :V.K. Khanna and S.K. Bhambri, Vikash Pub. House P. Ltd.
4. Topics in Algebra:I. N. Herstein, John Wiley & Sons, New York.

SEMESTER- I

PAPER –III Numerical Methods **SOSOS/Math/C003**

Unite I: Approximations and error in computation: Error propagation, error in series approximation, error in approximation of functions, accuracy of numbers, Solution of Algebraic and Transcendental Equations: Bisection method, Methods of false position, Secant Method, Newton-Rapson Method.

Unite II: Finite difference: Deference of polynomials, Factorial notation, Error in difference table, difference operators and their relations, missing term problems, difference equations, applications in summation of series.

Unite III: Interpolation: Newton's forward interpolation formula, Newton'sbackward interpolation formula, Central difference formula, Gauss's Forward Interpolation formula,Gauss's backward Interpolation formula, Stirling formula, interpolation of Unequal interval, Lagrange's interpolation formula.

Unite IV: Numerical differentiation using forward, backward and central differences. Numerical Integration: Newton-Cotes Quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eight rule, Weddle's rules. Numerical methods for ordinary differential equations.

Recommended Books:

1. C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis, 7th Edn, PEARSON
2. R.W. Hamming, Numerical Methods for Scientist and Engineers, Dover Publication
3. B. S. Grewal, Numerical Methods in Engineering and Sciences, Khanna Publisher

SEMESTER-I

PAPER-IV COMPLEX ANALYSIS SOS/ Math/C004

I. Power series of analytic functions,Convergence of power series,Radius of convergence,Taylor's and Laurent's series, Residue and poles, Singularities, Classification of singularities.

II. Residues,Residue at infinity,Cauchy residue theorem, Applications of residue theorem in evaluation of improper real integrals.

III. Conformal mapping: properties, Mobius transformation, Elementary examples.

IV. Maximum modulus theorem, Mittag-Leffler theorem,Rouche's theorem,Concept of entire functions with simple example, Analytic continuation.

TEXT/REFERENCE BOOKS

1. Complex Analysis:J.W. Brown and R.V.Churchill, McGraw-Hill Ed.Private Ltd.2015.
2. Complex Analysis:Dennis G. Zill, Jones &Bartlet Learning,2016.
3. Complex Analysis:H. S. Kasana, PHI Learning.
4. Foundation of Complex Analysis:S. Ponnusamy, Alpha Int. Sci.

SEMESTER-I

PAPER –V OPERATIONS RESEARCH –I SOS/ Math/C005

I. An introduction to operations research, Methodology of O.R., Features of O.R. problems, Different models in O.R., Opportunities and shortcomings of O.R. approach.
II. Dual simplex method, Revised simplex method, Sensitivity analysis.
III. Assignment and Transportation problems.
IV. Theory of games, Integer linear programming.

TEXT/REFERENCE BOOKS

1. Operations Research: KantiSwarup, P.K. Gupta & Man Mohan, S. Chand, 1978.
2. Operations Research: Theory and Applications: J.K. Sharma, Trinity Press, 2016.
3. Operations Research: H.A. Taha, Prentice Hall of India, 2011.
4. Operations Research: R. Bronson,Schaum's Outline Series.McGraw Hill, 1982.

SEMESTER-I

PAPER-VI VIVA-VOCE SOS/ Math/C006

SEMESTER-II

PAPER-VII ABSTRACT ALGEBRA-II SOS/ Math/C007

I. Embedding of rings, Ring of residue classes, Fundamental theorem on homomorphism of ring , Prime ideals, Maximal ideal.
II. Euclidean ring, Properties of Euclidean ring, Module, sub-module, Module homomorphism, Linear sum and direct sum of sub-module
III. Extension fields, Simple field extension, Algebraic field extension, Minimal polynomial, Roots of polynomials, Multiple roots, Splitting field.
IV. Automorphism of field, Fixed field, Normal extension, Galois group: Examples and characterizations, Construction with straight edge and compass.

TEXT/REFERENCE BOOKS

1. Contemporary Abstract Algebra :Josheph A. Gallian, Narosa Pub. House P. Ltd.
2. A First course in Abstract Algebra : John. B. Fraleigh, Pearson Edu. Inc. , 2003.
3. Abstract Algebra : V.K. Khanna and S.K. Bhambri, Vikash Pub. House P. Ltd.
4. Topics in Algebra : I. N. Herstein, John Wiley & Sons, New York.

SEMESTER-II

PAPER-VIII FLUID DYNAMICS SOS/ Math/C008

I. Kinematics of fluids, Lagrangian and Eulerian methods, Local and individual time rates of change, Equation of continuity, Boundary surface.
II. Equation of motion of inviscid fluids, Euler's equation of motion, Bernoulli's equation, Lagrange's equation, Conservative field of force, Cauchy's Integral, Helm- Holtz's equation.

III. Impulsive motion of a fluid, Energy equation of inviscid fluid, General theory of irrotational motion, Connectivity, Flow and circulation, Kelvin's circulation theorem, Stokes's theorem, Permanence of irrotational motions, Green's theorem, Kineticenergy of finite and infinite liquid, Kelvin's minimum energy theorem, Mean value ofthe velocity potential over a spherical surface.

IV. Motion in two dimensions, Stream function, Complex potential, Source, Sink, Doublet, Complex potential and images with respect to straight line and circle, Milne- Circle theorem, Blausius theorem.

TEXT/REFERENCE BOOKS

1. Foundation to Fluid Mechanics: S.W. Yuan, Prentice Hall Pvt. Ltd., 1960.
2. Text book of Fluid Dynamics: F. Chorlton, CBS Pub. & Dist. , 2004.
3. Theoretical Hydro-Dynamics: BansiLal, Skylark Pub., 1999.
4. A text book of Fluid – Dynamics: M. Ray & Sharma, S. Chand & Co. Ltd. 2005.

SEMESTER-II

PAPER-IX OPERATIONS RESEARCH-II SOS/ Math/C009

I. Inventory control, Functional role of inventory control, Classification of EOQ models with shortages and without shortages.

II. Queuing theory, Characteristics of Queuing system, Probability distribution in queuing system, Single served queuing model, M|M|1 queuing models, Multiple server queuing models.

III. Markov chain, Application of Markov analysis, State and transition probabilities, Steady state conditions, Sequencing problems, Processing n jobs through two and three machines.

IV. Dynamic programming, Dynamic programming under certainty, Non-linear programming methods, Quadratic programming, Kuhn- Tucker conditions.

TEXT/REFERENCE BOOKS

1. Operations Research: Kanti Swarup, P.K. Gupta & Man Mohan, S. Chand, 1978.
2. Operations Research: Theory and Applications: J.K. Sharma, Trinity Press, 2016.
3. Operations Research: H.A. Taha, Prentice Hall, 2011.
4. Operations Research: R. Bronson, McGraw Hill, 1982.

SEMESTER-II

PAPER-X REAL ANALYSIS SOS/ Math/C0010

I. The Riemann-Stieltjes Integral: Definition and existence of Riemann-Stieltjes integral, Properties of integrals, Integration and differentiation, Fundamental theorem of calculus, Integration of vector-valued functions.

II. Sequences and series of functions, Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Uniform convergence and continuity, Uniform convergence and Riemann-Stieltjes integral, Uniform convergence and differentiation, Weierstrass approximation theorem.

III. Power series, Algebra of power series, Uniqueness theorem for power series, Abel's theorem, Taylor's theorem.

IV. Functions of several variables, Concept of functions of two variables, Continuity, Partial derivatives, Differentiability, Change of variables, The inverse function theorem, The implicit function theorem, Chain rule.

TEXT/REFERENCE BOOKS

1. Mathematical Analysis: S.C. Malik and Savita Arora, New Age Int. 1992.
2. Mathematical Analysis: T.M. Apostol, Pearson Edu. , Taiwan Ltd., 1974.
3. Real analysis: H.L. Royden, Pearson, 2017.
4. Real Analysis: Terence Tao, Springer.

SEMESTER-II

PAPER-XI METRIC SPACES SOS/ Math/C0011

I. Metric on a set, Pseudo-metrics, Equivalent metrics, Limit point, Closed sets, Adherent point, Dense subsets, Interior of a set and its properties, Subspaces, Product spaces.

II. Convergent sequences, Cauchy sequences, Algebra of convergent sequences, Subsequences, Continuity at a point, Continuity over a apace, Algebra of real valued continuous functions in a metric space, Homeomorphism, Isometries, Uniform continuity.

III. Complete metric spaces, Completeness and continuous mappings, Cantor's intersection theorem, Contraction mapping theorem, Connectedness in metric spaces, Properties of connectedness.

IV. Compact spaces, Compact subsets of the real line, Compactness and continuous mappings, Sequential compactness, Countable compactness, B-W property, B-W property and boundedness, B-W property and compactness, Compactness and uniform continuity, Lebesgue covering Lemma.

TEXT/REFERENCE BOOKS

1. Introduction to Topology and Modern Analysis: G.F. Simmons, Tata McGraw-Hill.
2. Metric Spaces: E.T. Copson, Cambridge University Press, 1968.
3. Topology :Robert H.Kasriel, Dover Pub. , 2009.
4. Topology of Metric Spaces: S.Kumaresan, Alpha Science Int. , 2011.

SEMESTER-II

PAPER-XII VIVA-VOCE SOS/ Math/C0012

SEMESTER-III

PAPER-XIII TOPOLOGY SOS/ Math/C0013

I. Definition and examples of topological spaces, Closed sets, Closure, Dense subsets, Neighborhoods, Interior, Exterior and accumulation points, Bases and sub bases, subspaces, Product spaces and relative topology.

II. Continuous function, Homeomorphism, Connected and disconnected sets, Components, Locally connected spaces.

III. Countability axioms, First and second countable spaces, Lindelof's theorem, Separable spaces, Second countable and separability, Separable axioms: T_0, T_1, T_2, T_3, $T_{3\frac{1}{2}}$, T_4 and their characterizations.

IV. Compactness, Continuity and compact sets, Basic properties of compactness, Compactness and finite intersection property, Sequentially and countably compact sets, Local compactness, Tychonoff's theorem.

TEXT/REFERENCE BOOKS

1. Topology: A First Course: James R. Munkres, Prentice Hall, Incorporated, 2000.
2. General Topology: J.L. Kelly, Springer, 1975.
3. Topology and Modern Analysis: G.F. Simmons, Tata McGraw-Hill.
4. General Topology: Seymour Lipchitz, Schaum Outline Series.

SEMESTER-III

PAPER –XIV DIFFERENTIAL EQUATIONS SOS/ Math/C0014

I. Ordinary differential equations: Qualitative properties of solution, Oscillation, Wronskian, Sturm separation and comparison theorem, Picard iteration methods, Uniqueness and existence theorem.

II. Ordinary points, Regular and singular points, Frobenius series solution for Legendre's and Bessel's differential equations with generating functions.

III. Classification of PDE of 2^{nd} order and canonical forms, Concept of separation of variable solution.

IV. Solution of heat diffusion, Laplace and wave equations, Non-linear partial differential equation of second order.

TEXT/REFERENCE BOOKS

1. Differential equation with Applications and Historical notes: G.F. Simmons, CRC Press, Taylor & Francis Group.
2. A Course in ODE: B. Rai, D.P. Chaudhary & H.I. Freedman, Alpha Sci. Int. Ltd.
3. Advanced Differential Equations: M.D. Raisinghania, S. Chand Pvt. Ltd., 2008.

SEMESTER- III

PAPER- XV DIFFERENTIAL GEOMETRY SOS/ Math/ E001

I. Curves in space; Arc length, Order of contact, Tangent, Normal, Binormal, Osculating, Plane, Serret-Frenet formulae, Curvature and torsion. Osculating circle and osculating sphere, Helix, Bertrand curves.

II. Behaviour of a curve in the neighbourhood of a point. Concept of a surface, Envelope and developable surface, Parametric curves, Family of the surfaces, Edge of regression, Ruled surfaces, Central points.

III. Fundamental forms and curvature of surfaces: First fundamental form. Second fundamental form of the surfaces of revolution, Weingarten's equation, Direction coefficients, Family of curves.

IV. Local non-intrinsic properties of a surface Normal curvature, Principal directions, Principal curvatures, Minimal surface, Lines of curvature.

Rodrigues and Monge's theorem, Euler's theorem, Joachimisthal's theorem, Dupin's indicatrix, Third fundamental form.

TEXT/REFERENCE BOOKS

1. Differential Geometry: T.J. Willmore, Dover Pub. Inc., New York.
2. Differential Geometry of Three Dimensions: C.E. Weathrburn, Cambridge Univ. Press.
3. Elements of Differential Geometry: R.S. Millman & G.D. Parket, Prentice Hall.
4. Introduction to Differential Geometry: A. Goctz, Addison Wesley Pub. Co., 1970.

SEMESTER – III

PAPER-XVI MATHEMATICAL STATISTICS SOS/ Math/E002

I. Elements of probability, Sample space, Discrete probability, Baye's theorem, Random variables and distribution functions, Mathematical expectations and moments.

II. Some standard discrete and continuous univariate distributions: Binomial, Poisson, Normal, Gamma and Beta distributions.

III. Correlation, Rank correlation, Regression line, Multiple and partial correlation of three variables only, Data reduction techniques, Canonical correlation.

IV. Concepts of sampling, Stratified sampling and systematic sampling, Test of hypothesis: t,z ,chi square test.

TEXT/REFERENCE BOOKS

1. Fundamental of Mathematical Statistics: S.C. Gupta and V.K. Kapoor, S. Chand.
2. Advanced Theory of Statistics : M.G. Kandall.
3. A first Course on Mathematical Statistics: C.E.Weatherburn, Cambridge Univ. Press, 1968.

SEMESTER-III

PAPER-XVII CALCULUS OF VARIATIONS SOS/ Math/E003

I. Variation of functional, Continuity and differentiability of functional, Necessary condition for an extremum, Euler's equation, Variational problems in parametric form, Functional depending on higher order derivatives and variational problems with subsidiary condition.

II. The isoperimetric problem, Invariance of Euler's equation under coordinate transformation, General variational of functional, Variable end point problems, Transversality condition transversal theorem, Weierstrass-Endmann corner condition.

III. Sufficient condition for extremum: second variation, Legendre's and Jacobi's necessary condition, Canonical transformation, Noether's theorem, The principle of least action, Conservation law, Hamilton Jacobi's equations.

IV. Transformation of ODE and PDE into functionals and their solutions by Ritze, Galerkin, Collocation and Kantrovitch methods.

TEXT/REFERENCE BOOKS

1. Calculus of Variation: Gelfrand and Fomin, Dover Pub. Inc., New York.
2. Calculus of Variation: Elsgolt , University Press of the Pacific, 2003.

3. Calculus of Variation: A.S.Gupta, PHI Learning Pvt. Ltd., 2015.

SEMESTER- III

PAPER-XVIII COMPUTER FUNDAMENTALS AND DATA STRUCTURES SOS/ Math/E004

I. History and classification of computers, Fundamentals of computer system: Data types, Number system, Complements; Floating point representation, Normalized floating point representation, Fixed point represented arithmetic computations.

II. Truth tables, Boolean algebra, De-Morgan's theorem, Logical gates, Logic diagram, Logical expressions/functions, Karnaugh maps, Sum of product and product of sum, Combinational circuits and integrated circuits.

III. Introduction to data structures, Arrays, Stack and queues, Linked lists, Singly and doubly linked lists, Binary trees, Operations on binary trees and applications.

IV. Sorting, Searching, Algorithms and graphs.

TEXT/REFERENCE BOOKS

1. Fundamental of Computers: V. Raja Raman, PHI Learning Pvt. Ltd.
2. Introduction to Computers: P. Norto, Glencoe/ McGraw-Hill, 1998.
3. Data Structures with C: S.Lipschutz, Tata McGraw-Hill Pvt. Ltd.

SEMESTER -III

PAPER- XIX ALGEBRAIC CODING THEORY SOS/ Math/E005

I. The communication channel, The coding problem, Types of codes, Error-detecting and error-correcting codes, Linear codes, Hamming metric, Description of linear block codes by matrices.

II. Dual codes, Standard array, Step-by-step decoding, Modular representation, Error-correction, Capabilities of linear codes, Bounds of minimum distance for block codes, Plotkin bound, Hamming sphere packing bound, Bounds for burst-error detecting and correcting codes.

III. Important linear block codes, Hamming codes, Golaycodes, Perfect codes, Quasi-perfect codes, Reed-Muller codes, Codes derived from Hadamard matrices, Product codes, Concatenated codes.

IV. A double error correcting decimal code and an introduction to BCH codes, BCH bounds, Cyclic codes, Matrix representation of cyclic codes, Error detection and cyclic codes, MDS codes.

TEXT/REFERENCE BOOKS

1. Fundamental of Error- Correcting Codes: V. Pless and W.C. Huffman, Cambridge Univ. Press.
2. A First Course in Coding Theory: Ramond Hill, Oxford Univ. Press.
3. Error Correcting Coding Theory: M.Y. Rhee, McGraw-Hill, 1989.
4. Algebraic Coding Theory: E.R.Berlckamp, World Sci. Pub. Pvt. Ltd.

SEMESTER -III

PAPER-XX VIVA-VOCE SOS/Math/C0015

SEMESTER –IV

PAPER-XXI MEASURE AND INTEGRATION SOS/Math/C0016

I. Lebesgue outer measure, Measure of open and closed sets, Borel sets, Measurable sets, Measure of cantor's ternary set, Non-measurable sets.

II. Measurable functions, Algebra of measurable functions, Step functions, Characteristic function, Simple functions, Convergence in measure, Egoroff's theorem, Riesz theorem.

III. Lebesgue Integral and their properties, General Lebesgue integrals, Lebesgue integrals for unbounded functions, Convergence theorems, Fatou Lemma.

IV. Functions of bounded variations, Absolutely continuity, Variation function, Jordan-decomposition theorem, Indefinite integral and its characterizations, Differentiation of an integral, Lebesgue differentiation theorem.

TEXT/REFERENCE BOOKS

1. Real Analysis: H.L. Royden, Pearson, 2017.
2. Measure and Integration: S.K. Berberian, The Macmillan Company, 1965.
3. Lebesgue Measure and Integration: P.K. Jain and V.P. Gupta, Wiley, 1986.
4. Measure Theory and Integration: G. De. Barra, Horwood, 2003.

SEMESTER-IV

PAPER- XXII FUNCTIONAL ANALYSIS SOS/Math/C0017

I. Normed linear spaces, Banach spaces, Subspaces, Quotient Spaces, Equivalent, Norms.

II. Bounded linear Transformation/operators, Hahn- Banach theorem, Open mapping theorem, Closed graph theorem, Uniform boundedness principle.

III. Inner product spaces, Hilbert spaces, Orthogonality of vectors, Orthogonal complements and projection theorem, Riesz representation theorem, Orthonormal Sets.

IV. Operators on Hilbert Spaces, Self-adjoint, Normal and unitary operators, Orthogonal projection operators.

TEXT/REFERENCE BOOKS

1. Functional Analysis:P.K. Jain, O.P. Ahuza and Khalil Ahamad, Wiley, 1996.
2. Topology and Modern Analysis: G.F. Simmons, Tata McGraw-Hill.
3. Introductory functional Analysis with Applications: E. Kreyszig, Wiley, 1989.
4. Functional Analysis: B.V. Limaye, New Age Int. Pvt. Ltd.

SEMESTER IV

Paper-XXIII LINEAR INTEGRAL EQUATIONS SOS/Math/E007

I. Classification of integral equations, Relation between differential and integral Equations, Fredholm integral equations, Fredholm equations of second kind with separable kernels, Eigen values and eigen functions

II. Volterra integral equations, Resolvent kernel of Volterra equation, Convolution type kernel, Integral equations with symmetric kernel.

III. Method of successive approximation for Fredholm and Volterra equations of the second kind.

IV. Classical Fredholm theory, Singular integral equations, Hilbert type integral equations, Integral equation with Green's function type kernels.

TEXT/REFERENCE BOOKS

1. Integral Equations and Boundary Value Problem: M.D. Raisinghania, S. Chand.
2. Linear Integral Equations: W. V. Lovit, Dover Pub. Int. New York.
3. Linear Integral Equations: R.P. Kanwal, Birkhauser Boston, 1996.
4. Integral Equations: L. G. Chambers, International Textbook Co., 1976.

SEMESTER– IV

PAPER-XXIV INTEGRAL TRANSFORMS SOS/ Math/E008

I: Orthogonal set of functions, Fourier series, Fourier sine and cosine series, Half range expansions, Fourier integral Theorem, Fourier Transform and their Basic Properties.

II: Fourier Cosine Transform, Fourier Sine Transform, Transforms of Derivatives, Fourier Transforms of simple Functions, Fourier Transforms of Rational Functions, Convolution Integral, Parseval's Theorem for Cosine and Sine Transforms, Inversion Theorem, Solution of Partial Differential Equations using Fourier Transforms, Solution of Laplace and Diffusion equations.

III: Laplace Transform: Definition, Transform of some elementary functions, rules of manipulation of Laplace Transform, Transform of Derivatives, Relation involving Integrals, The error function, Transform of Bessel functions, Periodic functions, Convolution of two functions.

IV: Inverse Laplace Transform and their Properties, First & Second Shifting Properties, Inverse Laplace Transforms of Derivative and Integrals, Tauberian Theorem, Solution of Initial value problems for linear equations with constant coefficients, Linear differential equations with variable coefficients.

TEXT/REFERENCE BOOKS

1. Integral Transforms and Their Applications by Lokenath Debnath & Dambaru Bhatta, Chapman & Hall/CRC, Taylor and Francis Group , London, Newyork, 2007.
2. Integral Transforms in Applied Mathematics by John W. Miles, Cambridge University Press, 2010.
3. Ian N. Sneddon, Fourier Transforms , Dover Publications,2010 .
4. Advanced Engineering Mathematics by H.K. Dass, S. Chand , New Delhi,2015.

SEMESTER-IV

PAPER- XXV FUZZY SET THEORY SOS/Math/E009

I. Fuzzy sets, Basic definitions, Alpha-cut sets, Convex fuzzy sets, Basic operation on fuzzy sets, Types of fuzzy sets, Cartesian products, Algebraic products, Bounded sum and differences, t-norms and t-corners.

II. The extension principle, The Zadeh's extension principle, Images and inverse image of fuzzy sets, Fuzzy numbers, Element of fuzzy arithmetic.

III. Fuzzy relation and fuzzy graphs. Fuzzy relation on fuzzy sets, composition of fuzzy relation, min-max composition and properties, equivalence relations, fuzzy compatibility relation, Fuzzy relation equations.

IV. Fuzzy logic, An overview of classical logic, Multivalued logic, Fuzzy propositions, Fuzzy qualifiers, Linguistic variables and hedge.

TEXT/REFERENCE BOOKS

1. Fuzzy sets and Fuzzy logic: G.L. Klir and Yuan, World Sci. Pub. Co. Pvt. Ltd.
2. Fuzzy set theory and its Applications: H.J. Zimmermann, Springer, 1991.
3. Fuzzy set theory, Fuzzy logic and their Applications: A.K. Bhargava, S. Chand.
4. First Course on Fuzzy Theory and Applications : Kwang H. Lee, Springer, 2004.

SEMESTER-IV

PAPER- XXVI MATHEMATICAL MODELING SOS/Math/E010

I. Mathematical Modeling through ordinary differential equations of first order, Linear growth and decay models, Non-linear growth and decay models, Compartment models- dynamics problem, Geometrical problems.

II. Mathematical Modeling through systems of ordinary differential equations of first order, Population dynamics, Epidemics-compartment models, Economics, Medicine, Arm- race, Battles and international trade- dynamics.

III. Mathematical modeling through ordinary differential equations of second order, Planetary motions, Circular motion, Motion of satellites, Mathematical modeling through linear differential equations of second order, Miscellaneous mathematical models.

IV. Mathematical modeling through difference equations, Simple models, Basic theory of linear difference equations with constant coefficients, Economics and finance- population- dynamics and genetics- probability theory.

TEXT/REFERENCE BOOKS

1. Mathematical Modeling: J.N. Kapur, New Age Int. Pvt. Ltd. 2008.

2. Mathematical Models in Biology and Medicine: J. N. Kapur, New Delhi, Affiliated East-West Press, 1985.

3. Mathematical Modeling: Dick Clements, Cambridge Univ. Press, 2012.

4. The Nature of Mathematical Modeling: Neil Gershenfeld, Cambridge Univ. Press.

SEMESTER-IV

PAPER- XXVII NUMBER THEORY SOS/MATH/E011

I. The division algorithm, The gcd, The Euclidean algorithm, Diophantine equation $ax + by = c$, The fundamental theorem of arithmetic, The sieve of Eratosthenes, Goldbach conjucture.

II. The theory of congruences, Binary and decimal representation of integers, Linear congruences and Chinese remainder theorem, Fermat's theorem, Wilson's theorem.

III. Number theoretic function, Tau and sigma function, The Mobius inversion formula, The greatest integer function, Euler's phi function, Properties of phi function, Euler theorem.

IV. The order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots, The theory of indices, Continued fraction, Approximation of irrationals by rationals.

TEXT/REFERENCE BOOKS

1. Elementary Number Theory: David M. Burton, McGraw-Hill.

2. Theory of Numbers: George Andrews, Courier Corporation, 1994.

3. Elementary Number Theory with Applications: Thomas Koshy, Harcourt Acad. Press.

4. Fundamental of Number Theory: William J. Lereque, Dover Pub. Inc. New York.

PAPER -XXVIII SELF-STUDY: (Choose any one)

Paper -XXVIII (a) MATHEMATICAL METHODS SOS/Math/E006

I Hermite polynomiasl.
II Chebyshev polynomials.
III Laguerre polynomials.
IV Hypergeometric Functions.

TEXT/REFERENCE BOOKS

1. The Special Functions and their Applications: Y. L. Luke, Acad. Press, New York.

2. Special Functions: G.E. Andrews, R. Askey, R. Roy, Cambridge Univ. Press.

PAPER- XXVIII (b) TENSOR ANALYSIS AND SPECIAL THEORY OF RELATIVITY SOS/Math/E006

I. Invariance – Transformations of coordinates and its properties, Transformation by invariance, Transformations by covariance and contra variance, Tensor and their lows of transformations, Algebras of tensors-Quotient Tensors, Symmetric and skew symmetric tensors, Relative tensors.

II. Metric Tensor, The fundamental and associated tensors, Christoffel's symbols, Transformations of Christoffel's symbols, Covariant differentiation of tensors, Formulas for covariant differentiation, Ricci theorem, Riemann-Christoffel tensor and their properties.

III. Einstein tensor, Riemannian and Euclidean Spaces (Existence Theorem), The e- systems and the generalized Kronecker delta, Application of the e-systems.

IV. Special theory of relativity, Galilean transformation, Maxwell's equations, The ether theory, The principle of relativity, Relativistic kinematics, Lorentz transformation equations, Events and simultaneity, Example of Einstein strain, Time dilation, Longitudinal Contraction, Invariant Interval, Proper time and proper distance, World line, Example of twin paradox , Addition of velocities, Relativistic Doppler's effect.

TEXT/REFERENCE BOOKS

1. Tensor Analysis: I.S. Sokolnikoff, John Wiley and Sons, New York, 1964.
2. Classical Dynamics: D. Greenwood, Prentice Hall of India, New Delhi, 1985.
3. Tensor Calculus, Toronto, 1949 :J.L. Synge and A. Schild.
4. An Introduction to Theory of Relativity, New York, 1942: P.G. Bergman.

PAPER- XXVIII (c) FINANCIAL MATHEMATICS SOS/Math/E006

I. Single period model, Definitions of finance- pricing, Forward- one- step binary model, Ternary model- Characterization of no arbitrage, Risk-neutral probability measure

II. Bi normal trees and discrete parameter martingales, Multi-period binary model, American options, Discrete parameter martingales and Markov processes, Martingale theorems, Binomial representation theorem overturn to continuous models

III. Brownian motion, Definition of the process, Levy's construction of brownian motion, The reflection principle and scaling, Martingales, Continuous time.

IV. Stochastic calculus, Non-differentiability of stock prices, Stochastic integration, Ito's formula, Integration by parts and stochastic, Fubini theorem, Girsanov theorem, Brownian martingale representation theorem, Geometric brownian motion, The Feynman- Kac representation.

TEXT/REFERENCE BOOKS

1. A Course in Financial Calculus: Alison Etheridge, Cambridge Univ. Press, 2002.
2. Financial Calculus: An Introduction to Derivatives Pricing : Martin Boxter and Andrew Rennie, Cambridge Univ. Press, 1996.
3. Introduction to Stochastic Calculus Applied to Finance: Damien Lamberton and Bernard Lapeyre, Chapman and Hall, 1996.
4. Martingale Methods in Financial Madeling: Marek Musielaand Marek Ruthowshi, SpringerVerlag, New York, 1988.

Or : The Project Work

PAPER-XXI X VIVA-VOCE SOS/MATH/C001

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – MECHANICAL ENGINEERING

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

DEPARTMENT OF MECHANICAL ENGINEERING

SCHOOL OF ENGINEERING &TECHNOLOGY

Syllabus for Ph.D Admissions Test 2024-2025 onwards

Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.

Mechanics of Solids: Stress and Strain tensors, generalized Hooke's Law, Mohr's circle, thin and thick cylinders, rotating ring and discs, shear force and bending moment diagrams, bending and shear stresses,deflection of beams, torsion of circular shafts, Euler's theory of columns, energy methods, thermal stresses, strain gauges and rosettes.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms, dynamic analysis of linkages, cams, gears and gear trains, flywheels and governors, balancing of reciprocating and rotating masses, gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping, vibration isolation, resonance, critical speeds of shafts.

Design of Machine Elements: Design for static and dynamic loading, failure theories, fatigue strength and the S-N diagram, principles of the design of machine elements such as bolted, riveted and welded joints, shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Fluid Mechanics: Fluid properties, fluid statics, control-volume analysis of mass, momentum and energy, fluid acceleration, differential equations of continuity and momentum, Bernoulli's equation, dimensional analysis, viscous flow of incompressible fluids, boundary layer, flow through pipes.

Heat Transfer: : Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis

Thermodynamics: Thermodynamics systems and processes, properties of pure substances, behaviour of ideal and real gases, zeroth and first laws of thermodynamics, calculation of work and heat in various processes, second law of thermodynamics, availability and irreversibility, thermodynamic relations.

Applications: Power Engineering: Air and gas compressors, vapour and gas power cycles, concepts of regeneration and reheat. **I.C Engines:** Air-standard Otto, Diesel and dual cycles.

Refrigeration and Air-conditioning: Vapour and gas refrigeration and heat pump cycles, properties of moist air, psychrometric processes. **Turbo machinery:** Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan Turbines.

Engineering Materials: Structure and properties of Engineering Materials, heat treatment, stress-strain diagrams.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Manufacturing Process and Automation: Mechanics of Machining, machine tools, cutting tools and materials, non-traditional machining processes, design of jigs and fixtures. Concepts of CAD/CAM and their integration tools.

Metrology and Inspection: Limits, fits and tolerances, linear and angular measurements, comparators, gauge design, interferometry, tolerance and analysis in manufacturing and assembly.

Production Planning and Control: Forecasting, production planning, scheduling, material requirements planning. Inventory control deterministic models, safety stock inventory control systems. Optimization Techniques.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – MICROBIOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

DEPARTMENT OF BOTANY AND MICROBIOLOGY

REVISED SYLLABUS

M.Sc. (MICROBIOLOGY)

Effective from academic session 2015-2016

HNB Garhwal University
(A Central University)
Srinagar-Garhwal, Uttarakhand

SYLLABUS

HNB GARHWAL UNIVERSITY, SRINAGAR-GARHWAL

DEPARTMENT OF BOTANY & MICROBIOLOGY

Master of Science

MICROBIOLOGY

(Two Year Course- Semester System)

2015 Onwards

Admission to Master's Program in Microbiology shall be through entrance examination conducted by University and the program shall be based on the choice based credit system in which credit defines the quantum of content/ syllabus prescribed for a course system and determines the number of hours of instruction per week.

The student shall be eligible for admission to a Master's Degree Program in Microbiology after he/she has successfully completed a three year undergraduate degree or earned prescribed number of credits through the examinations conducted by University as equivalent to an undergraduate degree. The fee structure would be as per University ordinances but the fee once deposited by the candidate would not be refundable under any circumstances barring security fee.

Core courses prescribed for every Semester shall be mandatory for all students registered for the Master's Program in Microbiology and shall carry minimum 54 credits. There shall be Elective courses offered in semester III and IV and shall carry a minimum of 18 credits. A self-study course would comprise of maximum 09 credits of which minimum 03 credits shall be mandatory which shall not be included while calculating grades. The student may choose self-study course either only in one of the three semesters (II/III/IV) or one each in all the three semesters. The self study course shall be based on advanced topics of elective courses of III semester.

In order to qualify for a two year master's degree, a student must acquire a minimum of 72 credits including a minimum of 18 credits in electives choosing at least two elective (leading to a minimum 06 credits) in Semester III offered either by the parent department or other departments and one qualifying self-study course of minimum 03 credits.

The dissertation is a semester long elective course of 10 credits and is mandatory for every student. The dissertation would be allotted in the beginning of III Semester and candidate would submit the report during IV Semester examination. The dissertation may be in the form of a field based minor research work/ project work/ practical training. The students may complete the dissertation work in the department/ other research institutes/ industries/ hospitals etc.

A candidate has to secure a minimum of 51 percent marks in aggregate (Two Sessional Tests marks plus End-Term Examination marks) to pass.

SCHOOL OF LIFE SCIENCES
PAPER CODES
PROGRAMME- M.Sc. MICROBIOLOGY

M.Sc. I Semester (July- November)

Code	Paper	Credits				MM
		L	T	P	C	
SLS/MIC/C001	General Microbiology	4	0	0	4	100
SLS/MIC/C002	Fundamentals of Biochemistry	4	0	0	4	100
SLS/MIC/C003	Cell Biology	4	0	0	4	100
SLS/MIC/C004	Molecular Biology and Microbial Genetics	4	0	0	4	100
SLS/MIC/C005	Laboratory Course-I	0	0	3	3	100
SLS/MIC/C006	Laboratory Course-II	0	0	3	3	100
				Total		**600**

Core Credits= 22

M.Sc. II Semester (December-April)

Code	Paper	Credits				MM
		L	T	P	C	
SLS/MIC/C007	Microbial Physiology and Metabolism	4	0	0	4	100
SLS/MIC/C008	Immunology	4	0	0	4	100
SLS/MIC/C009	Biological Techniques	4	0	0	4	100
SLS/MIC/C010	Recombinant DNA Technology	4	0	0	4	100
SLS/MIC/C011	Laboratory Course-I	0	0	3	3	100
SLS/MIC/C012	Laboratory Course-II	0	0	3	3	100
				Total		**600**

Core Credits= 22 with additional 03 Credits of Self Study*

M.Sc. III Semester (July- November)

Code	Paper	Credits				MM
		L	T	P	C	
SLS/MIC/C013	Medical Microbiology	4	0	0	4	100
SLS/MIC/C014	Industrial Microbiology	4	0	0	4	100
SLS/MIC/C015	Laboratory Course-I	0	0	3	3	100
SLS/MIC/E01A	Food and Dairy Microbiology	3	0	0	3	100
SLS/MIC/E01B	Drug Designing and Nanobiotechnology	3	0	0	3	100
SLS/MIC/E01C	Genomics and Proteomics	3	0	0	3	100
SLS/MIC/E01D	Epidemiology	3	0	0	3	100
SLS/MIC/E01E	Bioprocess Technology	3	0	0	3	100
SLS/MIC/E01F	Environmental Microbiology	3	0	0	3	100
SLS/MIC/E02A	Agricultural Microbiology	3	0	0	3	100
SLS/MIC/E02B	Microbial Diversity	3	0	0	3	100
SLS/MIC/E02C	Pharmaceutical Microbiology	3	0	0	3	100
SLS/MIC/E02D	Infection and Immunity	3	0	0	3	100
SLS/MIC/E02E	Intellectual Property Rights	3	0	0	3	100
SLS/MIC/E02F	Research Methodology	3	0	0	3	100
SLS/MIC/E003	Laboratory Course-II	0	0	3	3	100
				Total		**600**

Total Credits = 20 (Core Credits 11+ Elective Credits 09) with additional 03 Credits of Self Study*

M.Sc. IV Semester

Code	Paper	Credits				MM
		L	T	P	C	
SLS/MIC/E004	Dissertation	0	0	10	10	200
					Total	**200**

Total Credits = 10 with additional 03 Credits of Self Study*

Grand Total: Core Credits 55+ Elective Credits 19= 74

***** With a total of 09 Credits (3+3+3 Credits in II, III and IV semester) of Self Study (2 Seminars equivalent to 2 Sessional Tests plus one End term written examination).

Maximum Marks for each paper is 100 (Sessional Tests-40 + End Term Test- 60).

** 01 Credit= 01 hour of lecture/instructions per week; 01 Credit course= 15 hours of lectures per semester.

*** 03 hours of laboratory course shall be considered equivalent to 01 hour of lecture.

The 2- Year Masters Programme will have the following components:

1. **Core course:** Minimum 54 credits.

2. **Elective course:** Minimum 18 credits choosing at least two Electives (leading to a minimum 06 credits) in Semester III offered either by the parent department or other departments and one Elective course as Dissertation (10 credits) in IV Semester.

3. **Self study course:** Maximum 09 credits (one minimum 03 credits shall be mandatory but not to be included while calculating grades).

Dissertation

Dissertation is an elective mandatory for every student. The dissertation is to be allotted in the beginning of III Semester and report would be submitted at the time of IV Semester examination.

The distribution of marks for the Dissertation will be as below:

Periodical Presentation : 40 Marks
Dissertation : 120 Marks
Viva Voce : 40 Marks
Total : 200 Marks

The dissertation would carry 10 credits in all. Dissertation shall be evaluated jointly by the supervisor and one external examiner.

SYLLABUS OF M.Sc. MICROBIOLOGY
I & II SEMESTERS

I SEMESTER

SLS/MIC/C001: GENERAL MICROBIOLOGY

Unit I: History and Classification

Discovery of microorganisms; Conflicts over spontaneous generation; Golden era of microbiology; Kingdom classification of microorganisms: Haeckel's three kingdom concept, Whittaker's five kingdom concept, Six kingdom classification, Eight kingdom classification, Three domain concept of Carl Woese; Differences between prokaryotes and eukaryotes; Techniques used in microbial classification (Morphological, chemotaxonomic and genetic methods); Tools for systematics (Phylogenetic, numerical and polyphasic taxonomy); Scope and relevance of microbiology.

Unit II: Basics of Microbiology

Microbial nutrition; Culture media; Culture techniques for isolation of pure culture; Cultivation of aerobic and anaerobic bacteria; Preservation methods; Microbial growth: Growth curve of batch and continuous cultivation, Diauxic growth curve, Generation time, Growth kinetics, Asynchronous and synchronous growth, Measurement of growth, Factors affecting growth; Control of microbial growth: Physical and chemical agents.

Unit III: General Bacteriology

Bergey's system of bacterial classification; Brief account of Gracilicutes, Fermicutes, Mendosicutes and Tenericutes; Ultrastructure of bacterial cell: Morphology of bacteria, Structure and properties of cell wall and cell membrane, Cell wall synthesis, Capsule (Types, composition and function), Ultrastructure and functions of flagella, cilia, pili, s-layer, cytoplasmic inclusions, ribosomes and nucleoid; Bacterial reproduction; Characteristic features of Archaea.

Unit IV: General Virology

Discovery of viruses; Characteristic feature of viruses, viroids, virusoids and prions; Baltimore scheme of classification; Morphology and ultrastructure: Capsids and their arrangements, Types and composition of envelopes, Viral genome (Types and structures); Isolation and cultivation of viruses using embryonated eggs, experimental animals and cell culture; Serological tests; Multiplication of viruses; Assay of viruses by physical and chemical methods (Protein, nucleic acid, radioactive tracers and electron microscopy); Genetic analysis of viruses by classical genetic methods (PCR and nucleic acid hybridization); Infectivity assay (Plaque method, pock method and end point methods); Bacteriophage: Structural organization, Cultivation, Replication, One step growth curve, Eclipse phase, Phage production, Burst size.

Unit V: General Mycology, Phycology and Protozoology

Mycology: General features, Mycelial organization and structure, Nutrition, Cultivation, Reproduction, Classification (Basis and general outline), Salient features of Ascomycetes, Basidiomycetes, Zygomycetes and Deuteromycetes, Characteristics of Lichens and Mycorrhiza; Phycology: General features of different algal groups with respect to thallus structure, nutrition and reproduction, Cultivation of algae, Distribution of microalgae in different classes, Classification of algae (Basis and general outline), Economic aspects of algae; Systemic position of cyanobacteria; Distinguishing characters of cyanobacteria and diatoms; Protozoology: Cell structure, Nutrition, Reproduction, Life cycle, Classification (Basis and general outline); Salient features of Dinoflagellates.

Reference Books

1. Wiley, J.M., Sherwood, L.M. and Woolverton, C.J. Prescott, Harley and Klein's microbiology. McGraw-Hill, New York.
2. Black, J.G. Microbiology: Principles and exploration. John Wiley and Sons, New Jersey.
3. Madigan, M.T., Martinko, J.M. and Parker, J. Brock biology of microorganisms. Prentice Hall, New Jersey.
4. Pommerville, J.C. Alcamo's fundamentals of microbiology. Jones and Bartlett Learning, Sudbury.
5. Wheelis, M. Principles of modern microbiology. Jones and Bartlett Learning, Sudbury.
6. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. General microbiology. MacMillan Press, London.
7. Sclegel, H.G. General microbiology. Cambridge University Press, Cambridge.
8. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. Microbiology. McGraw-Hill, New York.
9. Tiwari, S.P., Sharma, R. and Singh, R.K. Recent advances in microbiology. Nova Science, New York.
10. Topley, W.W.C., Wilson, S.G.S. and Parker, M.T. Topley and Wilson's principles of bacteriology, virology and immunity. Edward Arnold, London.
11. Dimmoc, N.J., Easton, A.J. and Leppard, K.N. Introduction to modern virology. Wiley-Blackwell, New Jersey.
12. Levy, J.A., Conrat, H.F. and Owens, R.A. Virology. Prentice Hall, New Jersey.
13. Primrose, S.B. Introduction to modern virology. John Wiley and Sons, New Jersey.
14. Burnett, J.H. Fundamentals of mycology. St. Martin's Press, New York.
15. Mehrotra, R.S. and Aneja, K.R. An introduction to mycology. New Age International (P) Limited, New Delhi.
16. Alexopoulos, C.J. and Bold, H.C. Algae and fungi. MacMillan Press, London.
17. Graham, L.E. and Wilcox, L.W. Algae. Prentice Hall, New Jersey.
18. Vashishta, B.R. Algae. S. Chand and Company, New Delhi.
19. Sharma, O.P. Textbook of algae. Tata McGraw-Hill Education, New Delhi.
20. Kumar, H.D. Introductory phycology. East-West Press, New Delhi.

I SEMESTER

SLS/MIC/C002: FUNDAMENTALS OF BIOCHEMISTRY

Unit I: Acid-base Chemistry and Bioenergetics

Acid-base chemistry: Bronsted concept of conjugate acid-conjugate base pairs, Ionization of solutions, pH, Important biological buffers, Henderson-Hasselbalch equation, Buffer capacity, Polyproteic acids, Amphoteric salt, Ionic strengths; Bioenergetics: Concept of free energy, Standard free energy, Enthalpy, Entropy, High energy phosphate compounds, Phosphate group transfer, Free energy of hydrolysis of ATP, Oxidation-reduction, Redox potential; Energy generation in biological systems: Phosphorylation and electron transport chain, Electron carriers, Artificial electron donors, Inhibitors and uncouplers of oxidative phosphorylation, Chemiosmotic theory of ATP synthesis.

Unit II: Carbohydrates

Classification, nomenclature, structure, general properties and functions of simple carbohydrates; Complex carbohydrates: Mucopolysaccharides, Amino sugars, Bacterial cell wall sugars, Sugar alcohols, Glycoconjugates; Regulation of carbohydrate metabolism.

Unit III: Lipids

General properties, nomenclature and classification of lipids; Lipid functions: Cell signals, cofactors, prostaglandins; Fatty acids; Saponification, acid value and iodine value of fats; Rancidity of fats; Storage and structural lipids; Special mention of sphingomyelins, cerebrosides and gangliosides; Vitamins: Structure and function of fat soluble vitamins; Metabolism: Biosynthesis of fatty acids, triacylglycerols, membrane phospholipids, cholesterol, steroids and isoprenoids, Beta oxidation and its regulation, LDL and HDL, Regulation of cholesterol biosynthesis.

Unit IV: Proteins and Nucleotides

Proteins: Structural features and classification of amino acids, General reactions of amino acid metabolism (Transamination, decarboxylation, oxidative and non-oxidative deamination of amino acids), Peptide bond, Properties and functions of primary, secondary, tertiary and quaternary structure of proteins, Ramachandran plot, Factors affecting secondary and tertiary structures, Hydropathy index, Protein domain and motifs; Nucleotides: Structure of purines and pyrimidines, Synthesis of purines and pyrimidines, Regulation of nucleotide biosynthesis, Degradation of purines and pyrimidines.

Unit V: Enzymes

General characteristics of enzymes; Co-enzymes; Holoenzymes; Prosthetic groups; Enzyme nomenclature; Classification of enzymes; Active site; Transition state; Activation energy; Enzyme activity; Specific activity and turn over number; Isozymes; Mechanism of enzyme catalysis; Enzyme kinetics for single substrate and multi-substrate reactions; Reaction mechanisms of enzymes (Acid base and covalent catalysis); Reversible and irreversible inhibition of enzymes; Effect of pH and temperature on enzyme activity; Allosteric enzymes; Determination of active site and turn over number.

Reference Books

1. Atkins, P. and Paula, J.D. Atkins' physical chemistry. Oxford University Press, Oxford.

2. Segel, I.H. Biochemical calculations. John Wiley and Sons, New York.
3. Nelson D.L. and Cox, M.M. Lehninger principles of biochemistry. W.H. Freeman and Company, New York.
4. Berg, J.M., Tymoczko, J.L. and Stryer, L. Biochemistry. W.H. Freeman and Company, New York.
5. Garrett, R.H. and Grisham, C.M. Biochemistry. Cole Publishing Company, California.
6. Voet, D. and Voet, J.G. Biochemistry. John Wiley and Sons, New York.
7. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.Y. Outlines of biochemistry. John Wiley and Sons, New York.
8. Robert, M., Bender, D., Botham, K.M., Kennelly, P.J., Rodwell, V. and Weil, P.A. Harper's illustrated biochemistry. McGraw-Hill, New York.
9. White, A., Handler, P., Smith, E., Hill, R. and Lehman, J. Principles of biochemistry. Mc-Graw Hill, New York.
10. Jain, J.L. Fundamentals of biochemistry. S. Chand and Company, New Delhi.
11. Palmer, T. Enzymes: Biochemistry, biotechnology and clinical chemistry. Horwood Publishing Company, Chinchester.

I SEMESTER

SLS/MIC/C003: CELL BIOLOGY

Unit I: Intracellular Compartmentalization of Cell

Structure, organization and functions of nucleus, mitochondria, chloroplast, endoplasmic reticulum, golgi body, peroxisome, lysosome and endosomes; Cytoskeleton: Actin filaments, microtubules and intermediate filaments; Cell motility; Integrating cell into tissue: Cell junctions, Cell- Cell adhesions, Cell – extracellular matrix adhesion; Molecular mechanism of vesicular trafficking.

Unit II: Architecture of Plasma Membrane and Solute Transport

Plasma membrane: Composition of membrane, Fluid mosaic model, Membrane fluidity, Membrane dynamics, Membrane fusion; Solute transport across membranes: Diffusion (Simple and facilitated), Active transport (Primary and secondary), Pumps and transporters, Ion channels (Ligand gated and voltage gated channels), Trans-epithelial transport, Mechanism of regulation of intracellular transport.

Unit III: Cell Signaling

Basic signaling mechanisms (Paracrine, endocrine and autocrine signaling); Mechanism of signal transduction: Signaling molecules, Ligand-receptors interaction, Transmembrane and intracellular signaling, Cell surface receptors (G protein-coupled, enzyme-linked and ion channel-linked receptors), Second messengers and their role in signal transduction, Signal integration, Signal amplification.

Unit IV: Cell Cycle and Cell Division

Cell cycle: Molecular events, Cyclin, CDKs, Checkpoints in cell cycle, Intracellular control of cell cycle events, Abnormalities in cell cycle: Oncogenesis (Causes, proto-oncogenes and tumor suppresser genes, Oncogenic mutations); Cell division: Molecular mechanism of mitosis and meiosis.

Unit V: Cell Death Pathways

Necrosis; Autophagy; Senescence; Apoptosis: Mechanisms of apoptosis, Signals triggering apoptosis, Apoptosis inducing factors, Apoptosis in cancer, Role of immune system in organ transplantation.

Reference Books

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. Molecular biology of the cell. Garland Science, New York.
2. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Scott, M.P., Bretscher, A., Ploegh, H. and Matsudaira, P. Molecular cell biology. W.H. Freeman and Company, New York.
3. Cooper, G.M. and Hausman, R.E. Cell: Molecular approach. ASM Press, Washington, D.C.
4. de Robertis, E. D. P. and de Robertis, E.M.F. Cellular and molecular biology. Saunders, Philadelphia.
5. Pollard, T.D., Earnshaw, W.C. and Schwartz, J.L. Cell biology. Saunders, Philadelphia.
6. Karp, G. Cell and molecular biology- Concepts and experiments. John Wiley and Sons, New York.

I SEMESTER

SLS/MIC/C004: MOLECULAR BIOLOGY AND MICROBIAL GENETICS

Unit I: Chromosome Structure

Experimental evidences for nucleic acid as carrier of genetic information; Chemical and physical properties of genetic material; Structure and types of DNA; DNA denaturation and renaturation kinetics; C- value paradox; Packaging of DNA into chromosome; Chromosome banding; Centromere and Telomere; Giant chromosome.

Unit II: Replication and Transcription

DNA replication in prokaryotes and eukaryotes: Experimental evidence, Modes of replication, Mechanism of replication, Inhibitors of replication; Transcription in prokaryotes and eukaryotes: RNA polymerases, Mechanism of transcription, Post transcriptional modifications of mRNA, rRNA and tRNA, Inhibitors of transcription; Structure features and functions of mRNA, t-RNA and r-RNA.

Unit III: Translation and Regulation of Gene Expression

Basic features of genetic code; Translation in prokaryotes and eukaryotes: Structure of ribosomes, Mechanism of translation, Post translational modifications, Protein degradation, Non ribosomal polypeptide synthesis, Inhibitors of translation; Regulation of gene expression: Structure and regulation of *lac*, *trp* and *arb* operon, DNA binding motifs in regulatory proteins, Role of activators, enhancers, insulators, RNA interference and antisense RNA.

Unit IV: Recombination, Transposition, Mutation and Repair mechanism

Recombination: Types, Models for homologous recombination (The Holliday model and Double strand break repair model), Proteins involved in recombination; Transposition: Insertion sequences and transposable elements in prokaryotes and eukaryotes, Mechanism of transposition; Mutations: Types of mutations, Mutagens, Screening chemicals for mutagenicity; DNA repair: Photoreactivation, methyl directed mismatch repair, very short - patch mismatch repair, nucleotide excision repair, base excision repair and SOS system.

Unit V: Microbial Genetics

Bacterial plasmids: Types of plasmids, Compatibility and incompatibility, Mobilizable plasmids, Copy number of plasmids, Fertility inhibition, Donation and conduction; Gene transfer mechanisms: Transformation (Competence factor, natural and artificial transformation), Conjugation (F^+ X F^- mating, Hfr, Hfr X F^-, and F', mechanism of conjugation and sexduction), Transduction (Mechanism of generalized and specialized transduction, LFT and HFT lysate), Phage genetics: Life cycle of lambda and M13 and ϕX 174 phage, Regulation of lytic and lysogeny in lambda phage.

Reference Books

1. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Scott, M.P., Bretscher, A., Ploegh, H. and Matsudaira, P. Molecular cell biology. W.H. Freeman and Company, New York.
2. Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T. Lewin's genes. Jones and Bartlett Learning Publishers, Sudbury.
3. Nelson D. L. and Cox, M.M. Lehninger principles of biochemistry. W.H. Freeman and Company, New York.
4. Snustad, D.P. and Simmons, M.J. Principles of genetics. John Wiley and Sons, New York.

5. Malacinski, G.M. and Friefelder, D. Essentials of molecular biology. Jones and Bartlett Learning, Sudbury.
6. Synder, L.J., Peters, E., Henkins, T.M. and Champness, W. Molecular genetics of bacteria. ASM Press, Washington, D.C.
7. Maloy, S.R., Cronan, J.E. and Freifelder, D.M. Microbial genetics. Jones and Bartlett Learning, Sudbury.
8. Hartwell, L. Genetics: From genes to genome. McGraw-Hill, New York.
9. Weaver, R. Molecular biology. McGraw-Hill, New York.
10. Watson, J.D., Baker, T., Bell, S.P., Gann, A., Levine, M. and Lodwick, R. Molecular biology of the gene. Pearson Education, New Jersey.
11. Karp, G. Cell and molecular biology- Concepts and experiments. John Wiley and Sons, New York.
12. Klug, W.S. and Cummings, M.R. Concepts of genetics. Prentice Hall, New Jersey.

I SEMESTER

SLS/MIC/C005: LAB COURSE-I
(Based on Theory Papers SLS/MIC/C001 and SLS/MIC/C002)

1. Safety rules of working in microbiology lab, disposal of cultures, calibration, validation and maintenance of instruments.
2. Principles and working of instruments used in microbiology lab.
3. Media preparation and its sterilization.
4. Isolation and enumeration of bacteria and fungi from given sample.
5. Isolation and maintenance of pure culture of bacteria and fungi.
6. Isolation and enumeration of bacteriophage from sewage water.
7. Staining of bacterial cell (Simple staining, gram staining and negative staining).
8. Staining of fungal cell.
9. Staining of endospore and capsule.
10. Study of morphology of algae.
11. Symptomatology of infection of plant pathogens.
12. Measurement of bacterial cell size using micrometer.
13. Safety rules of working in lab, hazard from chemicals, handling of chemicals, disposal of chemicals, recording of scientific experiments, calibration, validation and maintenance of instruments.
14. Calculation of moles, molarity, molality and normality of given solution.
15. Calculation of pH of given solution.
16. Preparation of solutions and buffers of different concentrations and pH.
17. Qualitative tests for sugars, amino acids, proteins and lipids in given sample.
18. Quantitative estimation of sugar in given sample.
19. Quantitative estimation of protein in given sample.
20. Estimation of lipid concentration in given sample.
21. Determination of acid value, saponification and iodine value of fats and oils.
22. Determination of activity of given enzyme.
23. Determination of K_m and V_{max} of given enzyme.
24. Determination of optimum pH and temperature of given enzyme.
25. Determination of temperature and pH stability of given enzyme.

Reference Books

1. Cappucino, J. and Sherman, N. Microbiology: A laboratory manual. Benjamin/Cummings Publishing Company, San Francisco.
2. Prescott, L.M. and Harley, J.P. Laboratory exercises in microbiology. William C. Brown, Dubuque.
3. Aneja, K.R. Experiments in microbiology, plant pathology and biotechnology. New Age International (P) Limited, New Delhi.
4. Atlas, R.M., Brown, A.E. and Parks, L.C. Laboratory manual of experimental microbiology. Mosby College Publishing Company, St. Louis.
5. Kannan, K. Laboratory manual in general microbiology. Panima, New Delhi.
6. Holt, J.G. and Krieg, N.R. Bergey's manual of determinative bacteriology. Lippincott Williams and Wilkin, Philadelphia.
7. Jayaraman, J. Laboratory manual in biochemistry. New Age International (P) Limited, New Delhi.

8. Sawhney, S.K. and Singh, R. Introductory practical biochemistry. Narosa Publishing House, New Delhi.
9. Segel, I.H. Biochemical calculations. John Wiley and Sons, New York.
10. Plummer, D.T. Introduction to practical biochemistry. Mc-Graw Hill, New York.
11. Boyer, R.F. Modern experimental biochemistry. Prentice Hall, New Jersey.
12. Gerhardt, P. Manual of methods for general bacteriology. ASM Press, Washington, D.C.
13. Barnett, M. Microbiology laboratory exercises. William C. Brown, Dubuque.
14. Wilson, K. and Walker, J.M. Principles and techniques of practical biochemistry. Cambridge University Press, Cambridge.

I SEMESTER

SLS/MIC/C006: LABCOURSE-II
(Based on Theory Papers SLS/MIC/C003 and SLS/MIC/C004)

1. Study of different stages of mitosis.
2. Study of different stages of meiosis.
3. Study of mechanism of diffusion.
4. Study of mechanism of exosmosis and endosmosis.
5. Effect of isotonic, hypotonic and hypertonic solutions on cell.
6. Preparation of splenocytes.
7. Quantitative estimation of DNA by diphenyl amine (DPA) and spectrophotometric method.
8. Quantitative estimation of RNA by orcinol and spectrophotometric method.
9. Determination of quality of DNA by spectrophotometric method.
10. Isolation of genomic DNA from bacterial culture.
11. Visualization of DNA by agarose gel electrophoresis.
12. Determination of T_m of given DNA sample.
13. Study of effect of temperature and pH on denaturation of DNA.
14. Study of effect of different concentrations of urea on denaturation of DNA.
15. Mutagenesis in given bacterial culture by U.V. radiation.
16. Demonstration of photoreactivation mechanism in bacteria.
17. Demonstration of dark repair mechanism in bacteria.
18. Demonstration of conjugation in bacteria.
19. Isolation of antibiotic resistant bacteria by gradient plate method.

Reference Books

1. Sambrook, J. and Russell, D.W. Molecular cloning: A laboratory manual. Cold Spring Harbor Lab Press, New York.
2. Miller, J.H. Experiments in molecular genetics. Cold Spring Harbor Lab Press, New York.
3. Murray, R.G.F., Wood, W.A. and Krieg, N.B. Methods for general and molecular bacteriology. ASM Press, Washington, D.C.
4. Chaitanya, K.V. Cell and molecular biology: A lab manual. PHI Learning, New Delhi.
5. Celis, J.E. Cell biology: A laboratory handbook. Elsevier, Amsterdam.

II SEMESTER

SLS/MIC/C007: MICROBIAL PHYSIOLOGY AND METABOLISM

Unit I: Microbial Photosynthesis and Inorganic Metabolism

Photosynthesis: General characteristics of photosynthetic bacteria, Brief account of photosynthetic and accessory pigments, Mechanism of oxygenic and anoxygenic photosynthesis, Photosynthetic electron transport system, Photophosphorylation, Dark reaction; Inorganic metabolism: Characteristic features of chemolithotrophs, Mechanism of sulphur, iron, hydrogen and nitrogen oxidations; Mechanism of energy generation in methylotrophs and methanogens.

Unit II: Nitrogen and Sulphur Metabolism

Nitrogen metabolism: Nitrogen fixation (Characteristics of nitrogen fixing bacteria, biochemistry of nitrogenase complex, nitrogenase types, functions of *nif* genes, symbiotic nitrogen fixation and regulation of nitrogenase), Inorganic nitrogen metabolism, Assimilation of inorganic nitrogen, Regulation of nitrate assimilation; Sulphur metabolism: Free and bound pathways of assimilation of sulphate into cysteine, Glutathione and its role in sulphur metabolism.

Unit III: Microbial Respiration and Fermentation

Respiration: Aerobic respiration, Components of electron transport chain in aerobic bacteria, Anaerobic respiration, Mechanism of oxygen toxicity; Fermentation: Glucose, acetic acid, lactic acid, butyric acid, propionic acid and mixed acid fermentation.

Unit IV: Microbial Transport and Communication

Bacterial transport system: Donnan equilibrium, Thermodynamics of various transport systems, Osmosis, Plasmolysis, Osmotic pressure of electrolyte and non-electrolyte transport protein, PEP-PTS system in relation to catabolite repression, ABC transporter, Protein secretion pathways in bacteria; Communication mechanisms in prokaryotes: Intercellular signaling (Pheromones mediated signaling and quorum sensing), Intracellular signaling (Two component system and phosphorelay system).

Unit V: Microbial Stress Response

Osmotic stress and osmoregulation, Mechanism of transition from aerobic to anaerobic, Oxidative stress and its regulation, pH stress and acid tolerance response, Thermal stress and heat shock response, Nutrition stress and starvation-stress response, Stringent response, Sporulation and morphogenesis (Endospores: Physiological and genetic aspects of sporulation, Activation, germination and outgrowth).

Reference Books

1. Foster, J.W. and Spector, M.P. Microbial physiology. John Wiley and Sons, New York.
2. Gottschalk, G. Bacterial metabolism. Springer-Verlag, New York.
3. Madigan, M.T., Martinko, J.M. and Parker, J. Brock biology of microorganisms. Prentice Hall, New Jersey.
4. Brun, Y.V. and Shimkets, L.J. Prokaryotic development. ASM Press, Washington, D.C.
5. Rose, A.H. Advances in microbial physiology. Academic Press, New York.
6. David, W., Drummond, J.T. and Fuqua, C. Physiology and biochemistry of prokaryotes. Oxford University Press, New York.
7. Caldwell, D. R. Microbial physiology and metabolism. Star Publishers, California.

8. Lengeler, J.W., Drews, G. and Schlegel, H.G. Biology of the prokaryotes. Blackwell Science, New York.
9. Rhodes, P.M. and Stanbury, P.F. Applied microbial physiology: A practical approach. IRL Press, Oxford.

II SEMESTER

SLS/MIC/C008: IMMUNOLOGY

Unit I: Immune System and Immunity

History of immunology; Innate and acquired immunity; Determinants of innate immunity; Hematopoiesis; Cells and organs of immune system: B lymphocyte, T lymphocyte, NK cells, Monocyte/Macrophages, Dendritic cells, Eosinophils, Basophils, Neutrophils, Mast cells, Organization and structure of lymphoid organs and their role in immunity; Humoral and cell-mediated immunity; Nonspecific immune mechanisms: Surface defenses, Tissue defenses, Opsonization, Inflammatory reactions.

Unit II: Antigens and Antibodies

Antigens: Structure and properties; Haptens; Adjuvents; Immunogenicity; Immunoglobulin: Structures, Heterogeneity, Types and subtypes, Properties (Physiochemical and biological), Antibody effector mechanism, Antibody receptors, Antibody diversity, Immunoglobulin gene recombination, Theories of antibody production, Effect of somatic mutations on the antibody diversity, Ab class switching, Antibody responses *in vivo*, Affinity maturation development of memory, Recombinant antibodies, Monoclonal antibodies (General properties and applications), Hybridoma technology; Antigen – antibody reactions: Precipitation and agglutination reactions; Immunodiagnostic techniques: Immunoelectrophoresis, RIA, ELISA, Chemiluminescence immunoassay, Western blotting, Complement fixation test, Immunofluorescence, Flow cytometry.

Unit III: Complement system, Cytokines and Major Histo-compatibility Complex

Complement System: Structure, properties and functions of different components, Complement activation pathways (Classical, alternate and lectin pathways), Biological consequences of complement activation, Complement assay; Structure and function of various cytokines; Cytokine receptors; Antigen presenting cells; Structure and functions of MHC and HL-A system; Antigen processing and presentation.

Unit IV: Humoral and Cell Mediated Immune Response and Regulation

B- cell receptor; Development and differentiation of B cells; Negative regulation; T – cell receptor complex; Genomic organization of T- cell receptor locus; Development and differentiation of T cells; Positive and negative regulation; Immune Response: T -Cell independent defense mechanisms, T- Cell dependent defense mechanisms; Cell mediated cytotoxicity: T cytotoxic cells, Natural Killer (NK) Cells,Antibody dependent cell cytotoxicity (ADCC), Macrophage-mediated cytotoxicity.

Unit V: Immunopathology and Transplantations

Immunopathology: Rh- blood groupings, Hypersensitivity reactions (Antibody mediated type I, anaphylaxis, type II- antibody dependent cell cytotoxicity, type III-immune complex mediated reactions and type IV-delayed hypersensitivity reactions), Immune surveillance, Self tolerance, Autoimmune diseases, Immunodeficiency; Tumor immunology: Tumor specific antigens, Immune response to tumor, Tumor escape mechanisms, Immunotherapy of cancer, Immunotoxins; Transplantation: Graft vs. host reaction and rejection; Immunization: Active and passive; Vaccines.

Reference Books

1. Kindt, T.J., Goldsby, R.A., Osborne, B.A. and Kuby, J. Kuby immunology. W.H. Freeman and Company, New York.
2. Male, D.K. Immunology: An illustrated outline. Elsevier Health Sciences, Philadelphia.
3. Abbas, A.K., Lichtman, A.H.H. and Pillai, S. Cellular and molecular immunology. Saunders, Philadelphia.
4. Delves, P.J., Martin, S.J., Burton, D.R. and Roitt, I.M. Roitt's essential immunology. Wiley-Blackwell, New Jersey.
5. Tizard, I.R. Immunology: An introduction. Saunders, Philadelphia.
6. Playfair, J.H.L. Immunology at a glance. Blackwell Scientific Publications, Oxford.
7. Abbas, A.K. and Lichtman, A.H.H. Basic immunology: Functions and disorders of the immune system. Saunders, Philadelphia.
8. Chapel, H., Haeney, M., Misbah, S. and Snowden, N. Essentials of clinical immunology. Wiley, New Jersey.
9. Palyfair, J.H.L. and Chain, B.M. Immunology at a glance. Wiley- Blackwell, New Jersey.
10. Coico, R. and Sunshine, G. Immunology: A short course. Wiley- Blackwell, New Jersey.
11. Rao, C.V. Immunology. Alpha Science International, New Delhi.
12. Pathak, S. and Palan, U. Immunology: Essential and fundamental. Science, New Hampshire.

II SEMESTER

SLS/MIC/C009: BIOLOGICAL TECHNIQUES

Unit I: Microscopy and Biosensors

Microscopy (Principles and applications): Light, phase contrast, fluorescence and confocal microscopy, Scanning and transmission electron microscopy; Biosensors: Introduction and principles, First, second and third generation instruments, Cell based biosensors, Enzyme immunosensors, DNA biosensor.

Unit II: Centrifugation

Basic principle and applications of centrifugation; Centrifugal force; Sedimentation rate; Sedimentation coefficient; Common centrifuges used in laboratory (Clinical, micro, high speed, ultra and industrial centrifuges); Types of rotors (Fixed- angle, swinging bucket and continuous tubular); Types of centrifugation (Principle and applications): Preparative (Differential and density gradient centrifugation) and analytical centrifugation.

Unit III: Chromatography

General principle and applications of chromatography; Types of chromatography (Principles and applications): Adsorption chromatography, Ion exchange chromatography, Affinity chromatography, Size exclusion chromatography, Thin layer chromatography, Gas chromatography, High pressure liquid chromatography (HPLC), Supercritical fluid chromatography.

Unit IV: Electrophoretic Techniques

General principle and applications of electrophoresis; Types of electrophoresis (Principles and applications): Paper electrophoresis, Moving boundary electrophoresis, Isotachophoresis, Agarose gel electrophoresis, Polyacrylamide gel electrophoresis (SDS-PAGE, Native-PAGE, Denaturing-PAGE and Reducing-PAGE), Isoelectric focusing (IEF), Pulse field gel electrophoresis (PFGE), Disc gel electrophoresis.

Unit V: Spectroscopy and Radiotracer Techniques

Spectroscopic methods (Principle and applications): UV, Visible, IR, NMR, Fluorescence, ESR, Atomic absorption, CD, ORD and Raman Spectroscopy; Mass Spectrometry: Principles and application of MALDI-MS, Ionization methods; Radiotracer techniques: Applications of radioisotopes in biology, Properties and units of radioactivity, Radioactive isotopes and half-life, Safety rules in handling of radioisotopes, Measurement of radioactivity (GM counter, gamma counter, wilson cloud chamber and liquid scintillation counter), Autoradiography: Principle and its applications.

Reference Books

1. Wilson, K. and Walker, J. Principles and techniques of biochemistry and molecular biology. Cambridge University Press, Cambridge.
2. Robyt, J.F. and White, B.J. Biochemical techniques: Theory and practice. Waveland Press, Long Grove.
3. Holme, D.J. and Peck, H. Analytical biochemistry. Longman Group Limited, London.
4. Chatwal, G. and Anand, S. Instrumental methods of chemical analysis. Himalaya Publishing House, Mumbai.

5. Miller, J. Chromatography: Concepts and contrasts. John Wiley and Sons, New York.
6. Message, G.M. Practical aspects of gas chromatography/ mass spectrometry. John Wiley and Sons, New York.
7. Kremmer, T. and Boross, L. Gel chromatography: Theory, methodology, applications. John Wiley and Sons, New York.
8. Hamilton, R.J. and Sewell, P.A. Introduction to high performance liquid chromatography. Chapman and Hall Limited, London.
9. Sharma, V.K. Techniques in microscopy and cell biology. Tata McGraw-Hill, New Delhi.
10. Westermeier, R. Electrophoresis in practice. Wiley-Blackwell, New Jersey.
11. Hames, B.D. Gel electrophoresis of proteins: A practical approach. Oxford University Press, Oxford.
12. Ford, T.C. and Graham, J.M. An introduction to centrifugation. Bios, New York.
13. Spencer, M. Fundamentals of light microscopy. Cambridge University Press, Cambridge.
14. Hayat, M.A. Principles and techniques of electron microscopy: Biological applications. Cambridge University Press, Cambridge.
15. Price, R.L. and Jerome, W.G. Basic confocal microscopy. Springer-Verlag, New York.
16. Rost, F.W.D. Fluorescence microscopy. Cambridge University Press, Cambridge.
17. Ploem, J.S. and Tanke, H.J. Introduction to fluorescence microscopy. Oxford University Press, Oxford.
18. Keeler, J. Understanding NMR spectroscopy. John Wiley and Sons, New York.
19. Straughan, B.B. and Walker, S. Spectroscopy. Chapman and Hall Limited, London.
20. Davies, A.M.C. and Creaser, C.S. Analytical applications of spectroscopy. Royal Society of Chemistry, California.
21. Thornburn, C.C. Isotopes and radiations in biology. Butterworths, Oxford.
22. Wang, C.H. and Willis, D.L. Radiotracer methodology in biological science. Prentice Hall, New Jersey.
23. Sambrook, J. and Russell, D.W. Molecular cloning: A laboratory manual. Cold Spring Harbor Lab Press, New York.

II SEMESTER

SLS/MIC/C010: RECOMBINANT DNA TECHNOLOGY

Unit I: Principles and Tools of Gene Cloning

Isolation of nucleic acids: DNA (Genomic, plasmid and bacteriophage), RNA; Enzymes used in genetic engineering (Restriction endonucleases, ligase, polymerases, kinase, alkaline phosphatase and terminal transferase); Cloning vectors: Characteristic features and applications of vectors based on plasmids (*E. coli* and yeast), phages (λ and M13 bacteriophage), cosmids, phasmids, artificial chromosome vectors (BAC and YAC), vectors for plants and animal cells and shuttle vectors.

Unit II: Strategies of Gene Cloning

Gene cloning: Steps of cloning, Formation of DNA fragments using linkers, adaptors and homopolymer tails, Introduction of DNA into host cells (Bacteria, plant and animal cells); Library construction: Synthesis of cDNA, Construction of cDNA and genomic library; Obtaining clone of a specific gene: Problem of selection, Direct selection, Selection strategies for recombinant produced by different vectors, Methods of identification of clone from gene library.

Unit III: Expression of Cloned Gene in Heterologous System: Prokaryotes and Eukaryotes

Basic architecture of an expression vector; Critical components of an expression vector; Expression of fusion protein; Characteristic features of pEt, pcDNA3 and cytomegalovirus expression system; Model host systems: *E. coli*, Fungi, Mammalian cell lines, Insect cells, Transgenic plants and animals; Screening strategies; Identification and study of translation product of a cloned gene: HRT and HART techniques.

Unit IV: Sequence Detection, Amplification and Modification Techniques

Blotting techniques (Methodologies and applications): Southern, Northern and Western blotting; Probe labelling and hybridization; DNA sequencing (Chemical, enzymatic and automated methods); Sequence assembly for whole genome analysis; PCR: Principle and applications; Types of PCR (Principle and applications): Degenerate PCR, Multiplex PCR, Hot start PCR, *In situ* PCR, Nested PCR, Q-PCR, RACE, Real Time PCR, RT-PCR; Site directed mutagenesis (Methods and applications).

Unit V: Genome Analysis and Applications of RDT

Principles and applications of techniques used in genome analysis: Exon trapping, R loop analysis, S1–mapping, Chromosome walking, Ribonuclease protection assay, Gel retardation assay, DNA foot printing, DNA fingerprinting, Antisense technology, Ribozyme technology; Applications of recombinant DNA technology in forensic science, therapeutics and agriculture.

Reference Books

1. Brown, T.A. Gene cloning and DNA analysis: An introduction. Wiley-Blackwell, New Jersey.
2. Primrose, S.B. and Twyman, R. Principles of gene manipulation and genomics. Wiley-Blackwell, New Jersey.
3. Nicholl, D.S.T. An introduction to genetic engineering. Cambridge University Press, Cambridge.

4. Glick, B.R., Pasternak, J.J. and Patten, C.L. Molecular biotechnology: Principles and applications of recombinant DNA. ASM Press, Washington, D.C.
5. Hartwell, L. Genetics: From genes to genome. McGraw-Hill, New York.
6. Old, R.W. and Primrose, S.B. Principles of gene manipulations. Blackwell Science, Oxford.
7. Winnacker, E.L. From genes to clones: Introduction to gene technology. Wiley-VCH, Germany.
8. Kingsman, S.M. and Kingsman, A.J. Genetic engineering: An introduction to gene analysis and exploitation in eukaryotes. Blackwell Science, Oxford.
9. Greene, J.J. and Rao, V.B. Recombinant DNA principles and methodologies. Marcel Dekker, New York.
10. Brown, T.A. Genomes. Wiley-Liss, Oxford.
11. Pevsner, J. Bioinformatics and functional genomics. Wiley-Blackwell, New Jersey.
12. Sambrook, J. and Russell, D.W. Molecular Cloning: A laboratory manual. Cold Spring Harbor Lab Press, New York.
13. Reece R.J. Analysis of genes and genomes. John Wiley and Sons, New York.
14. Recombinant DNA safety guidelines. Department of Biotechnology, Ministry of Science and Technology, Government of India, New Delhi.

II SEMESTER

SLS/MIC/C011: LAB COURSE-I
(Based on Theory Papers SLS/MIC/C007 and SLS/MIC/C008)

1. Study of effect of temperature, pH and salt concentration on growth of bacteria.
2. Determination of ability of bacteria to reduce nitrate.
3. Determination of ability of bacteria to produce H_2S.
4. Determination of presence of cytochrome oxidase in bacteria.
5. Determination of presence of catalase in bacteria.
6. Determination of ability of bacteria to produce acidic or neutral end product from glucose.
7. Determination of ability of bacteria to utilize sugars by oxidative or fermentative mode.
8. Study of different stages of sporulation in *Bacillus*.
9. Effect of pH, sugars, amino acids and inorganic ions on spore germination.
10. Separation and preservation of serum and plasma.
11. Determination of blood group and Rh factor.
12. Demonstration of agglutination reaction of bacterial cultures by slide agglutination test.
13. Quantitative estimation of antigen by radial immunodiffusion.
14. Detection and quantification of either antibody or antigen by ouchterlony double diffusion method.
15. Determination of concentration of antigen by rocket immunoelectrophoresis.
16. Determination of the presence of specific antibody for its antigen by Dot-ELISA method.
17. Determination of concentration of antigen by sandwich ELISA.
18. Detection of the presence of either specific antibody or specific antigen in a patient's serum by complement fixation test.

Reference Books

1. Cappucino, J. and Sherman, N. Microbiology: A laboratory manual. Benjamin/Cummings Publishing Company, San Francisco.
2. Prescott, L.M. and Harley, J.P. Laboratory exercises in microbiology. William C. Brown, Dubuque.
3. White, D. and Hegeman, G.D. Microbial physiology and biochemistry laboratory: A quantitative approach. Oxford University Press, New York.
4. Aneja, K.R. Experiments in microbiology, plant pathology and biotechnology. New Age International (P) Limited, New Delhi.
5. Atlas, R.M., Brown, A.E. and Parks, L.C. Laboratory manual of experimental microbiology. Mosby College Publishing Company, St. Louis.
6. Kannan, K. Laboratory manual in general microbiology. Panima, New Delhi.
7. Holt, J.G. and Krieg, N.R. Bergey's manual of determinative bacteriology. Lippincott Williams and Wilkin, Philadelphia.
8. Rose, N.R., Hamilton, R.G. and Detrick, B. Manual of clinical laboratory immunology. ASM Press, Washington, D.C.
9. Weir, D.M. Handbook of experimental immunology. Blackwell Scientific Publications, New Jersey.
10. Stafseth, H.J., Stockton, J.J. and Newman, J.P. A laboratory manual for immunology. Burgess Publishing Company, Stockland.

II SEMESTER

SLS/MIC/C012: LAB COURSE-II
(Based on Theory Papers SLS/MIC/C009 and SLS/MIC/C010)

1. Separation and identification of amino acids by ascending and descending paper chromatography.
2. Separation and identification of sugars by paper chromatography.
3. Separation and identification of sugars by thin layer chromatography.
4. Verification of Lambert Beer's law.
5. Determination of molecular weight of DNA by agarose gel electrophoresis.
6. Separation and determination of molecular weight of proteins by SDS-PAGE.
7. Visualization of enzyme activity by NATIVE-PAGE.
8. Interpretation of UV spectra.
9. Interpretation of IR spectra.
10. Interpretation of NMR spectra.
11. Interpretation of Mass spectra.
12. Isolation of genomic DNA from plant sample.
13. Isolation of plasmid DNA from bacterial cell culture.
14. PCR amplification of DNA.
15. Restriction digestion of vector and DNA.
16. Ligation of DNA construct and vector.
17. Preparation of competent cells.
18. Introduction of recombinant DNA into bacterial cells and selection of recombinant clones.
19. Demonstration of inducible enzyme β-galactosidase in *E. coli*.
20. Expression of gene in *E. coli*.
21. Determination of similarity between different bacterial isolates using RFLP.

Reference Books

1. Jayaraman, J. Laboratory manual in biochemistry. New Age International (P) Limited, New Delhi.
2. Sawhney, S.K. and Singh, R. Introductory practical biochemistry. Narosa Publishing House, New Delhi.
3. Boyer, R.F. Modern experimental biochemistry. Prentice Hall, New Jersey.
4. Wilson, K. and Walker, J.M. Principles and techniques of practical biochemistry. Cambridge University Press, Cambridge.
5. Sambrook, J. and Russell, D.W. Molecular cloning: A laboratory manual. Cold Spring Harbor Lab Press, New York.
6. Miller, J.H. Experiments in molecular genetics. Cold Spring Harbor Lab Press, New York.

SYLLABUS OF M.Sc. MICROBIOLOGY
III & IV SEMESTERS

III SEMESTER

SLS/MIC/C013: MEDICAL MICROBIOLOGY

Unit I: Basics of Medical Microbiology

Normal microbiota of human body; Role of resident flora and human host; Routes of transmission of pathogens; Nosocomial infections; Collection, transportation and processing of clinical samples; Isolation and identification of pathogenic organisms; Quality control in medical microbiology laboratory.

Unit II: Pathogenesis and Antimicrobial Chemotherapy

Pathogenicity islands; Mechanism of pathogenesis: Mechanism of bacterial adhesion, colonization and invasion, Protein toxins (Classification and mode of action), Cytoskeletal modulation of host cell; Mechanism of action of antimicrobial agents; Methods of drug susceptibility testing: Kirby-Bauer's disc diffusion method, Stokes method, Agar dilution method, Broth dilution method, E-strip method; Emergence of drug resistance in bacteria (MRSA, ESBL and MDR TB); Resistance mechanism; Various types of vaccines for prevention of infectious diseases; National immunization program and immunization schedule.

Unit III: Bacterial Diseases

Clinical features, transmission, characteristics of causative organism, pathogenesis, laboratory diagnosis, prevention and control of bacterial diseases and clinical syndromes: Cholera, Leprosy, Diphtheria, Tetanus, Meningitis, Conjunctivitis, Pneumonia and Gastroenteritis.

Unit IV: Viral Diseases

Clinical features, transmission, characteristics of causative organism, pathogenesis, laboratory diagnosis, prevention and control of viral diseases: Herpes, Chikungunya, Influenza, Measles, Mumps, Hepatitis, HIV, Viral cancer.

Unit V: Protozoal and Fungal Diseases

Clinical features, transmission, pathogenesis, laboratory diagnosis, prevention and control of protozoal diseases: Amoebiasis, Giardiasis, Leishmaniasis, Malaria; Clinical features, transmission, pathogenesis, laboratory diagnosis, prevention and control of fungal diseases: Aspergillosis, Cryptococcosis, Candidiasis, Blastomycosis.

Reference Books

1. Murrey, P.R., Rosenthal, K.S., Kobayashi, G.S. and Pfaller, M.A. Medical microbiology. Saunders, Philadelphia.
2. Baron, E.J., Peterson, L.R. and Finegold, S.M. Bailey and Scott's diagnostic microbiology. Mosby, St. Louis.
3. Dockrell, H., Zuckerman, M., Roitt, I.M. and Chiodini, P.L. Mim's medical microbiology. Elsevier, London.
4. Collee, J.C., Duguid, J.P., Fraser, A.C. and Marimon, B.P. Mackie and McCartney practical medical microbiology. Churchill Livingstone, London.
5. Ananthanarayanan, R. and Panicker, C.K.J. Text book of microbiology. Orient Longman, Hyderabad.
6. Koneman, E.W. Koneman's color atlas and textbook of diagnostic microbiology. Lippincott Williams and Wilkins, Philadelphia.

7. Topley, W.W.C., Wilson, S.G.S and Parker, M.T. Topley and Wilson's principles of bacteriology, virology and immunity. Edward Arnold, London.
8. Greenwood, D., Slack, R.B. and Peutherer, J.F. Medical microbiology. Churchill Livingstone, London.
9. Mahon, C.R. and Manuselis, G. Textbook of diagnostic microbiology. Saunders, Philadelphia.
10. Maza, L.M.D.L. Color atlas of medical bacteriology. ASM Press, Washington, D.C.
11. Garcia, L.S and Isenberg, H.D. Clinical microbiology procedures handbook. ASM Press, Washington, D.C.
12. Balows, A., Hausler, W.J., Ohashi, M. and Turano, A. Laboratory diagnosis of infectious diseases: Principles and practice. Springer-Verlag, New York.
13. Chakraborthy, P. A textbook of microbiology. New Central Book Agency Private Limited, Calcutta.
14. Morag, C. and Timbury, M.C. Medical virology. Churchill Livingston, London.
15. Dimmock, N.J. and Pimrose, S.B. Introduction to modern virology. Blackwell Scientific Publications, Oxford.
16. Flint, S.J., Racaniello, V.R., Enquist, L.W., Rancaniello, V.R. and Skalka, A.M. Principles of virology: Molecular biology, pathogenesis and control of animal viruses. ASM Press, Washington, D.C.
17. Karyakarte, R.P. and Damle, A.S. Medical parasitology. Books and Allied Private Limited, Kolkatta.
18. Paniker, J. Text book of medical parasitology. Jaypee Brothers Medical Private Limited, New Delhi.
19. Chander, J. A text book of medical mycology. Interprint, New Delhi.

III SEMESTER

SLS/MIC/C014: INDUSTRIAL MICROBIOLOGY

Unit I: Introduction to Industrial Microbiology
Primary and secondary metabolites; Structure of fermentor/bioreactor; Types of fermentor/bioreactors; Scale up and scale down processes; Types of fermentation (Solid state, surface and submerged fermentation).

Unit II: Basic Aspects of Fermentation
Media formulation; Sterilization; Inoculum development; Effect of temperature, pH and high nutrient concentration on fermentation; Operational modes of fermentation (Batch, fed- batch and continuous); Downstream processing.

Unit III: Microbial Strain Improvement
Strategies for isolation and cultivation of desired microorganisms; Screening for the desired product; Strategies for strain improvement: Mutation, Protoplast fusion, Recombinant DNA technology, Novel strategies (Metabolic engineering, genome shuffling, ribosome engineering and epigenetic modification); Preservation of cultures after strain improvement programme.

Unit IV: Industrial Production Aspects I
Production aspects (Microbial strains, substrate, flow diagrams, product optimization and applications): Production of antibiotics (penicillin, D-cycloserine, streptomycin, tetracycline, bacitracin and grieseofulvin), amino acid (glutamic acid and lysine), biopolymers (dextran, alginate, xanthan and pullulan) and steroids biotransformation.

Unit V: Industrial Production Aspects II
Production aspects (Microbial strains, substrate, flow diagrams, product optimization and applications): Production of enzymes (pectinase, amylase, lipase, protease, cellulase and xylanase), alcohol and alcoholic beverages, vitamins (B12 and riboflavin), organic acids (citric acid, acetic acid and lactic acid), ergot alkaloids and bioplastics (PHB and PHA).

Reference Books

1. Hershnergev, C.L., Queener, S.W. and Hedemen, Q. Genetics and biotechnology of industrial microorganisms. ASM Press, Washington, D.C.
2. Crueger, W. and Crueger, A. Biotechnology: A textbook of industrial microbiology. Sinauer Associates, Sunderland.
3. Reed, G. Prescott and Dunn's industrial microbiology. Globe Bookservices, London.
4. Demain, A.L and Davies, J.E. Manual of industrial microbiology and biotechnology. ASM Press, Washington, D.C.
5. Casida, J.E. Industrial microbiology. Wiley Eastern, New Delhi.
6. Patel, A.H. Industrial microbiology. MacMillan India Limited, New Delhi.
7. Stanbury, A.H., Whittaker, A. and Hall, S.J. Principles of fermentation technology. Pergamon Press, Oxford.
8. Richard, H., George, B., Hagemann, D. and Paul, L. Industrial microorganisms: Basic and applied molecular genetics. ASM Press, Washington, D.C.

III SEMESTER

SLS/MIC/C015: LAB COURSE-I
(Based on Theory Papers SLS/MIC/C013 and SLS/MIC/C014)

1. Biosafety guidelines and biosafety levels.
2. Prevalence of pathogenic microorganisms in clinical sample.
3. Isolation and biochemical characterization of pathogenic bacteria.
4. Isolation and identification of fungal pathogens from clinical specimens.
5. Determination of antimicrobial susceptibility of pathogens by disc diffusion test.
6. Determination of MIC and MBC concentration of antibiotics by broth dilution test.
7. Isolation and screening of bacterial and fungal cultures for enzyme production.
8. Estimation of enzyme production by microbial culture *via* liquid state fermentation.
9. Estimation of enzyme production by microbial culture *via* solid state fermentation.
10. Media formulation for enhanced enzyme production by microbial culture *via* liquid and solid state fermentation.
11. Optimization of culture conditions for enhanced enzyme production by microbial culture *via* liquid and solid state fermentation.
12. Production of wine from fruit juice.
13. Monitoring of sugar reduction during wine production.
14. Estimation of alcohol concentration in wine.
15. Estimation of vicinal diketone in beer.
16. Improvement of strain for increased yield by U.V. mutagenesis.

Reference Books

1. Collee, J.C., Duguid, J.P., Fraser, A.C. and Marimon, B.P. Mackie and McCartney practical medical microbiology. Churchill Livingstone, London.
2. Garcia, L.S and Isenberg, H.D. Clinical microbiology procedures handbook. ASM Press, Washington, D.C.
3. Murray, P.R., Baron, E.J., Jorgensen, J.H., Pfaller, M.A. and Yoke, R.H. Manual of clinical microbiology. ASM Press, Washington, D.C.
4. Balows, A., Hausler, W.J., Ohashi, M. and Turano, A. Laboratory diagnosis of infectious diseases: Principles and practice. Springer-Verlag, New York.
5. Faddin, J.F.M. Biochemical tests for identification of medical bacteria. Williams and Wilkins, Baltimore.
6. Baltz, R.H., Demain, A.L and Davies, J.E. Manual of industrial microbiology and biotechnology. ASM Press, Washington, D.C.
7. Leboffe, M.J. and Pierce, B.E. Microbiology: Laboratory theory and application. Morton Publishing Company, Englewood.
8. Singer, S. Experiments in applied microbiology. Academic Press, New York.
9. Kannan, K. Laboratory manual in general microbiology. Panima, New Delhi.
10. Holt, J.G. and Krieg, N.R. Bergey's manual of determinative bacteriology. Lippincott Williams and Wilkin, Philadelphia.

III SEMESTER

SLS/MIC/E01A: FOOD AND DAIRY MICROBIOLOGY

Unit I: Principles of Food Preservation
Factors influencing microbial growth in food; Asepsis; Food preservation: Principles, Physical methods (Dehydration, freeze drying, heat and irradiation), Chemical methods (Chemical preservatives and food additives); Canning; Processing for heat treatment (D, Z and F values) and working out treatment parameters; Microbiological quality standards of food.

Unit II: Contamination and Spoilage
Characterization of contamination and spoilage of cereals, vegetables, fruits, meat and meat products, milk and milk products, fish and sea foods, beer and wines; Spoilage of fermented foods and canned foods.

Unit III: Foodborne Infections and Intoxications
Bacterial and nonbacterial infections and intoxications of *Brucella*, *Bacillus*, *Clostridium*, *Escherichia*, *Salmonella*, *Shigella*, *Staphylococcus*, *Vibrio*, *Yersinia*, *Listeria*, nematodes, protozoa, algae, fungi and viruses; Structure and functions of aflatoxins; Laboratory testing procedures.

Unit IV: Food Safety and Quality Assurance
Food sanitation in manufacture and retail trade; Microbiological quality standards of food; Food control agencies and their regulations: FDA, EPA, CDC and ISI; Good Manufacturing Practice; Plant sanitation (Employees health standards, waste treatment and disposal); Hazard Analysis and Critical Control Point (HACCP) system; Food Safety Act and Trade Regulations.

Unit V: Production of Fermented Foods
Industrial production methods of bread, cheese, fermented vegetables (olives and cucumber), fermented dairy products (acidophilus milk, cheese and yoghurt), single cell proteins, sauerkraut, meat and fishery products (sausages and fish sauces); Production of oriental foods (mycoprotein, tempeh, soya sauce, idli, natto and poi) and beverages (vinegar, cider, sake and palm wines); Alcoholic beverages of Himalayan region; Genetically modified foods; Probiotics.

Reference Books

1. Adams, M.R., and Moss, M.O. Food microbiology. Royal Society of Chemistry Publication, Cambridge.
2. Frazier, W.C. and Westhoff, D.C. Food microbiology. Tata McGraw Hill, New Delhi.
3. Stanbuty, P.F. and Hall, S.J. Principles of fermentation technology. Pergamon Press, Oxford.
4. Banwart, G.J. Basic food microbiology. CBS Publishers and Distributors, New Delhi.
5. Robinson, R.K. Dairy microbiology. Elsevier Applied Sciences, London.
6. James M.J. Modern food microbiology. CBS Publishers and Distributors, New Delhi.
7. Wood, B.J. Microbiology of fermented foods. Elsevier Applied Sciences, London.
8. Ayres, J.C., Mundt, O. and Sandinee, W.E. Microbiology of foods. W.H. Freeman and Company, New York.
9. Jay, M.J., Loessner, M.J. and Golden, D.A. Modern food microbiology. Springer Science and Business Media, New York.
10. Hobbs, B.C. and Roberts, D. Food poisoning and food hygiene. Edward Arnold, London.

III SEMESTER

SLS/MIC/E01B: DRUG DESIGNING AND NANOBIOTECHNOLOGY

Unit I: Drug Receptor Interactions

Receptors: Classification of receptors and receptor subtypes, Structure of receptors, Blood cell receptors for endogenous compounds, Neurotransmitters and their receptors, Receptor modulation and mimics, Receptor sites, Receptor cross-talk, Organ receptors, Non-liganded and constitutive receptor activation, r-DNA receptor bioassays, Desensitization of receptors, Receptors as targets for vaccines and newer drug development; Drug-receptor interactions: Active transport, Affinity and efficacy, Allosteric binding sites, Chirality and receptor binding, Signal transduction and second messenger system, Introduction of various classes of drugs based on their interaction with target site, Interaction of drugs with receptors, enzymes, DNA and carbohydrates.

Unit II: Drug Targeting and Drug Delivery Systems

Introduction and historical perspectives of drug delivery systems; Controlled, targeted and delayed drug delivery systems; Oral dosage forms: Diffusion, Dissolution system, Osmotic pumps, Ion exchange resin; Soluble delivery systems: Micro and nano systems; Injections; Routes of drug delivery systems; Stability profile; Barriers to proteins and peptide delivery; Lymphatic transportation of proteins; Site specific protein modification; Toxicology profile characterization; Cellular level events in targeting; Carrier systems for targeting; Specialized liposomes for drug targeting.

Unit III: Structure Activity Relationship

Structure activity relationship (SAR): Introduction and scope, Structure activity relationship illustrated with examples from sulphonamides, β-lactams, quinolones, nucleosides and alkaloids; Quantitative structure activity relationship (QSAR): Role of physicochemical, electronic (Hammett equation), lipophilicity (Hansch equation) and steric parameter (Taft equation).

Unit IV: Molecular Modelling

Quantum mechanical and molecular orbital methods; Introduction to semiempirical, molecular mechanics and *ab initio* techniques; Potential energy surface; Docking and modelling substrate-receptor interactions; Introduction to software tools for CADD.

Unit V: Nanobiotechnology

Functional principles of nanobiotechnology; Basic biology principles and practice of micro fabrication techniques; Atomic force microscopy; Biological production of metal nanoparticles and macromolecular assemblies; Bacterial structure relevant to nanobiotechnology; Cubosomes; Dendrimers; DNA nanoparticle conjugates; DNA octahedron; Fullerenes; Nanoshells; Carbon nanotubes; Nanopores; Nanostructured silicon; Viruses as nanoparticles; DNA based nanostructures: DNA-protein nanostructures, Self-assembled DNA nanotubes, Drug delivery tools *via* nanobiotechnology; Protein and peptide delivery; Tumor targeting and other diagnostic applications; Nanoparticle based immobilization assays; Quantum dots technology and its application; Immuno- nanotechnology; Biosensors and nanobiotechnology.

Reference Books

1. Silverman, R. Organic chemistry of drug design and drug action. Elsevier, London.

2. Gorden, E.M. and Kerwin, J.F. Combinatorial chemistry and molecular diversity in drug discovery. Wiley-Liss, Oxford.
3. Pirrung, M.C. Molecular diversity and combinatorial chemistry: Principles and applications. Elsevier, London.
4. Larsen, P.K. and Stromgaard, K. Textbook of drug design and discovery. CRC Press, Boca Raton.
5. Silverman, R.B. The organic chemistry of drug design and drug action. Elsevier, London.
6. Patrick, G.L. An introduction to medicinal chemistry. Oxford University Press, Oxford.
7. Gregoriadis, G. Drug carriers in biology and medicine. Academic Press, New York.
8. Chorghade, M.S. Drug discovery and development. John Wiley and Sons, New York.
9. Graly, J.O. and Joubert, P.H. Handbook of phase I / II clinical drug trials. CRC Press, Boca Raton.
10. Eisenberg, D. and Crothers, D. Physical chemistry with applications to the life sciences. Benjamin/ Cummings Publishing Company, Melano Park.
11. Niemeyer, C.M. and Mirkin, A. Nanobiotechnology: Concepts, applications and perspectives. Wiley, New York.
12. Donald, M. Nanobiotechnology of biomimetic membranes. Springer Verlag, New York.
13. deVilliers, M.M., Aramwit, P. and Kwon, G.S. Nanotechnology in drug delivery. Springer-Science, New York.
14. Kulkarni, S.S. Nanotechnology: Principles and practices. Capital Publishing Company, New Delhi.
15. Goosell, D.S. Bionanotechnology: Lessons from nature. John Wiley and Sons, New York.

III SEMESTER

SLS/MIC/E01C: GENOMICS AND PROTEOMICS

Unit I: Genome Anatomies

Introduction to structural, comparative and functional genomics; Applications of genomics; Anatomy of eukaryotic and prokaryotic genome; Genome size and complexity; Repetitive DNA content of genome; Introduction to gene networks and epigenetic analysis; DNA methylation analysis: Global DNA methylation analysis, Gene-specific methylation analysis, Methylation sensitive PCR, Quantitative methods of DNA methylation analysis; Sequencing of genome: Shot gun sequencing, High throughput sequencing; Methods for sequence assembly: Whole genome shot gun approach, Clone contig approach.

Unit II: Mapping genomes

Genetic mapping: DNA markers used (RFLP, SSLP and SNP), Gene mapping by linkage and pedigree analysis, Genetic mapping in bacteria, Limitations of genetic mapping; Physical mapping: Restriction mapping, Fluorescence *in situ* hybridization, Sequence tagged site mapping.

Unit III: Genome sequence analysis

Location of gene by sequence inspection, Techniques used for gene location: Northern hybridization, Zoo blotting, cDNA sequencing; Techniques used for transcript mapping (RACE and heteroduplex analysis); Location of exon and exon-intron boundaries; Determining function of individual genes: Homology analysis, Gene inactivation by homologous recombination (gene targeting and gene trapping), genome-wide mutagenesis, transposon tagging and RNA interference; Overexpression of genes; Directed mutagenesis; Determining pattern of gene expression: Reporter gene and immunocytochemistry; Human Genome Project: Strategies and implications.

Unit IV: Transcriptomics

Serial analysis of gene expression (SAGE); Massively parallel signature sequencing (MPSS); DNA chip and microarray; Tiling arrays; Applications of transcriptomics.

Unit V: Proteomics

Techniques used to study proteome: 2-D PAGE, Mass-Spectrometry, MALDI-TOF, Identifying proteins with posttranslational modifications; Fast parallel proteolysis; Protein sequencing; Identifying protein – protein interactions: Yeast two-hybrid system, Phage display library, Protein microarray, Affinity purification, Protein interaction maps; Chromatin immunoprecipitation; Applications of proteomics.

Reference Books

1. Brown, T.A. Genomes. Wiley-Liss, Oxford.
2. Pevsner, J. Bioinformatics and functional genomics. Wiley-Blackwell, New Jersey.
3. Reece, R.J. Analysis of genes and genomes. John Wiley and Sons, New York.
4. Gibson, G. and Muse, S.V. A primer of genome science. Sinauer Associates, Massachusetts.
5. Campbell, A.M. and Heyer, L.J. Discovering genomics, proteomics and bioinformatics. Benjamin/ Cummings Publishing Company, San Francisco.

III SEMESTER

SLS/MIC/E01D: EPIDEMIOLOGY

Unit I: **Basics of Epidemiology**
Introduction; Scope and applications of epidemiology in health care; Role, ethics and responsibilities of an epidemiologist; Relation between virulence and spread; Reservoirs of infection (Human, animal and non-living reservoirs); Types of carriers; Portals of entry and exit.

Unit II: Transmission of Disease
Sources of infection; Modes of disease transmission; Disease cycle; Role of remote sensing and geographical information in recognition of an epidemic; Serological surveys; Influence of behavioral or spatial factors on transmission; Spatial, temporal and social distributions of communicable diseases; History of outbreaks: SARS, Chikungunya, Hantavirus infection, Swine flu, Haiti cholera.

Unit III: Mathematical Modelling I
Transmission dynamics: Incidence, Prevalence, Morbidity, Mortality; Public health surveillance: Purpose and characteristics, Identifying health problems for surveillance, Collection of data for surveillance, Analysis and interpretation of data, Disseminating data and interpretation, Evaluating and improving surveillance.

Unit IV: Mathematical Modelling II
Epidemiological studies: Collection of frequency data, Descriptive, analytical and experimental studies, Cross-sectional, case-control and cohort studies, Models for developing epidemiological theory, Modelling tools, Population dynamics, Epidemiological statistics relating exposure and disease; Measures of risks: Frequency measures, Morbidity and mortality frequency measures, Natality measures, Measures of association, Measures of public health impact.

Unit V: Control of Epidemics
Cycle of epidemics; Emerging and re-emerging infectious diseases and pathogens; Control of transmission: Isolation, Quarantine, Threat of bioterrorism, Global travel and health considerations; Community based control by vaccination, mass vaccination and herd immunity; Public health organizations for control: Centre of Disease Control (CDC), Guidelines issued by CDC and WHO, Health standards for international epidemics.

Reference Books

1. Rothman, K.J. and Greenland, S. Modern epidemiology. Lippincott-Raven, Philadelphia.
2. Dockrell, H., Zuckerman, M., Roitt, I.M. and Chiodini, P.L. Mim's medical microbiology. Elsevier, London.
3. Gordis, L. Epidemiology. Saunders, Philadelphia.
4. Anderson, R.M. and May, R.M. Infectious diseases of humans: Dynamics and control. Oxford University Press, Oxford.
5. Giesecke, J. Modern infectious disease epidemiology. Edward Arnold, London.
6. Clayton, D. and Hills, M. Statistical models in epidemiology. Oxford University Press, Oxford.
7. Rothman K.J., Greenland, S. and Lash, T.L. Modern epidemiology. Lippincott Williams and Wilkins, Philadelphia.

8. Vynnycky, E. and White, R.G. An introduction to infectious disease modelling. Oxford University Press, Oxford.
9. Gerstman, B.B. Epidemiology kept simple: An introduction to classic and modern epidemiolgy. John Wiley and Sons, New York.
10. Vynnycky, E. and White, R. An introduction to infectious disease modelling. Oxford University Press, Oxford.
11. Kestenbaum, B. Epidemiology and biostatistics: An introduction to clinical research. Springer-Verlag, New York.

III SEMESTER

SLS/MIC/E01E: BIOPROCESS TECHNOLOGY

Unit I: Bioreactor Design

Introduction to fermentation technology; Ideal bioreactor; Types of bioreactor (Stirred tank bioreactor, airlift bioreactor, continuous stirred tank bioreactor, immobilized cell reactors, plug flow reactor, tube reactors, packed bed reactors, fluidized bed reactors, cyclone reactors and trickle flow reactors); Designing of a bioreactor: Bioreactor configuration, Design features, Parts of bioreactor; Reactor with non-ideal mixing; Sterilization reactors; Multiphase bioreactors; Animal and plant cell reactor technology.

Unit II: Fermentation Process and Kinetics

Types of fermentation; Media formulation; Sterilization (Batch and continuous); Inoculum development; Operational modes (Applications, advantages and limitations of batch, fed-batch and continuous processes); Scaling up of process; Specific growth rate; Kinetics of microbial growth in batch, continuous and fed batch culture; Kinetics of substrate utilization and product yield; Multistage system; Feedback systems and its kinetics; Biomass productivity and metabolic productivity; Basic principles of operation; Optimization and modelling of fermentation process: Single variable design, Multivariate screening designs, Critical factor analysis, Optimization designs for two or more factors, Singlet method, Metabolic and flux control analysis.

Unit III: Mass and Energy: Transfer and Balance

Aeration: Principles and methods; Oxygen requirement in industrial fermentation; Theory of oxygen transfer in bubble aeration; Oxygen transfer kinetics (Oxygen uptake rate, Oxygen transfer rate and C_{crit}); Determination of kLa; Functions of agitation; Flow patterns with different types of impellers; Fermentation broth rheology and power requirements for agitation: Concept of Newtonian and non-Newtonian fluids, Effect of broth rheology on heat, nutrient and oxygen transfer, Reynold's number, Power number, Aeration number; Conversion and balance of nutrient and biomass, Heat balance and affecting factors, Heat transfer.

Unit IV: Downstream Processing

Biomass separation by centrifugation, filtration, flocculation and other recent developments; Cell disintegration: Physical, chemical and enzymatic methods; Extraction (Solvent, two phase, liquid extraction, whole broth and aqueous multiphase extraction); Purification by different methods; Concentration by precipitation, ultra-filtration and reverse osmosis; Drying and crystallization.

Unit V: Instrumentation and Control

Methods of measuring process variability and their control: Temperature, Flow, Pressure, Dissolved oxygen and free CO_2, pH and other chemical factors; Control systems: Manual control, Automatic control systems (Two-position controllers (ON/OFF), proportional controllers, integral controllers and derivative controllers); Combinations of methods of control; Computers application in process control.

Reference Books

1. Crueger, W. and Crueger, A. Biotechnology: A textbook of industrial microbiology. Sinaeur Associates, Sunderland.
2. Stanbury, A.H., Whittaker, A. and Hall, S.J. Principles of fermentation technology. Pergamon Press, Oxford.

3. Casida, J.E. Industrial microbiology. Wiley Eastern, New Delhi.
4. Bhosh, T.K., Fiechter, A. and Blakebrough, N. Advances in biochemical engineering. Springer Verlag, New York.
5. Veith, W.F. Bioprocess engineering kinetics, mass transport, reactors and gene expressions. John Wiley and Sons, New York.
6. Pauline, D. Bioprocess engineering principles. Academic Press, New York.
7. Lydersen, B., Elia, N.A.D. and Nelson, K.M. Bioprocess engineering: Systems, equipment and facilities. John Wiley and Sons, New York.
8. Hershnergev, C.L., Queener, S.W. and Hedemen, Q. Genetics and biotechnology of industrial microorganisms. ASM Press, Washington, D.C.
9. Reed, G. Prescott and Dunn's industrial microbiology. Globe Bookservices, London.
10. Demain, A.L and Davies, J.E. Manual of industrial microbiology and biotechnology. ASM Press, Washington, D.C.
11. Patel, A.H. Industrial microbiology. MacMillan India Limited, New Delhi.
12. Richard, H., George, B., Hagemann, D. and Paul, L. Industrial microorganisms: Basic and applied molecular genetics. ASM Press, Washington, D.C.
13. Kalaichelvan, P.T. and Arulpandi, I. Bioprocess technology. MPJ Publishers, Chennai.
14. Asenjo, J.A. Separation process in biotechnology. Marcel Dekker, New York.
15. Belter, P.A. Cussler, E.L. and Hu, W.S. Bioseparation: Downstream processing for biotechnology. John Wiley and Sons, New York.
16. Peppler, H.J. and Perlman, D. Microbial technology. Academic Press, New York.

III SEMESTER

SLS/MIC/E01F: ENVIRONMENTAL MICROBIOLOGY

Unit I: Fundamentals of Microbial Ecology

Ecosystem; Biotic and abiotic components; Habitat and Niche; Population and guilds; Concept of community; Stability hypothesis; Intermediate-disturbance hypothesis; Concept of ecological niche; Ecosystem organization: Structure and functions, Primary production, Energy dynamics (Trophic organization and energy flow pathways); Microbial community dynamics: r and k strategies of population selection within communities.

Unit II: Air and Aquatic Microbiology

Aerobiology: Droplet nuclei, Aerosol, Assessment of air quality, Solid and liquid impingement methods, Brief account of air born transmission of microbes; Aquatic microbiology: Zonation and microbiota of fresh water (ponds, lake and rivers) and marine habitats (estuaries, deep sea and coral reefs), Upwelling and downwelling, Eutrophication, Food chain, Mechanism of dissolved organic matter production, Microbial assessment of water quality, Water purification.

Unit III: Microbial Interactions

Positive and negative interactions amongst microbial populations: Cooperation, Neutralism, Commensalism, Synergism, Mutualism, Competition, Amensalism, Parasitism, Predation; Interactions between microorganisms and plants: Rhizobacteria, Mycorrhiza, Epiphytic and endophytic microorganisms; Interactions between microorganisms and animals: Predation on microorganisms by animals, Cultivation of microorganisms by animals for food and food processing.

Unit IV: Pollution and its Control

Air pollution and its control: Sources, Major pollutants, Adverse effect on living organisms: Acid rain and its impact on ecosystem, Greenhouse effect, Global warming, Ozone layer depletion and its effect, Smog, Control through biotechnology (deodorization, reduction in CO_2 emission, bioscrubbers, biobeds and biofilters); Water pollution and its control: Sources, Ground water contamination, Wastes: Characterization of solid and liquid wastes, Solid waste treatment (Landfills, incineration, composting, anaerobic digestion and pyrolysis), Waste water treatment: Pretreatment, primary, secondary and tertiary treatment; Application of biofilm in waste water treatment; Environment impact assessment.

Unit V: Impact of Microbes on Environment

Biodegradation of recalcitrant compounds: Pesticides and Petroleum; Bioremediation: *In situ* & *Ex situ* remediation, Bioremediation of oil spills; Bioaugmentation; Biomagnification; Biomineralization; Metal corrosion: Mode of deterioration, Microorganisms involved, Mode of prevention; Bioleaching of ore; Microbial plastics; Biodiesel.

Reference Books

1. Alexander, M. Microbial ecology. John Wiley and Sons, New York.
2. Eldowney, S., and Waites, S. Pollution: Ecology and biotreatment. Longman, Harlow.
3. Baker, K.H. and Herson, D.S. Bioremediation. McGraw- Hill, New York.
4. Marshal, K.C. Advances of microbial ecology. Plenum Press, New York.

5. Madigan, M.T., Martinko, J.M. and Parker, J. Brock biology of microorganisms. Prentice Hall, New Jersey.
6. Chapman, J.L. and Reiss, M.J. Ecology: Principles and applications. Cambridge University Press, Cambridge.
7. Heywood, V.H. and Watson, R.T. Global biodiversity assessment. Cambridge University Press, Cambridge.
8. Kormondy, E.J. Concepts of ecology. Prentice-Hall, New Delhi.
9. Odum, E.P. Basic ecology. Saunders, Philadelphia.
10. Mitchell, R. and Gu, J.D. Environmental microbiology. Wiley-Blackwell, New Jersey.
11. Maier, R., Pepper, I. and Gerba, C. Environmental microbiology. Academic Press, San Diego.
12. Evans, G.M. and John, J.C.F. Environmental biotechnology: Theory and applications. John Wiley and Sons, New York.
13. Satyanarayana, T., Littlechild, J. and Kawarabayasi, Y. Thermophilic microbes in environmental and industrial biotechnology. Springer Science and Business Media, Dordrecht.
14. Satyanarayana, T., Johri, B.N. and Prakash, A. Microorganisms in environmental management: Microbes and environment. Springer Verlag, New York.

III SEMESTER

SLS/MIC/E02A: AGRICULTURAL MICROBIOLOGY

Unit I: Abiotic and Biotic Components of Soil

Physico-chemical characteristics of soil; Soil enzymes and significance; Soil microbes; Influence of microbial metabolism on soil chemistry and humus formation; Organic matter dynamics in soil: Microbial decomposition of cellulose, hemicellulose and lignin, Factors affecting organic matter decomposition.

Unit II: Rhizosphere and Rhizoplane Microorganisms

Rhizosphere; Rhizoplane; Composition of root exudates; Factors affecting exudation; Plant growth promoting rhizobacteria; Mycorrhiza; Rhizosphere effect; Factors affecting microbial community in soil; Mechanism of plant growth promotion: Mechanism of nitrogen fixation, Mechanism of phosphate solubilization and phosphate mobilization, Mechanism of iron chelation, Production of plant growth promoting hormones from bacteria and fungi, Production of antibiotics by plant growth promoting microorganisms.

Unit III: Plant Pathogens

Symptoms, casuative organisms, disease cycle and control measures of plant diseases: Blight of rice, Citrus canker, Wilt of potato, *Pythium* seed rot, Grapes downy mildew, Potato early and late blights, Fusarial wilt, Wheat-smut and rust, Tikka leaf spot in groundnut, Common viral diseases of plants (Paddy, cotton, potato, tobacco, cauliflower, tomato and sugarcane); Biochemical and genetic basis of virulence in plant pathogens.

Unit IV: Biocontrol Agents for Agriculturally Important Crop Plants

Biopesticides: Source organisms (*Bacillus thuringiensis*, *Beauveria bassiana*,*Metarhizium anisopliae*, *Trichoderma* and Baculoviruses); Mechanism of biocontrol; Other means of pathogen control: Application of viral proteins in controlling viral diseases, Antisense RNA technology in disease control and RNAi in controlling plant pathogens.

Unit V: Biofertilizers

Isolation, purification, mass multiplication, inoculum production and method of application of biofertilizers: *Azospirillum*, *Azotobacter*, *Rhizobium*, Cyanobacteria, AM fungi, Phosphate solubilizer, Algal biofertilizers; Storage, shelf life, quality control and marketing of biofertilizers.

Reference Books

1. Subba Rao, N.S. Soil microorganisms and plant growth. Oxford and IBH Publishing Company, New Delhi.
2. Alexander, M. Introduction to soil microbiology. John Wiley and Sons, New York.
3. Kononova, M.M. Soil organic matter: Nature, its role in soil formation and in soil fertility. Pergamon, Oxford.
4. Burges, A. and Raw, F. Soil biology. Academic Press, London.
5. Rangasami G. and Bagyarai, D.J. Agricultural microbiology. Prentice-Hall, New Delhi.
6. Agrios, G.N. Plant pathology. Academic Press, San Diego.
7. Mathews, R.E. Functionals of plant virology. Academic Press, San Diego.
8. Adrian, G. and Harrison, B. Plant virology: The principles. Edward Arnold, London.

9. Board, N. The complete technology book on biofertilizer and organic farming. National Institute of Industrial Research, India.
10. Sharma, A.K. Biofertilizers for sustainable agriculture. ABD Publishers, Jaipur.
11. Goel, P.K. and Pathade, G.R. Biotechnological applications in environment and agriculture. ABD Publishers, Jaipur.
12. Aneja, K.R. Experiments in microbiology, plant pathology and biotechnology. New Age International (P) Limited, New Delhi.
13. Tilak, K.V.B.R. Bacterial biofertilizers. IARI Publications, New Delhi.
14. Venkataraman, G.S. Algal biofertilizers and rice cultivation. Today and Tomorrow's Printers and Publishers, New Delhi.

III SEMESTER

SLS/MIC/E02B: MICROBIAL DIVERSITY

Unit I: Microbial Evolution and Biodiversity

Evolution of earth and early life forms; Genetic basis for evolution; Stromatolites; Evolution of microbes and eukaryotes; Evolution of physiological diversity; Prokaryote-eukaryote evolutionary relationship; Methods for determining evolutionary relationships: Evolutionary chronometers, Ribosomal RNA analyses, Signature sequences, Phylogenetic probes; Search for life on Mars: Biology box, gas exchange, label release and pyrolytic release experiments, Alterations in load of microbial flora of astronauts; Microbial diversity: Tools used for studying culturable and non culturable microbial diversity, Indices (Diversity, dominance and species richness indices).

Unit II: Bacterial Diversity I

Classification of bacteria into different phylums; General characteristics, ecology, physiology and metabolism of bacterial phylums: Acidobacteria,Actinobacteria, Aquificae, Bacteroidetes, Chlamydiae, Chlorobi, Chloroflexi, Chrysiogenetes, Deferribacteres, Deinococcus-Thermus, Dictyoglomi, Fibrobacteres, Fusobacteria.

Unit III: Bacterial Diversity II

General characteristics, ecology, physiology and metabolism of bacterial phylums: Nitrospira, Planctomycetes, Proteobacteria, Spirochaetes, Synergistetes, Thermodesulfobacteria, Thermotogae, Verrucomicrobia.

Unit IV: Archaea Diversity

Phylum Euryarchaeota: Halobacteria, Methanogens, Thermoplasms, Thermococcales; Phylum Crenarchaeota: Desulfurococcales, Thermoproteales, Sulfolobales; Phylum Korarchaeota; Phylum Nanoarchaeota: Nanoarchaeum.

Unit V: Physiology and molecular adaptations of extremophiles

Characteristic features, classification, physiology, molecular adaptations and applications of acidophiles, alkalophiles, psychrophiles, thermophiles, barophiles, halophiles, oligotrophs, osmophiles, radiophiles, metallophiles and xerophiles.

Reference Books

1. Madigan, M.T., Martinko, J.M. and Parker, J. Brock biology of microorganisms. Prentice Hall, New Jersey.
2. Wiley, J.M., Sherwood, L.M. and Woolverton, C.J. Prescott, Harley and Klein's microbiology. McGraw-Hill, New York.
3. Colwd, D. Microbial diversity. Academic Press, New York.
4. Holt, J.S., Krieg, N.R., Sneath, P.H.A. and Williams, S.S.T. Bergey's manual of determinative bacteriology. Lippincott Williams and Wilkins, Philadelphia.
5. Satynarayana, T. and Johri, B.N. Microbial diversity: Current perspectives and potential applications. I.K. International (P) Limited, New Delhi.
6. Antranikian, G. Biotechnology of extremophiles. Springer- Verlag, New York.
7. Johri B.N. Extremophiles. Springer Verlag, New York.
8. Kushner, D.J. Microbial life in extreme environments. Academic Press, New York.

9. Edward, C. Microbiology of extreme environments. McGraw-Hill, New York. .
10. Heinrich, M.R. Extreme environment: Mechanism of microbial adaptation. Academic Press, New York.
11. da Costa, M.S., Duarate, J.C. and Williams, R.A.D. Microbiology of extreme environments and its potential for biotechnology. Elsevier Applied Science, London.
12. Horikoshi, K. and Grant, W.D. Extremophiles: Microbial life in extreme environments. Wiley-Liss, New York.

III SEMESTER

SLS/MIC/E02C: PHARMACEUTICAL MICROBIOLOGY

Unit I: Drug Discovery

Introduction to pharmacogenomics; High throughput screening; Phases of drug discovery: Bioprospecting, Principles of extraction, purification and characterization of bioactive molecules from natural resources, Candidate drug selection, Preclinical trials, Clinical trial phase I/II/III; Toxicological evaluation of drug; Drug interactions; Drug metabolism (Activation / inhibition of drug *in vivo*); Adverse drug reactions; FDA guidelines for approval of new drugs and their use; Drug distribution in body; Bio-availability and pharmacokinetic studies; Bioequivalence studies.

Unit II: Development of Antimicrobial Agent

Screening and development strategies for new antimicrobial agents; Bioassay of antimicrobial agents using standard guidelines; Factors affecting bioassay; Laboratory methods to assess activity of antimicrobial combinations (Antagonism, synergism and additive effect).

Unit III: Microbial Production and Spoilage of Pharmaceutical Products

Manufacturing procedures and in process control of pharmaceuticals; Pharmaceuticals produced by microbial fermentations (Streptokinase and streptodornase); Vaccines: Multivalent subunit vaccines, Purified macromolecules, Synthetic peptide vaccines, Immuno-adhesions, Recombinant antigen vaccines, Vector vaccines, Anti-idiotype vaccines, Targeted immune stimulants, New generation vaccines; Microbial contamination and spoilage of pharmaceutical products (Sterile injectibles, non-injectibles, ophthalmic preparations and implants) and their sterilization.

Unit IV: Quality Assurance and Validation

Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry; Basic principles of quality control (QA) and quality assurance (QC); Regulatory aspects of quality control; Quality assurance and quality management in pharmaceuticals: Guidelines for QA and QC (Raw materials, sterilization, media, stock cultures and products), ISO, WHO and US certification; Sterilization control and sterility testing: Heat sterilization, D value, z value, Survival curve, Radiation, gaseous and filter sterilization, Chemical and biological indicators, Validation study; LAL test; Sterility testing and bioassay; Biosensors in pharmaceuticals; Design and layout of sterile product manufacturing unit.

Unit V: Regulatory practices and applications in pharmaceuticals

Financing R&D capital and market outlook; IP, BP and USP; Government regulatory practices and policies; FDA perspective; Reimbursement of drugs and biological; Legislative perspective; Introduction to pharmacopoeia; Immobilization procedures for pharmaceutical applications; Macromolecular, cellular and synthetic drug carriers; Application of microbial enzymes in pharmaceuticals.

Reference Books

1. Hugo, W.B. and Russell, A.D. Pharmaceutical microbiology. Blackwell Science, London.
2. Cooper, M.S. Quality control in the pharmaceutical industry. Academic Press, New York.
3. Vyas, S.P. and Dixit, V.K. Pharmaceutical biotechnology. CBS Publishers, New Delhi.

4. Willig, S.H., Tuckerman, M.M. and Hitchings, W.S. Good manufacturing practices for pharmaceuticals. Marcel Dekker, New York.
5. Gregoriadis, G. Drug carriers in biology and medicine. Academic Press, New York.
6. Bhatia, R. and Ihhpunjani, R.L. Quality assurance in microbiology. CBS Publishers and Distributors, New Delhi.
7. Burn, J.H. Principles of therapeutics. Blackwell Scientific Publications Limited, Oxford.
8. Chatwal, G.P. Biopharmaceutics and pharmacokinetics. Himalaya Publishing House, Mumbai.
9. Chorghade, M.S. Drug discovery and development. John Wiley and Sons, New York.
10. Dewick, P.M. Medicinal natural products: A biosynthetic approach. John Wiley and Sons, New York.
11. Gale E.F., Cundliffe, E., Reynolds, P.E., Richmond, M.H. and Waring, M.J. The molecular basis of antibiotic action. John Wiley and Sons, New York.
12. Graly, J.O. and Joubert, P.H. Handbook of phase I / II clinical drug trials. CRC Press, Boca Raton.
13. Satoskar, R.S. and Bhandarkar, S.D. Pharmacology and pharmacotherapeutics. Popular Prakashan, Mumbai.

III SEMESTER

SLS/MIC/E02D: INFECTION AND IMMUNITY

Unit I: Infectious Agents

Infection and its types; Infectious agents: Viruses, Bacteria, Fungi, Protozoa, Helminthes (worms), Parasites, Prions; Pathogens and immunity; Immunogenicity of pathogens; Virulence and susceptibility; Pathogen associated molecular patterns.

Unit II: Immune Regulation of Infection

Barriers preventing establishment of infection; Mechanism of establishment of infection: Invasion, Survival in intracellular and cytoplasmic space, Role of molecular factors in establishment of infection, Role of cells and molecules of immune system in infection, Adoptive immunity to infection, Immune elimination of infection, Mechanisms of escape from immune-mediated destruction, Infection in immuno-compromised host.

Unit III: Immune Responses to Infection

Immune alteration during early and late phases of infection; Immunological basis of infection; Infection and antigen presentation; Recognition of molecular pattern of pathogen; Phagocytosis and killing of infectious agents; Humoral and cell-mediated immunity against infection; Infection associated immunosuppression; Immunodeficiency and infection; Acquired immuno-deficiencies; Nosocomial and community acquired infections; Co-infections; Immunity in local and systemic infection (bacterimia and viremia); Septic infection and immunity; Immunological memory against infection and secondary responses; Immunization: Active and passive; Vaccination.

Unit IV: Immunity against Bacterial, Viral and Prions Infections

Immune responses and immunological control of bacterial infection (*Staphylococcus* and *Mycobacterium*), viral diseases (Influenza and hepatitis) and prion infections.

Unit V: Immunity against Fungal and Parasite Infections

Immune responses and immunological control of fungal infection (Candidiosis and aspergillosis) and parasitic diseases (Malaria, leishmaniasis, schistisomasis and filarisas).

Reference Books

1. Kindt, T.J., Goldsby, R.A., Osborne, B.A. and Kuby, J. Kuby immunology. W.H. Freeman and Company, New York.
2. Abbas, A.K., Lichtman, A.H.H. and Pillai, S. Cellular and molecular immunology. Saunders, Philadelphia.
3. Delves, P.J., Martin, S.J., Burton, D.R. and Roitt, I.M. Roitt's essential immunology. Wiley-Blackwell, New Jersey.
4. Palyfair, J.H.L. and Chain, B.M. Immunology at a glance. Wiley- Blackwell, New Jersey.
5. Coico, R. and Sunshine, G. Immunology: A short course. Wiley- Blackwell, New Jersey.
6. Rao, C.V. Immunology. Alpha Science International Limited, New Delhi.
7. Gooi, H.C. and Chapel, H. Clinical immunology: A practical approach. Oxford University Press, Oxford.
8. Pathak, S. and Palan, U. Immunology: Essential and fundamental. Science Publishers, New Hampshire.

9. Playfair, J.H.L and Bancroft, G.J. Infection and immunity. Oxford University Press, Oxford.
10. Pier, G.B., Lyczak, J.B. and Wetzler, L.M. Immunology, infection and immunity. ASM Press, Washington, D.C.

III SEMESTER

SLS/MIC/E02E: INTELLECTUAL PROPERTY RIGHTS

Unit I: Basic Aspects of Intellectual Property Rights

Introduction to IPR; Intellectual property; WIPO; Types of Intellectual Property Rights: Copyrights, Trademarks (Collective marks, certification marks and well-known marks),Industrial designs, Geographical indications, Patents, Plant breeder's rights; Importance and business interest of IPR for industry and academia; Relationship of IPRs with biotechnology; Trade secrets; Non-disclosure agreements.

Unit II: International Treaties for Protection of Intellectual Property

Brief background of different treaties: WIPO copyright treaty, Berne convention, Rome convention, TRIPS agreement, WIPO performances and phonograms treaty, Madrid agreement, Madrid protocol, Paris convention, Lisbon agreement, Hague agreement, Patent Cooperation Treaty; Relationship between IPR and trade: WTO, TRIPS Agreement, GATT, Enforcement and dispute settlement under the TRIPS agreement, Implication of TRIPS for developing countries in the overall WTO system.

Unit III: Patents

Patent terminology; Patent claims; Patent life and geographical boundaries; Utilization of intellectual patents; Licensing of patents; Elements of patentability; Procedure for grant of patent in India, USA and Europe; PCT application; Patent search invention in context of "prior art"; Patent search methods; Patent databases and libraries; Country-wise patent searches (USPTO, EPO, ARIPO and India); Patent mapping; Patent harmonization; Case studies of patents in biotechnology.

Unit IV: Patent Acts, Issues in Pharmaceuticals and Patent Infringement

Patent acts and latest amendments of Indian, European and US patent systems; Patent issues in drugs and pharmaceuticals: Generics, Compulsory licensing, Exclusive marketing rights, Bolar provision, Bayh-Dole act, Second medical use; Patent infringement (Case studies, defenses to infringement including experimental use, patent misuse, legal considerations, enforcement measures, patent valuations, competition and confidentiality issues); Assignment of Intellectual Property Rights; Technology Transfer Agreements.

Unit V: Protection of Plant Varieties and Traditional Knowledge

Protection of plant varieties: Interface between technology and IPRs in the context of plants, Key features of UPOV 1978, UPOV 1991 and TRIPS with respect to IPRs on plants, Indian law on protection of plant varieties, DUS criteria, *Sui* generis system for protection, Patenting of genetically modified plants, Significance of IPRs in agricultural biotechnology: Case studies; Traditional knowledge: Importance and relevance of traditional knowledge for developing nations, Various approaches for protecting traditional knowledge, Case studies of patenting of health foods.

Reference Books

1. Subbaram N. Patents. Pharma Book Syndicate, Hyderabad.
2. Ganguli, P. Intellectual property rights. Tata Mc-Graw Hill, New Delhi.

3. Shippey, K.C. A short course in international intellectual property rights: Protecting your brands, marks, copyrights, patents, designs and related rights worldwide. World Trade Press, Petaluma.
4. Bently, L. and Sherman, B. Intellectual property law. Oxford University Press, Oxford.
5. Parulekar, A. and D'Souza, S. Indian patent law: Legal and business implications. MacMillan Press, London.
6. Grubb, P.W. Patents for chemicals, pharmaceuticals and biotechnology: Fundamentals of global law, practice and strategy. Oxford University Press, Oxford.
7. Knight, H.J. Patent strategy: For researchers and research managers. John Wiley and Sons, New York.
8. Bryant, J.L. Protecting your ideas: The inventor's guide to patents. Academic Press, New York.
9. Durham, A.L. Patent law essentials: A concise guide. Quorum books, Westport.
10. Gordon, T.T. and Cookfair, A.S. Patent fundamentals for scientists and engineers. CRC Press, Boca Raton.
11. Halpern, S. Fundamentals of United States intellectual property law: Copyright, patent and trademark. Springer-Verlag, New York.
12. Santaniello, V., Evenson, R.E., Zilberman, D. and Carlson, G.A. Agriculture and Intellectual Property Rights: Economic, institutional and implementation issues in biotechnology. CABI Publications, New York.

III SEMESTER

SLS/MIC/E02F: RESEARCH METHODOLOGY

Unit I: Formulating Research Problem and Experimental Planning

Selection of an area for research; Importance and need of research in that field; Literature survey; Planning of experimental work: Importance and designing of the problem to be undertaken, Defining the aim and objectives of the research work planned, Importance of prior collection of protocols, Time bound frame of work plan, Designing of experimental protocol; Description of strategies to meet the objectives using state-of-the-art techniques and proper citation of standard procedures.

Unit II: Data Collection and Analysis

Types of data: Qualitative and quantitative data, Primary and secondary data; Site selection for sample collection; Source selection for data acquisition; Sampling techniques: Simple and random sampling, Systematic sampling, Stratified sampling, Multistage sampling, Cluster sampling, Multiphase sampling; Sample size; Recording of data and data summarization; Significance of triplicate readings; Measures of dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Coefficient of variation; Probability: Random experiment, Events, Sample space, Mutually exclusive events, Independent and dependent events, Statement of addition and multiplication theorems of probability.

Unit III: Statistical Basis of Biological Assay

Response-Dose metameler; Direct and indirect assays; Quantal responses; LD_{50}, ED_{50} and PD_{50}; Standard line interpolation assay; Parallel line assay (4 point and 6 point assays); Slope ratio assay; Count data: Examples of count data (Bacterial cell count, radioactivity count, colony counts and plaque counts); Statistical treatment to count data: Poison distribution, Skewness and kurtosis, Standard error; Statistical treatment to proportion data (MPN, sterility testing of medicines, therapeutic trial of drugs and vaccines); Properties and uses of tests of significance (T-test, z-test and chi-square tests of heterogeneity and independence of attributes, F-test).

Unit IV: Analysis of Variance

Principles of experimental designs; Randomized block and latin square designs; One- way and two-way classifications with single observation per cell; Standard curves: Correlation, Linear regression (fitting of best line through a series of points), MLR, Multiple collinearity, Standard curves and interpolation of unknown Y-values.

Unit V: Basics of Bioinformatics and Technical Writing

Bioinformatics: Introduction to various biological databases (Primary, secondary and composite databases); Introduction to biological information system: SRS, ENTREZ; Sequence comparison and alignment: Sequence similarity searching tools (FASTA and BLAST), Multiple sequence alignment and applications; Introduction of data mining: Classification, Clustering, Data collection, Data warehousing, Data preprocessing, Applications of data mining and genomes mining; Databases: Nucleotide sequence information sources (GenBank, EMBL, EBI, DBJ and UCSC), Protein sequence information sources (PIR, ExPASY, UniProt KB, SwissProt and TrEMBL); Phylogenetic analysis: Phenetic and cladistic approach; Phylogenetic tree construction (Rooted and unrooted method); Prediction of protein structure and modelling: Introduction to various methods for prediction of primary and secondary structure, Homology and threading methods for tertiary structure prediction; Technical writing: Selection of

appropriate title, Abstract, Introduction, Aims and objectives, Review of literature, Methodology, Results, Discussion, Summary and Conclusions, Bibliography.

Reference Books

1. Bhattacharyya, D.K. Research methodology. Excel Books, New Delhi.
2. Kumar, R. Research methodology: A step-by-step guide for beginners. SAGE Publications, California.
3. Singh, Y.K. Research methodology. APH Publishing Corporation, New Delhi.
4. Khan, J.A. Research methodology. APH Publishing Corporation, New Delhi.
5. Gupta, S. Research methodology and statistical techniques. Deep and Deep Publications, New Delhi.
6. Khanzode, V.V. Research methodology. APH Publishing Corporation, New Delhi.
7. Goddard, W. and Melville, S. Research methodology: An introduction. Juta and Company Limited, Landsdown.
8. Dawson, C. Practical research methods: A user-friendly guide to mastering research techniques and projects. How to Books Limited, London.
9. Daniel, P.S. and Sam, A.G. Research methodology. Gyan Publishing House, New Delhi.
10. Murray, R. How to write a thesis. McGraw-Hill, New York.
11. Glantz, S.A. Primer of biostatistics. McGraw-Hill, New York.
12. Dawson, B., Trapp, R.G., Dawson, B. and Trapp, R. Basic and clinical biostatistics. McGraw-Hill, New York.
13. Bliss, C.I.K. Statistics in biology. McGraw-Hill, New York.
14. Campbell R.C. Statistics for biologists. Cambridge University Press, Cambridge.
15. Wardlaw, A.C. Practical statistics for experimental biologists. John Wiley and Sons, New York.
16. Claverie J.M. and Notredame, C. Bioinformatics for dummies. Wiley, New York.
17. Mount, D.W. Bioinformatics: Sequence and genome analysis. Cold Spring Harbor Laboratory Press, New York.
18. Higginns, D. and Taylor, W. Bioinformatics: Sequence, structure and databanks – A practical approach. Oxford University Press, Oxford.
19. Baxevanis A.D and Ouellette, B.F.F. Bioinformatics – A practical guide to the analysis of genes and proteins. Wiley – Interscience, New York.
20. Gibson, G. and Muse, S.V. A primer of genome science. Sinauer Associates, Sunderlands.
21. Attwood, T.K. and Smith, D.J.P. Introduction to bioinformatics. Pearson Education Asia, Singapore.

III SEMESTER

SLS/MIC/E003: LAB COURSE-II
(Based on Theory Papers SLS/MIC/E01 and SLS/MIC/E02)

Lab exercises based on theory paper SLS/MIC/E01A

1. Microbiological examination of food.
2. Assay of quality of milk sample using MBRT test.
3. Adulteration tests for milk.
4. Microbial production of curd.
5. Isolation and identification of *Lactobacillus* from fermented dairy products.
6. Isolation and biochemical identification of microorganisms from contaminated food and dairy samples.
7. Determination of D value in heat treatment of foods.
8. Effect of freezing temperatures on microorganisms in food
9. Production of sauerkraut.
10. Estimation of lactic acid production in sauerkraut.
11. Effect of salt concentration on lactic acid production in sauerkraut.
12. Estimation of acidity of vinegar.

Lab exercises based on theory paper SLS/MIC/E01B

1. Testing of presence of drug in the given biological sample.
2. Structure analysis of different medicinal compounds using software.
3. Computational approach for sequence design of DNA nanostructures.

Lab exercises based on theory paper SLS/MIC/E01C

1. Data mining using NCBI, SWISSPROT, EBI, PDB and MBGD.
2. Database search.
3. Determination of protein structure.
4. Genome sequence analysis.
5. Determining homology between different microorganisms based on their rDNA sequence in database.
6. Pairwise sequence alignment and multiple sequence alignment.

Lab exercises based on theory paper SLS/MIC/E01D

1. Universal precautions and recommendations from CDC for personnel employed in clinical laboratories.
2. Study of morbidity and mortality weekly reports (MMWR) issued by CDC.
3. Calculation of mortality, morbidity and prevalence rate in data procured from websites of health organisations.

Lab exercises based on theory paper SLS/MIC/E01E

1. Determination of Thermal Death Point (TDP) and Thermal Death Time (TDT) of microorganisms for design of a sterilizer.
2. Inoculum preparation for bioreactor.
3. Media formulation for enhanced enzyme production by microbial culture *via* batch fermentation.
4. Extraction of intracellular and extracellular enzyme produced by microbial culture *via* batch fermentation.

5. Optimization of culture conditions for enhanced enzyme production by microbial culture *via* batch fermentation.
6. Determination of oxygen transfer rate.
7. Determination of substrate degradation profile.
8. Immobilization of microbial cells and enzyme.

Lab exercises based on theory paper SLS/MIC/E01F

1. Isolation of antibiotic producing microbes from soil sample.
2. Isolation and identification of symbiotic bacteroids of *Rhizobium* sp. from root nodules of leguminous plants.
3. Study of microbial community succession in decomposing litter.
4. Study of symptoms of bacterial diseases of plants.
5. Study of symptoms of fungal diseases of plants.
6. Study of symptoms of viral diseases of plants.
7. Isolation and identification of pathogenic microorganisms from diseased plant sample.
8. Isolation of xenobiotic compound degrading bacteria by enrichment culture technique.
9. Determination of indices of pollution by measuring BOD and COD of different effluents.

Lab exercises based on theory paper SLS/MIC/E02A

1. Isolation and biochemical identification of *Azotobacter* from soil.
2. Isolation and biochemical identification of *Rhizobium* from root nodule of leguminous plant.
3. Isolation of phosphate solubilizers from soil.
4. Isolation and biochemical identification of PGPR from plant rhizosphere.
5. Determination of siderophore production by PGPR.
6. Determination of phosphorus solubilization by PGPR.
7. Determination of rhamnolipid production by PGPR.
8. Study of symptoms of bacterial, fungal and viral diseases of plants.
9. Isolation and identification of pathogenic microorganisms from diseased plant sample.

Lab exercises based on theory paper SLS/MIC/E02B

1. Determination of diversity of microbial community in different habitats.
2. Determination of species richness and evenness in microbial community in different habitats.
3. Isolation and characterization of thermophilic microorganisms.
4. Isolation and characterization of acidophilic and alkalophilic microorganisms.

Lab exercises based on theory paper SLS/MIC/E02C

1. Screening of plant extracts for antimicrobial potential.
2. Evaluation of synergistic antimicrobial potential of antibiotics and plant extracts.
3. Determination of MIC and MBC concentration of plant extracts by broth dilution test.
4. Sterility testing of pharmaceutical products.

Lab exercises based on theory paper SLS/MIC/E02D

1. Determination of antibody synthesis after vaccination in mouse.
2. cDetermination of infection induced alteration in TLC and DLC.
3. Isolation of macrophages from mouse peritoneal cavity.
4. *In vitro* activation of macrophages by bacterial cell wall components.
5. Phagocytosis of bacterial and yeast cells by macrophages.
6. Determination of effect of infection on cytokine level in blood.

7. Determination of alteration in cytokine production by infected macrophages.

Lab exercises based on theory paper SLS/MIC/E02E

1. Online search for patents in WIPO site.
2. Case studies of different patents: Basmati, Neem, Turmeric, Oncomouse, Bald mouse, Novartis gleevec, Cre-lox, Diamond versus Chakrabarty, Round up ready crops.
3. Theoretical exrercises for identifying the protection of different elements of a common discovery under different types of IPR.

Lab exercises based on theory paper SLS/MIC/E02F

1. Literature survey on selected problem and its proper citation.
2. Defining aim and objectives of the problem.
3. Writing a review article for a journal.
4. Statistical and graphical representation of data.
5. Calculation of mean, median and mode.
6. Linear equation analysis (Regression analysis).
7. Exponential equation analysis (Survival curve).
8. Chi square test.
9. Normal distribution.
10. Data mining using NCBI, SWISSPROT, EBI, PDB and MBGD.
11. Database search- Working on various BLAST programs.
12. Pairwise sequence alignment and multiple sequence alignment.
13. Phylogenetic analysis.

Reference Books

1. McLandsborough, L. Food microbiology laboratory. CRC Press, Boca Raton.
2. Harrigan, W.F. Laboratory methods in food microbiology. Gulf Professional Publishing, Houston.
3. Leboffe, M.J. and Pierce, B.E. Microbiology: Laboratory theory and application. Morton Publishing Company, Englewood.
4. Gunasekaran, P. Laboratory manual in microbiology. New Age International, New Delhi.
5. Graly, J.O. and Joubert, P.H. Handbook of phase I / II clinical drug trials. CRC Press, Boca Raton.
6. Higginns, D. and Taylor, W. Bioinformatics: Sequence, structure and databanks – A Practical approach. Oxford University Press, Oxford.
7. Baxevanis A.D and Ouellette, B.F.F. Bioinformatics – A practical guide to the analysis of genes and proteins. Wiley – Interscience, New York.
8. Ausubel, F.M., Breut, R., Kingston, R.E. and Moore, D.D., Siedman, J.G., Smith, J.A. and Struhl, K. Short protocols in molecular biology. Wiley, New York.
9. Clayton, D. and Hills, M. Statistical models in epidemiology. Oxford University Press, Oxford.
10. Kestenbaum, B. Epidemiology and biostatistics: An introduction to clinical research. Springer-Verlag, New York.
11. Baltz, R.H., Demain, A.L and Davies, J.E. Manual of industrial microbiology and biotechnology. ASM Press, Washington, D.C.
12. Prescott, L.M. and Harley, J.P. Laboratory exercises in microbiology. William C. Brown, Dubuque.

13. Aneja, K.R. Experiments in microbiology, plant pathology and biotechnology. New Age International (P) Limited, New Delhi.
14. Holt, J.G. and Krieg, N.R. Bergey's manual of determinative bacteriology. Lippincott Williams and Wilkin, Philadelphia.
15. Chorghade, M.S. Drug discovery and development. John Wiley and Sons, New York.
16. Dewick, P.M. Medicinal natural products: A biosynthetic approach. John Wiley and Sons, New York.
17. Rose, N.R., Hamilton, R.G. and Detrick, B. Manual of clinical laboratory immunology. ASM Press, Washington, D.C.
18. Weir, D.M. Handbook of experimental immunology. Blackwell Scientific Publications, New Jersey.
19. Stafseth, H.J., Stockton, J.J. and Newman, J.P. A laboratory manual for immunology. Burgess Publishing Company, Stockland.
20. Burrell, R.G. and Mascoli, C.C. Experimental immunology. Burgess Publishing Company, Stockland.
21. Grubb, P.W. Patents for chemicals, pharmaceuticals and biotechnology: Fundamentals of global law, practice and strategy. Oxford University Press, Oxford.
22. Pepper, I.L., Gerba, C.P. and Brendecke, J.W. Environmental microbiology: A laboratory manual. Academic Press, San Diego.
23. Hurst, C.J., Crawford, R.L., Garland, J.L., Lipson, D.A., Mills, A.L. and Stetzenbach, L.D. Manual of environmental microbiology. ASM Press, Washington, D.C.
24. Dawson, C. Practical research methods: A user-friendly guide to mastering research techniques and projects. How to Books Limited, London.
25. Wardlaw, A.C. Practical statistics for experimental biologists. John Wiley and Sons, New York.
26. Mount, D.W. Bioinformatics: Sequence and genome analysis. Cold Spring Harbor Laboratory Press, New York.

IV SEMESTER

SLS/MIC/E004: DISSERTATION

Topics for Dissertation

1. Drug Discovery
2. Drug Resistance
3. Infection and Immunity
4. Plant- Microbes Interaction
5. Microbial Diversity
6. Bioremediation
7. Prevalence and Characterization of Pathogenic Microorganisms
8. Food Adulteration and Food borne Pathogens
9. Fermented Foods
10. Strain Improvement
11. Enzyme Production
12. Microbial Biotechnology
13. Biomass and Bioenergy Production

Any other topic suggested by departmental committee may also be considered for the dissertation/project work.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – PHARMACEUTICAL CHEMISTRY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

Chemical Bonding and Molecular Structure Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of sp mixing) and heteronuclear diatomic molecules such as CO, NO and NO+ . Comparison of VB and MO approaches.

Fundamentals of Organic Chemistry Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems). (10 Lectures) Aliphatic Hydrocarbons Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution:

Halogenation. Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. KMnO4.

FUNCTIONAL ORGANIC CHEMISTRY

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Aromatic hydrocarbons Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. FriedelCraft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution. Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Alcohols, Phenols and Ethers (Upto 5 Carbons) Alcohols: Preparation: Preparation of 1o , 2o and 3o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO4, acidic dichromate, conc. HNO3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. PinacolPinacolone rearrangement. Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann

Reaction. Ethers (aliphatic and aromatic): Cleavage of ethers with HI. Aldehydes and ketones (aliphatic and aromatic): (Formaldehye, acetaldehyde, acetone and benzaldehyde) Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, NaHSO3, NH2 -G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Carboxylic acids and their derivatives Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction. Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation. Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes.

Amino Acids, Peptides and Proteins: Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of –COOH group, acetylation of –NH2 group, complexation with Cu2+ ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis. Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. Paper chromatographic. To compare paint samples by TLC method. Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

1.General: Computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviations, calibration of analytical equipments.

2. Fundamental of volumetric analysis: Method of expressing concentrations, primary and secondary standards

3. Physical and chemical concepts required for analysis: Electrolytic dissociations, chemical equilibrium, pH, buffer solutions and actions, Handerson-Hasselbach equation, solubility product, common ion effect, hydrolysis of salts and amphoteric substances

4. Acid base titrations: Modern concept of acids and bases, role of solvent, relative strengths of acids and bases, ionization, law of mass action, ionic product of water, neutralization curves, acid base indicators, theory of indicators, choice of indicators, mixed indicators

5. Precipitation titrations: Precipitation reactions, solubility products, effect of acids, temperature and solvent upon the solubility of the precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, Mercuric nitrate and barium sulphate, Indicators, Gaylussac method, Mohr's method, Volhard's method and Fajan's method

6. Non aqueous titrations: General discussion and principle of titration in non aqueous media, aprotic, protophillic, protogenic and amphiprotic solvents. Titrations with perchoric acid, potassium methoxide and tetrabutyl ammonium hydroxide

7. Oxidation reduction titrations: Concepts of oxidation and reduction, redox reactions, strengths and equivalent weights of oxidizing and reducing agents.

8. Miscellaneous methods of analysis: Principle of diazotization titrations using sodium nitrite, Kjeldahl method of nitrogen estimation, Karl Fischer titrations

The theoretical aspects, basic instrumentation, elements of interpretation of spectra and application of the following analytical techniques to be discussed

1. Fundamentals and principles of spectroscopy

2. Ultra-Violet (UV) and Visible Spectrophotometry: Electronic excitation, Lambert-Beer law, deviation from Beer's law, chromophores, instrumentation, single and double beam instruments

3. Infrared Spectrophotometry: Theory, characteristic absorbance bands of organic functional groups, interpretation of infrared absorption spectra, preparation of sample, sample cells, IR instrumentation qualitative and quantitative applications in pharmaceutical analysis.

4. Nuclear Magnetic Resonance spectroscopy: An introduction to the theory of 1H NMR, chemical shift & spin-spin coupling, brief introduction to 13C NMR.

5. Mass Spectrometry: Introduction to mass spectra, molecular ions peak, fragmentation peak, mass spectra of some simple compounds.

6. Flame Photometry: Origin of spectra, atomization and ionization, instrumentation, background emission, interferences, qualitative and quantitative applications in pharmaceutical analysis.

7. X-ray Diffraction: Introduction, production and detection of X rays, Bragg's Law, identification of powder diffraction patterns.

8. Fluorimetry: Theory, quantitative description, experimental factors affecting fluorescence intensity, factors affecting OC and F directly, relationship to fluorescence to molecular structure, instrumentation, correction of spectra, pharmaceutical applications.
9. Chromatography: Basis of GLC (instrumentation excluded) and instrumentation and applications of HPLC

10. Electrophoresis: Definition, free solution electrophoresis, Tiselius method, moving boundary electrophoresis, density gradient electrophoresis, zone electrophoresis, paper electrophoresis and its applications

11. Validation, Quality Audit: quality of equipment, validation of equipment, validation of analytical procedures.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – PHARMACEUTICAL SCIENCE

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

2016

THE MASTER OF PHARMACY (M. PHARM.)

COURSE REGULATION 2014

(BASED ON NOTIFICATION IN THE GAZETTE OF INDIA NO. 362, DATED DECEMBER 11, 2014)

SCHEME AND SYLLABUS

PHARMACY COUNCIL OF INDIA
Combined Council's Building, Kotla Road,
Aiwan-E-Ghalib Marg, New Delhi-110 002.
Website : www.pci.nic.

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The Gazette of India

असाधारण
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PHARMACY COUNCIL OF INDIA

NOTIFICATION

New Delhi, the 10th December, 2014

The Master of Pharmacy (M.Pharm) Course Regulations, 2014

No. 14-136/ 2014-PCI.—In exercise of the powers conferred by Sections 10 and 18 of the Pharmacy Act, 1948 (8 of 1948), the Pharmacy Council of India, with the approval of the Central Government hereby makes the following regulations; namely–

CHAPTER –I:REGULATIONS

1. Short Title and Commencement

These regulations shall be called as "The Revised Regulations for the Master of Pharmacy (M. Pharm.)Degree Program - Credit Based Semester System (CBSS) of the Pharmacy Council of India, New Delhi". They shall come into effect from the Academic Year 2016-17. The regulations framed are subject to modifications from time to time by the authorities of the university.

2. Minimum qualification for admission

A Pass in the following examinations

a) B. Pharm Degree examination of an Indian university established by law in India from an institution approved by Pharmacy Council of India and has scored not less than 55 % of the maximum marks (aggregate of 4 years of B.Pharm.)

b) Every student, selected for admission to post graduate pharmacy program in any PCI approved institution should have obtained registration with the State Pharmacy Council or should obtain the same within one month from the date of his/her admission, failing which the admission of the candidate shall be cancelled.

Note: It is mandatory to submit a migration certificate obtained from the respective university where the candidate had passed his/her qualifying degree (B.Pharm.)

3. Duration of the program

The program of study for M.Pharm. shall extend over a period of four semesters (two academic years). The curricula and syllabi for the program shall be prescribed from time to time by Phamacy Council of India, New Delhi.

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semestershall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from the month of December/January to May/June in every calendar year.

6. Attendance and progress

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

7. Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, practical classes, seminars, assignments, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week/per activity.

7.1. Credit assignment

7.1.1. Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and a multiplier of half (1/2) for practical (laboratory) hours.Thus, for example, a theory course having four lectures per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

The contact hours of seminars, assignments and research work shall be treated as that of practical courses for the purpose of calculating credits. i.e., the contact hours shall be multiplied by 1/2. Similarly, the contact hours of journal club, research work presentations and discussions with the supervisor shall be considered as theory course and multiplied by 1.

7.2. Minimum credit requirements

The minimum credit points required for the award of M. Pharm. degree is 95. However based on the credit points earned by the students under the head of co-curricular activities, a student shall earn a maximum of 100 credit points. These credits are divided into Theory courses, Practical, Seminars, Assignments,Research work, Discussions with the supervisor, Journal club and Co-Curricular activities over the duration of four semesters. The credits

are distributed semester-wise as shown in Table 14. Courses generally progress in sequence, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

8. Academic work

A regular record of attendance both in Theory, Practical, Seminar, Assignment, Journal club, Discussion with the supervisor, Research work presentation and Dissertation shall be maintained by the department / teaching staff of respective courses.

9. Course of study

The specializations in M.Pharm program is given in Table 1.

Table – 1: List of M.Pharm. Specializations and their Code

S. No.	Specialization	Code
1.	Pharmaceutics	MPH
2.	Industrial Pharmacy	MIP
3.	Pharmaceutical Chemistry	MPC
4.	Pharmaceutical Analysis	MPA
5.	Pharmaceutical Quality Assurance	MQA
6.	Pharmaceutical Regulatory Affairs	MRA
7.	Pharmaceutical Biotechnology	MPB
8.	Pharmacy Practice	MPP
9.	Pharmacology	MPL
10.	Pharmacognosy	MPG

The course of study for M.Pharm specializations shall include Semester wise Theory & Practical as given in Table – 2 to 11. The number of hours to be devoted to each theory and practical course in any semester shall not be less than that shown in Table – 2 to 11.

Table – 2: Course of study for M. Pharm. (Pharmaceutics)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPH101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPH102T	Drug Delivery System	4	4	4	100
MPH103T	Modern Pharmaceutics	4	4	4	100
MPH104T	Regulatory Affair	4	4	4	100
MPH105P	Pharmaceutics Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4	4	100
MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	4	4	4	100
MPH203T	Computer Aided Drug Delivery System	4	4	4	100
MPH204T	Cosmetic and Cosmeceuticals	4	4	4	100
MPH205P	Pharmaceutics Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 3: Course of study for M. Pharm. (Industrial Pharmacy)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MIP101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MIP102T	Pharmaceutical Formulation Development	4	4	4	100
MIP103T	Novel drug delivery systems	4	4	4	100
MIP104T	Intellectual Property Rights	4	4	4	100
MIP105P	Industrial Pharmacy Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MIP201T	Advanced Biopharmaceutics and Pharmacokinetics	4	4	4	100
MIP202T	Scale up and Technology Transfer	4	4	4	100
MIP203T	Pharmaceutical Production Technology	4	4	4	100
MIP204T	Entrepreneurship Management	4	4	4	100
MIP205P	Industrial Pharmacy Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 4: Course of study for M. Pharm. (Pharmaceutical Chemistry)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPC101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPC1012T	Advanced Organic Chemistry -I	4	4	4	100
MPC103T	Advanced Medicinal chemistry	4	4	4	100
MPC104T	Chemistry of Natural Products	4	4	4	100
MPC105P	Pharmaceutical Chemistry Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650
Semester II					
MPC201T	Advanced Spectral Analysis	4	4	4	100
MPC202T	Advanced Organic Chemistry -II	4	4	4	100
MPC203T	Computer Aided Drug Design	4	4	4	100
MPC204T	Pharmaceutical Process Chemistry	4	4	4	100
MPC205P	Pharmaceutical Chemistry Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 5: Course of study for M. Pharm. (Pharmaceutical Analysis)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPA101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPA102T	Advanced Pharmaceutical Analysis	4	4	4	100
MPA103T	Pharmaceutical Validation	4	4	4	100
MPA104T	Food Analysis	4	4	4	100
MPA105P	Pharmaceutical Analysis Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPA201T	Advanced Instrumental Analysis	4	4	4	100
MPA202T	Modern Bio-Analytical Techniques	4	4	4	100
MPA203T	Quality Control and Quality Assurance	4	4	4	100
MPA204T	Herbal and Cosmetic Analysis	4	4	4	100
MPA205P	Pharmaceutical Analysis Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 6: Course of study for M. Pharm. (Pharmaceutical Quality Assurance)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MQA101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MQA102T	Quality Management System	4	4	4	100
MQA103T	Quality Control and Quality Assurance	4	4	4	100
MQA104T	Product Development and Technology Transfer	4	4	4	100
MQA105P	Pharmaceutical Quality Assurance Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MQA201T	Hazards and Safety Management	4	4	4	100
MQA202T	Pharmaceutical Validation	4	4	4	100
MQA203T	Audits and Regulatory Compliance	4	4	4	100
MQA204T	Pharmaceutical Manufacturing Technology	4	4	4	100
MQA205P	Pharmaceutical Quality Assurance Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 7: Course of study for M. Pharm. (Regulatory Affairs)

Course Code	Course	Credit Hours	Credit Points	Hrs./ wk	Marks
Semester I					
MRA 101T	Good Regulatory Practices	4	4	4	100
MRA 102T	Documentation and Regulatory Writing	4	4	4	100
MRA 103T	Clinical Research Regulations	4	4	4	100
MRA 104T	Regulations and Legislation for Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals In India and Intellectual Property Rights	4	4	4	100
MRA 105P	Regulatory Affairs Practical I	12	6	12	150
	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650
Semester II					
MRA 201T	Regulatory Aspects of Drugs & Cosmetics	4	4	4	100
MRA 202T	Regulatory Aspects of Herbal & Biologicals	4	4	4	100
MRA 203T	Regulatory Aspects of Medical Devices	4	4	4	100
MRA 204T	Regulatory Aspects of Food & Nutraceuticals	4	4	4	100
MRA 205P	Regulatory Affairs Practical II	12	6	12	150
	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 8: Course of study for M. Pharm. (Pharmaceutical Biotechnology)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPB 101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPB 102T	Microbial And Cellular Biology	4	4	4	100
MPB 103T	Bioprocess Engineering and Technology	4	4	4	100
MPB 104T	Advanced Pharmaceutical Biotechnology	4	4	4	100
MPB 105P	Pharmaceutical Biotechnology Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPB 201T	Proteins and protein Formulation	4	4	4	100
MPB 202T	Immunotechnology	4	4	4	100
MPB 203T	Bioinformatics and Computer Technology	4	4	4	100
MPB 204T	Biological Evaluation of Drug Therapy	4	4	4	100
MPB 205P	Pharmaceutical Biotechnology Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 9: Course of study for M. Pharm. (Pharmacy Practice)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPP 101T	Clinical Pharmacy Practice	4	4	4	100
MPP 102T	Pharmacotherapeutics-I	4	4	4	100
MPP 103T	Hospital & Community Pharmacy	4	4	4	100
MPP 104T	Clinical Research	4	4	4	100
MPP 105P	Pharmacy Practice Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPP 201T	Principles of Quality Use of Medicines	4	4	4	100
MPP 102T	Pharmacotherapeutics II	4	4	4	100
MPP 203T	Clinical Pharmacokinetics and Therapeutic Drug Monitoring	4	4	4	100
MPP 204T	Pharmacoepidemiology & Pharmacoeconomics	4	4	4	100
MPP 205P	Pharmacy Practice Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 10: Course of study for (Pharmacology)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPL 101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPL 102T	Advanced Pharmacology-I	4	4	4	100
MPL 103T	Pharmacological and Toxicological Screening Methods-I	4	4	4	100
MPL 104T	Cellular and Molecular Pharmacology	4	4	4	100
MPL 105P	Pharmacology Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPL 201T	Advanced Pharmacology II	4	4	4	100
MPL 202T	Pharmacological and Toxicological Screening Methods-II	4	4	4	100
MPL 203T	Principles of Drug Discovery	4	4	4	100
MPL 204T	Experimental Pharmacology practical- II	4	4	4	100
MPL 205P	Pharmacology Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 11: Course of study for M. Pharm. (Pharmacognosy)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPG101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPG102T	Advanced Pharmacognosy-1	4	4	4	100
MPG103T	Phytochemistry	4	4	4	100
MPG104T	Industrial Pharmacognostical Technology	4	4	4	100
MPG105P	Pharmacognosy Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPG201T	Medicinal Plant biotechnology	4	4	4	100
MPG102T	Advanced Pharmacognosy-II	4	4	4	100
MPG203T	Indian system of medicine	4	4	4	100
MPG204T	Herbal cosmetics	4	4	4	100
MPG205P	Pharmacognosy Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
	Total	35	26	35	650

Table – 12: Course of study for M. Pharm. III Semester
(Common for All Specializations)

Course Code	Course	Credit Hours	Credit Points
MRM 301T	Research Methodology and Biostatistics*	4	4
-	Journal club	1	1
-	Discussion / Presentation (Proposal Presentation)	2	2
-	Research Work	28	14
Total		35	21

* Non University Exam

Table – 13: Course of study for M. Pharm. IV Semester
(Common for All Specializations)

Course Code	Course	Credit Hours	Credit Points
-	Journal Club	1	1
-	Research Work	31	16
-	Discussion/Final Presentation	3	3
Total		35	20

Table – 14: Semester wise credits distribution

Semester	Credit Points
I	26
II	26
III	21
IV	20
Co-curricular Activities (Attending Conference, Scientific Presentations and Other Scholarly Activities)	Minimum=02 Maximum=07*
Total Credit Points	Minimum=95 Maximum=100*

*Credit Points for Co-curricular Activities

Table – 15: Guidelines for Awarding Credit Points for Co-curricular Activities

Name of the Activity	Maximum Credit Points Eligible / Activity
Participation in National Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	01
Participation in international Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	02
Academic Award/Research Award from State Level/National Agencies	01
Academic Award/Research Award from International Agencies	02
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	01
Research / Review Publication in International Journals (Indexed in Scopus / Web of Science)	02

Note: International Conference: Held Outside India

International Journal: The Editorial Board Outside India

*The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

10. Program Committee

1. The M. Pharm. programme shall have a Programme Committee constituted by the Head of the institution in consultation with all the Heads of the departments.

2. The composition of the Programme Committee shall be as follows:
A teacher at the cadre of Professor shall be the Chairperson; One Teacher from eachM.Pharm specialization and four student representatives (two from each academic year), nominated by the Head of the institution.

3. Duties of the Programme Committee:
   i. Periodically reviewing the progress of the classes.
   ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.
   iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.

iv. Communicating its recommendation to the Head of the institution on academic matters.
v. The Programme Committee shall meet at least twice in a semester preferably at the end of each sessionalexam and before the end semester exam.

11. Examinations/Assessments

The schemes for internal assessment and end semester examinations are given in Table – 16.

11.1. End semester examinations

The End Semester Examinations for each theory and practical coursethrough semesters I to IVshall beconducted by the respective university except for the subject with asterix symbol (*) in table I and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

Tables – 1616 : Schemes for internal assessments and end semester

(Pharmaceutics- MPH)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPH 101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPH 102T	Drug Delivery System	10	15	1 Hr	25	75	3 Hrs	100
MPH 103T	Modern Pharmaceutics	10	15	1 Hr	25	75	3 Hrs	100
MPH 104T	Regulatory Affair	10	15	1 Hr	25	75	3 Hrs	100
MPH 105P	Pharmaceutics Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPH 201T	Molecular Pharmaceutics(Nano Tech and Targeted DDS)	10	15	1 Hr	25	75	3 Hrs	100
MPH 202T	Advanced Biopharmaceutics & Pharmacokinetics	10	15	1 Hr	25	75	3 Hrs	100
MPH 203T	Computer Aided Drug Delivery System	10	15	1 Hr	25	75	3 Hrs	100
MPH	Cosmetic	10	15	1 Hr	25	75	3 Hrs	100

204T	and Cosmeceutic als							
MPH 205P	Pharmaceuti cs Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 1717 : Schemes for internal assessments and end semester
(Industrial Pharmacy- MIP)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MIP101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MIP102T	Pharmaceutical Formulation Development	10	15	1 Hr	25	75	3 Hrs	100
MIP103T	Novel drug delivery systems	10	15	1 Hr	25	75	3 Hrs	100
MIP104T	Intellectual Property Rights	10	15	1 Hr	25	75	3 Hrs	100
MIP105P	Industrial Pharmacy Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MIP201T	Advanced Biopharmaceutics and Pharmacokinetics	10	15	1 Hr	25	75	3 Hrs	100
MIP202T	Scale up and Technology Transfer	10	15	1 Hr	25	75	3 Hrs	100
MIP203T	Pharmaceutical Production Technology	10	15	1 Hr	25	75	3 Hrs	100
MIP204T	Entrepreneurship Management	10	15	1 Hr	25	75	3 Hrs	100

MIP205P	Industrial Pharmacy Practical II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

(Pharmaceutical Chemistry-MPC)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPC101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPC102T	Advanced Organic Chemistry -I	10	15	1 Hr	25	75	3 Hrs	100
MPC103T	Advanced Medicinal chemistry	10	15	1 Hr	25	75	3 Hrs	100
MPC104T	Chemistry of Natural Products	10	15	1 Hr	25	75	3 Hrs	100
MPC105P	Pharmaceutical Chemistry Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPC201T	Advanced Spectral Analysis	10	15	1 Hr	25	75	3 Hrs	100
MPC202T	Advanced Organic Chemistry -II	10	15	1 Hr	25	75	3 Hrs	100
MPC203T	Computer Aided Drug Design	10	15	1 Hr	25	75	3 Hrs	100
MPC204T	Pharmaceutical Process Chemistry	10	15	1 Hr	25	75	3 Hrs	100
MPC205P	Pharmaceutic	20	30	6 Hrs	50	100	6	150

	al Chemistry Practical II						Hrs	
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 19: Schemes for internal assessments and end semester examinations (Pharmaceutical Analysis-MPA)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total			
			Marks	Duration		Marks	Duration	
SEMESTER I								
MPA101T	Modern Pharmaceutical Analysis	10	15	1 Hr	25	75	3 Hrs	100
MPA102T	Advanced Pharmaceutical Analysis	10	15	1 Hr	25	75	3 Hrs	100
MPA103T	Pharmaceutical Validation	10	15	1 Hr	25	75	3 Hrs	100
MPA104T	Food Analysis	10	15	1 Hr	25	75	3 Hrs	100
MPA105P	Pharmaceutical Analysis-I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPA201T	Advanced Instrumental Analysis	10	15	1 Hr	25	75	3 Hrs	100
MPA202T	Modern Bio-Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPA203T	Quality Control and Quality	10	15	1 Hr	25	75	3 Hrs	100

	Assurance							
MPA204T	Herbal and Cosmetic analysis	10	15	1 Hr	25	75	3 Hrs	100
MPA205P	Pharmaceutical Analysis-II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 20: Schemes for internal assessments and end semester examinations (Pharmaceutical Quality Assurance-MQA)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total			
			Marks	Duration		Marks	Duration	
SEMESTER I								
MQA101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MQA102T	Quality Management System	10	15	1 Hr	25	75	3 Hrs	100
MQA103T	Quality Control and Quality Assurance	10	15	1 Hr	25	75	3 Hrs	100
MQA104T	Product Development and Technology Transfer	10	15	1 Hr	25	75	3 Hrs	100
MQA105P	Pharmaceutical Quality Assurance Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MQA201T	Hazards and Safety Management	10	15	1 Hr	25	75	3 Hrs	100
MQA202T	Pharmaceutical Validation	10	15	1 Hr	25	75	3 Hrs	100
MQA203T	Audits and Regulatory Compliance	10	15	1 Hr	25	75	3 Hrs	100
MQA204T	Pharmaceutical Manufacturing Technology	10	15	1 Hr	25	75	3 Hrs	100
MQA205P	Pharmaceutical Quality Assurance Practical II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 21: Schemes for internal assessments and end semester examinations (Pharmaceutical Regulatory Affairs-MRA)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total			
			Marks	Duration		Marks	Duration	
SEMESTER I								
MRA101T	Good Pharmaceutical Practices	10	15	1 Hr	25	75	3 Hrs	100
MRA102T	Documentation and Regulatory Writing	10	15	1 Hr	25	75	3 Hrs	100
MRA103T	Clinical Research Regulations	10	15	1 Hr	25	75	3 Hrs	100
MRA104T	Regulations and Legislation for Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals In India and Intellectual Property Rights	10	15	1 Hr	25	75	3 Hrs	100
MRA105T	Pharmaceutical Regulatory Affairs Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MRA201T	Regulatory Aspects of Drugs & Cosmetics	10	15	1 Hr	25	75	3 Hrs	100

MRA202T	Regulatory Aspects of Herbal & Biologicals	10	15	1 Hr	25	75	3 Hrs	100
MRA203T	Regulatory Aspects of Medical Devices	10	15	1 Hr	25	75	3 Hrs	100
MRA204T	Regulatory Aspects of Food & Nutraceuticals	10	15	1 Hr	25	75	3 Hrs	100
MRA205P	Pharmaceutical Regulatory Affairs Practical II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 22: Schemes for internal assessments and end semester examinations (Pharmaceutical Biotechnology-MPB)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPB101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPB102T	Microbial And Cellular Biology	10	15	1 Hr	25	75	3 Hrs	100
MPB103T	Bioprocess Engineering and Technology	10	15	1 Hr	25	75	3 Hrs	100
MPB104T	Advanced Pharmaceutical Biotechnology	10	15	1 Hr	25	75	3 Hrs	100
MPB105P	Pharmaceutical Biotechnology Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPB201T	Proteins and protein Formulation	10	15	1 Hr	25	75	3 Hrs	100
MPB202T	Immunotechnology	10	15	1 Hr	25	75	3 Hrs	100
MPB203T	Bioinformatics and Computer Technology	10	15	1 Hr	25	75	3 Hrs	100
MPB204T	Biological Evaluation of Drug Therapy	10	15	1 Hr	25	75	3 Hrs	100
MPB205P	Pharmaceutical Biotechnology Practical II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 23: Schemes for internal assessments and end semester examinations (Pharmacy Practice-MPP)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPP101T	Clinical Pharmacy Practice	10	15	1 Hr	25	75	3 Hrs	100
MPP102T	Pharmacotherapeutics-I	10	15	1 Hr	25	75	3 Hrs	100
MPP103T	Hospital & Community Pharmacy	10	15	1 Hr	25	75	3 Hrs	100
MPP104T	Clinical Research	10	15	1 Hr	25	75	3 Hrs	100
MPP105P	Pharmacy Practice Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPP201T	Principles of Quality Use of Medicines	10	15	1 Hr	25	75	3 Hrs	100
MPP102T	Pharmacotherapeutics II	10	15	1 Hr	25	75	3 Hrs	100
MPP203T	Clinical Pharmacokinetics and Therapeutic Drug Monitoring	10	15	1 Hr	25	75	3 Hrs	100
MPP204T	Pharmacoepidemiology & Pharmacoeconomics	10	15	1 Hr	25	75	3 Hrs	100
MPP205P	Pharmacy Practice Practical II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 24: Schemes for internal assessments and end semester examinations (Pharmacology-MPL)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPL101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPL102T	Advanced Pharmacology-I	10	15	1 Hr	25	75	3 Hrs	100
MPL103T	Pharmacological and Toxicological Screening Methods-I	10	15	1 Hr	25	75	3 Hrs	100
MPL104T	Cellular and Molecular Pharmacology	10	15	1 Hr	25	75	3 Hrs	100
MPL105P	Experimental Pharmacology - I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPL201T	Advanced Pharmacology II	10	15	1 Hr	25	75	3 Hrs	100
MPL102T	Pharmacological and Toxicological Screening Methods-II	10	15	1 Hr	25	75	3 Hrs	100
MPL203T	Principles of Drug Discovery	10	15	1 Hr	25	75	3 Hrs	100
MPL204T	Clinical research and pharmacovigilance	10	15	1 Hr	25	75	3 Hrs	100
MPL205P	Experimental Pharmacology - II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 25: Schemes for internal assessments and end semester examinations (Pharmacognosy-MPG)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPG101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPG102T	Advanced Pharmacognosy-1	10	15	1 Hr	25	75	3 Hrs	100
MPG103T	Phytochemistry	10	15	1 Hr	25	75	3 Hrs	100
MPG104T	Industrial Pharmacognostical Technology	10	15	1 Hr	25	75	3 Hrs	100
MPG105P	Pharmacognosy Practical I	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPG201T	Medicinal Plant biotechnology	10	15	1 Hr	25	75	3 Hrs	100
MPG102T	Advanced Pharmacognosy-II	10	15	1 Hr	25	75	3 Hrs	100
MPG203T	Indian system of medicine	10	15	1 Hr	25	75	3 Hrs	100
MPG204T	Herbal cosmetics	10	15	1 Hr	25	75	3 Hrs	100
MPG205P	Pharmacognosy Practical II	20	30	6 Hrs	50	100	6 Hrs	150
-	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 26: Schemes for internal assessments and end semester examinations (Semester III& IV)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER III								
MRM301T	Research Methodology and Biostatistics*	10	15	1 Hr	25	75	3 Hrs	100
-	Journal club	-	-	-	25	-	-	25
-	Discussion / Presentation (Proposal Presentation)	-	-	-	50	-	-	50
-	Research work*	-	-	-	-	350	1 Hr	350
Total								525
SEMESTER IV								
-	Journal club	-	-	-	25	-	-	25
-	Discussion / Presentation (Proposal Presentation)	-	-	-	75	-	-	75
-	Research work and Colloquium	-	-	-	-	400	1 Hr	400
Total								500

*Non University Examination

11.2. Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table – 27: Scheme for awarding internal assessment: Continuous mode

Theory	
Criteria	Maximum Marks
Attendance (Refer Table – 28)	8
Student – Teacher interaction	2
Total	10
Practical	
Attendance (Refer Table – 28	10
Based on Practical Records, Regular viva voce, etc.	10
Total	20

Table – 28: Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	8	10
90 – 94	6	7.5
85 – 89	4	5
80 – 84	2	2.5
Less than 80	0	0

11.2.1. Sessional Exams

Two sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s). The scheme of question paper for theory and practical sessional examinations is given in the table. The average marks of two sessional exams shall be computed for internal assessment as per the requirements given in tables.

12. Promotion and award of grades

A student shall be declared PASS and eligible for getting grade in a course of M.Pharm.programme if he/she secures at least 50% marks in that particular courseincluding internal assessment.

13. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

14. Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the sessional exam component of the internal assessment. The re-conduct of the sessional exam shall be completed before the commencement of next end semester theory examinations.

15. Reexamination of end semester examinations

Reexamination of end semester examination shall be conducted as per the schedule given in table 29. The exact dates of examinations shall be notified from time to time.

Table – 29: Tentative schedule of end semester examinations

Semester	For Regular Candidates	For Failed Candidates
I and III	November / December	May / June
II and IV	May / June	November / December

16. Allowed to keep terms (ATKT):

No student shall be admitted to any examination unless he/she fulfills the norms given in 6. ATKT rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I and IIsemesters till the III semester examinations. However, he/she shall not be eligible to attend the courses of IV semester until all the courses of I, II and III semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to IV semesters within the stipulated time period as per the norms.

Note: Grade AB should be considered as failed and treated as one head for deciding ATKT. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

17. Grading of performances

17.1. Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course.The letter grades and their corresponding grade points are given in Table – 30.

Table – 30: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtainedin all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C1, C2, C3 and C4 and the student's grade points in these courses are G1, G2, G3 and G4, respectively, and then students' SGPA is equal to:

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4}{C_1 + C_2 + C_3 + C_4}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, theSGPA shall then be computed as:

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * ZERO}{C_1 + C_2 + C_3 + C_4}$$

19. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the IV semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all IV semesters and their courses. The CGPA shall reflect the failed statusin case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passedby obtaining a pass grade on subsequent examination(s) theCGPA

shall only reflect the new grade and not the fail grades earned earlier.The CGPA is calculated as:

$$CGPA = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4}{C_1 + C_2 + C_3 + C_4}$$

where C_1, C_2, C_3,.... is the total number of credits for semester I,II,III,.... and S_1,S_2, S_3,....is the SGPA of semester I,II,III,.... .

20. Declaration of class

The class shall be awarded on the basis of CGPA as follows:

First Class with Distinction	= CGPA of. 7.50 and above
First Class	= CGPA of 6.00 to 7.49
Second Class	= CGPA of 5.00 to 5.99

21. Project work

All the students shall undertake a project under the supervision of a teacher in Semester III to IV and submit a report. 4 copies of the project report shall be submitted (typed & bound copy not less than 75 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). The projects shall be evaluated as per the criteria given below.

Evaluation of Dissertation Book:

Objective(s) of the work done	50 Marks
Methodology adopted	150 Marks
Results and Discussions	250 Marks
Conclusions and Outcomes	50 Marks
Total	500 Marks

Evaluation of Presentation:

Presentation of work	100 Marks
Communication skills	50 Marks
Question and answer skills	100 Marks
Total	250 Marks

22. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the M.Pharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the M. Pharm program in minimum prescribed number of years, (two years) for the award of Ranks.

23. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

24. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration of the program and the students have to pass within the said period, otherwise they have to get fresh Registration.

25. Revaluation I Retotaling of answer papers

There is no provision for revaluation of the answer papers in any examination. However, the candidates can apply for retotaling by paying prescribed fee.

26. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.

PHARMACEUTICS(MPH)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPH 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know,

- Chemicals and Excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY 60 HOURS

1. a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy. 11 Hrs

   b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy

   c. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

   d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy. 11 Hrs

3	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy	11 Hrs
4	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Affinity chromatography	11 Hrs
5	a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing b. X ray Crystallography: Production of X rays, Different X ray diffraction methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	11 Hrs
6	Immunological assays : RIA (Radio immuno assay), ELISA, Bioluminescence assays.	5 Hrs

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series

DRUG DELIVERY SYSTEMS
(MPH 102T)

SCOPE

This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

OBJECTIVES

Upon completion of the course, student shall be able to understand

The various approaches for development of novel drug delivery systems.

The criteria for selection of drugs and polymers for the development of delivering system

The formulation and evaluation of Novel drug delivery systems..

THEORY 60 Hrs

1.	Sustained Release(SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.	10 Hrs
2	Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems;Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals.	10 Hrs
3	Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations.	10 Hrs
4	Occular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.	06 Hrs

5	Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation.	10 Hrs
6	Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules.	08 Hrs
7	Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.	06 Hrs

REFERENCES

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded,
Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York! Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

JOURNALS

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian drugs (IDMA)
3. Journal of controlled release (Elsevier Sciences) desirable
4. Drug Development and Industrial Pharmacy (Marcel & Decker) desirable

MODERN PHARMACEUTICS
(MPH 103T)

Scope

Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries

Objectives

Upon completion of the course, student shall be able to understand

- The elements of preformulation studies.
- The Active Pharmaceutical Ingredients and Generic drug Product development
- Industrial Management and GMP Considerations.
- Optimization Techniques & Pilot Plant Scale Up Techniques
- Stability Testing, sterilization process & packaging of dosage forms.

THEORY 60 HRS

1.	a. Preformation Concepts – Drug Excipient interactions - different methods, kinetics of stability, Stability testing. Theories of dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation and stability Large and small volume parental - physiological and formulation consideration, Manufacturing and evaluation.	10 Hrs
	b. Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation	10 Hrs
2	Validation : Introduction to Pharmaceutical Validation, Scope & merits of Validation, Validation and calibration of Master plan, ICH & WHO guidelines for calibration and validation of equipments, Validation of specific dosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & P.Q. of facilities.	10 Hrs
3	cGMP & Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenance Production management: Production organization, , materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Concept of Total Quality Management.	10 Hrs

4	Compression and compaction: Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles. Solubility.	10 Hrs
5	Study of consolidation parameters; Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters, Heckel plots, Similarity factors – f2 and f1, Higuchi and Peppas plot, Linearity Concept of significance, Standard deviation , Chi square test, students T-test , ANOVA test.	10 Hrs

REFERENCES

1. Theory and Practice of Industrial Pharmacy By Lachmann and Libermann
2. Pharmaceutical dosage forms: Tablets Vol. 1-3 by Leon Lachmann.
3. Pharmaceutical Dosage forms: Disperse systems, Vol, 1-2; By Leon Lachmann.
4. Pharmaceutical Dosage forms: Parenteral medications Vol. 1-2; By Leon Lachmann.
5. Modern Pharmaceutics; By Gillbert and S. Banker.
6. Remington's Pharmaceutical Sciences.
7. Advances in Pharmaceutical Sciences Vol. 1-5; By H.S. Bean & A.H. Beckett.
8. Physical Pharmacy; By Alfred martin
9. Bentley's Textbook of Pharmaceutics – by Rawlins.
10. Good manufacturing practices for Pharmaceuticals: A plan for total quality control, Second edition; By Sidney H. Willig.
11. Quality Assurance Guide; By Organization of Pharmaceutical producers of India.
12. Drug formulation manual; By D.P.S. Kohli and D.H.Shah. Eastern publishers, New Delhi.
13. How to practice GMPs; By P.P.Sharma. Vandhana Publications, Agra.
14. Pharmaceutical Process Validation; By Fra. R. Berry and Robert A. Nash.
15. Pharmaceutical Preformulations; By J.J. Wells.
16. Applied production and operations management; By Evans, Anderson, Sweeney and Williams.
17. Encyclopaedia of Pharmaceutical technology, Vol I – III.

REGULATORY AFFAIRS
(MPH 104T)

Scope

Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents : filing process of IND, NDA and ANDA

- To know the approval process of
- To know the chemistry, manufacturing controls and their regulatory importance
- To learn the documentation requirements for
- To learn the importance and

Objectives:

Upon completion of the course, it is expected that the students will be able to understand

- The Concepts of innovator and generic drugs, drug development process
- The Regulatory guidance's and guidelines for filing and approval process
- Preparation of Dossiers and their submission to regulatory agencies in different countries
- Post approval regulatory requirements for actives and drug products
- Submission of global documents in CTD/ eCTD formats
- Clinical trials requirements for approvals for conducting clinical trials
- Pharmacovigilence and process of monitoring in clinical trials.

THEORY 60 Hrs

1. a. Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction , Hatch-Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION) ,drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in –vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO. 12 Hrs

   b. Regulatory requirement for product approval: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs

2	CMC, post approval regulatory affairs. Regulation for combination products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.	12 Hrs
3	Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB).	12 Hrs
4	Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, pharmacovigilance safety monitoring in clinical trials.	12 Hrs

REFERENCES

1. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and IsaderKaufer,Marcel Dekker series, Vol.143
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P.Martin, Drugs and the Pharmaceutical Sciences,Vol.185, Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD,5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons.Inc.
5. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.
6. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A.Rozovsky and Rodney K. Adams
7. www.ich.org/
8. www.fda.gov/
9. europa.eu/index_en.htm
10. https://www.tga.gov.au/tga-basics

PHARMACEUTICS PRACTICALS - I
(MPH 105P)

1. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. To perform In-vitro dissolution profile of CR/ SR marketed formulation
8. Formulation and evaluation of sustained release matrix tablets
9. Formulation and evaluation osmotically controlled DDS
10. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS
11. Formulation and evaluation of Muco adhesive tablets.
12. Formulation and evaluation of trans dermal patches.
13. To carry out preformulation studies of tablets.
14. To study the effect of compressional force on tablets disintegration time.
15. To study Micromeritic properties of powders and granulation.
16. To study the effect of particle size on dissolution of a tablet.
17. To study the effect of binders on dissolution of a tablet.
18. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.

MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS)
(MPH 201T)

Scope

This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Objectives

Upon completion of the course student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of NTDS
- The formulation and evaluation of novel drug delivery systems.

THEORY 60 Hrs

1.	Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery.	12 Hrs
2	Targeting Methods: introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.	12 Hrs
3	Micro Capsules / Micro Spheres: Types, preparation and evaluation , Monoclonal Antibodies ; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes.	12 Hrs
4	Pulmonary Drug Delivery Systems : Aerosols, propellents, ContainersTypes, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.	12 Hrs
5	Nucleic acid based therapeutic delivery system : Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. knowledge of therapeutic antisense molecules and aptamers as drugs of future.	12 Hrs

REFERENCES

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded,Marcel Dekker, Inc., New York, 1992.
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, VallabhPrakashan, New Delhi, First edition 2002.
3. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, NewDelhi, First edition 1997 (reprint in 2001).

ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS
(MPH 202T)

Scope

This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students' to clarify the concepts.

Objectives

Upon completion of this course it is expected that students will be able understand,

- The basic concepts in biopharmaceutics and pharmacokinetics.
- The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.
- The critical evaluation of biopharmaceutic studies involving drug product equivalency.
- The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
- The potential clinical pharmacokinetic problems and application of basics of pharmacokinetic

THEORY 60 Hrs

1. Drug Absorption from the Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formuulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form ,Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form ,Dissolution methods ,Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data.Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction Complex. 12 Hrs

2	Biopharmaceutic considerations in drug product design and In Vitro Drug Product Performance: Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing,meeting dissolution requirements,problems of variable control in dissolution testingperformance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability,considerations in the design of a drug product.	12 Hrs
3	Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion, extra-vascular. Multi compartment model:two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimation of k_{max} and v_{max}. Drug interactions: introduction, the effect of protein-binding interactions,the effect of tissue-binding interactions,cytochrome p450-based drug interactions,drug interactions linked to transporters.	12 Hrs
4	Drug Product Performance, In Vivo: Bioavailability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example, study submission and drug review process. biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods.generic biologics (biosimilar drug products),clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution.	12 Hrs
5	Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies.	12 Hrs

REFERENCES

1. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 4th edition,Philadelphia, Lea and Febiger, 1991
2. Biopharmaceutics and Pharmacokinetics, A. Treatise, D .M. Brahmankar and Sunil B. Jaiswal., VallabPrakashan, Pitampura, Delhi
3. Applied Biopharmaceutics and Pharmacokinetics by Shargel. Land YuABC, 2nd edition, Connecticut Appleton Century Crofts, 1985
4. Textbook of Biopharmaceutics and Pharmacokinetics, Dr. Shobha Rani R. Hiremath,Prism Book
5. Pharmacokinetics by Milo Gibaldi and D. Perrier, 2nd edition, Marcel Dekker Inc.,New York, 1982
6. Current Concepts in Pharmaceutical Sciences: Biopharmaceutics, Swarbrick. J, Leaand Febiger, Philadelphia, 1970
7. Clinical Pharmacokinetics, Concepts and Applications 3rd edition by MalcolmRowland and Thom~ N. Tozer, Lea and Febiger, Philadelphia, 1995
8. Dissolution, Bioavailability and Bioequivalence, Abdou. H.M, Mack PublishingCompany, Pennsylvania 1989
9. Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition,revised and expande by Robert. E. Notari, Marcel Dekker Inc, New York and Basel,1987.
10. Biopharmaceutics and Relevant Pharmacokinetics by John. G Wagner and M.Pemarowski, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
11. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.
12. Basic Pharmacokinetics,1 st edition,Sunil S JambhekarandPhilip J Breen,pharmaceutical press, RPS Publishing,2009.
13. Absorption and Drug Development- Solubility, Permeability, and Charge State, Alex Avdeef, John Wiley & Sons, Inc,2003.

COMPUTER AIDED DRUG DEVELOPMENT
(MPH 203T)

Scope

This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

Objectives

Upon completion of this course it is expected that students will be able to understand,

- History of Computers in Pharmaceutical Research and Development
- Computational Modeling of Drug Disposition
- Computers in Preclinical Development
- Optimization Techniques in Pharmaceutical Formulation
- Computers in Market Analysis
- Computers in Clinical Development
- Artificial Intelligence (AI) and Robotics
- Computational fluid dynamics(CFD)

THEORY		60 Hrs
1.	a. Computers in Pharmaceutical Research and Development: A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modeling in Pharmaceutical research and development: Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modeling b. Quality-by-Design In Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application.	12 Hrs
2	Computational Modeling Of Drug Disposition: Introduction ,Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution ,Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter.	12 Hrs

3	Computer-aided formulation development:: Concept of optimization, Optimization parameters, Factorial design, Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, microemulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis	12 Hrs
4	a. Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in vitro-in vivo correlation, Biowaiver considerations b. Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes. c. Computers in Clinical Development: Clinical Data Collection and Management, Regulation of Computer Systems	12 Hrs
5	Artificial Intelligence (AI), Robotics and Computational fluid dynamics: General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions.	12 Hrs

REFERENCES

1. Computer Applications in Pharmaceutical Research and Development, Sean Ekins, 2006, John Wiley & Sons.
2. Computer-Aided Applications in Pharmaceutical Technology, 1st Edition, Jelena Djuris, Woodhead Publishing
3. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.

COSMETICS AND COSMECEUTICALS
(MPH 204T)

Scope

This course is designed to impart knowledge and skills necessary forthefundamental need for cosmetic and cosmeceutical products.

Objectives

Upon completion of the course, the students shall be able to understand

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

THEORY 60 Hrs

1. Cosmetics – Regulatory : Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import of cosmetics., Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics - Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties. 12 Hrs

2 Cosmetics - Biological aspects : Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm. 12 Hrs

3 Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants – Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste. Soaps and syndetbars. 12 Hrs

Perfumes; Classification of perfumes. Perfume ingredients listed as allergens in EU regulation.

	Controversial ingredients: Parabens, formaldehyde liberators, dioxane.	
4	Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.	12 Hrs
5	Herbal Cosmetics : Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics.	12 Hrs

REFERENCES

1. Harry's Cosmeticology. 8th edition.
2. Poucher'sperfumecosmeticsandSoaps,10th edition.
3. Cosmetics - Formulation, Manufacture and quality control, PP.Sharma,4th edition
4. Handbook of cosmetic science and Technology A.O.Barel, M.Paye and H.I. Maibach. 3rd edition
5. Cosmetic and Toiletries recent suppliers catalogue.
6. CTFA directory.

PHARMACEUTICS PRACTICALS - II
(MPH 205P)

1. To study the effect of temperature change , non solvent addition, incompatible polymer addition in microcapsules preparation
2. Preparation and evaluation of Alginate beads
3. Formulation and evaluation of gelatin /albumin microspheres
4. Formulation and evaluation of liposomes/niosomes
5. Formulation and evaluation of spherules
6. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.
7. Comparison of dissolution of two different marketed products /brands
8. Protein binding studies of a highly protein bound drug & poorly protein bound drug
9. Bioavailability studies of Paracetamol in animals.
10. Pharmacokinetic and IVIVC data analysis by Winnoline^{R} software
11. In vitro cell studies for permeability and metabolism
12. DoE Using Design Expert® Software
13. Formulation data analysis Using Design Expert® Software
14. Quality-by-Design in Pharmaceutical Development
15. Computer Simulations in Pharmacokinetics and Pharmacodynamics
16. Computational Modeling Of Drug Disposition
17. To develop Clinical Data Collection manual
18. To carry out Sensitivity Analysis, and Population Modeling.
19. Development and evaluation of Creams
20. Development and evaluation of Shampoo and Toothpaste base
21. To incorporate herbal and chemical actives to develop products
22. To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff

INDUSTRIALPHARMACY(MIP)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES

(MIP 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know,

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY 60 HOURS

1. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy. 11 Hrs

   IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy

   Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

   Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy. 11 Hrs

3	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy	11 Hrs
4	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Affinity chromatography	11 Hrs
5	Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	11 Hrs
6.	Immunological Assays: Radioimmunology assay (RIA), ELISA (Theory & practical) and knowledge on Bioluminescence assays.	5 Hrs

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, 6th edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series

PHARMACEUTICAL FORMULATION DEVELOPMENT
(MIP 102T)

Scope

This course is designed to impart knowledge and skills necessary to train the students on par with the routine of Industrial activities in R&D and F&D.

Objectives

On completion of this course it is expected that students will be able to understand-

- The scheduled activities in a Pharmaceutical firm.
- The pre formulation studies of pilot batches of pharmaceutical industry.
- The significance of dissolution and product stability

THEORY 60 Hrs

1. Preformulation Studies: Molecular optimization of APIs (drug substances), crystal morphology and variations, powder flow, structure modification, drug-excipient compatibility studies, methods of determination. 12 Hrs

2 Formulation Additives: Study of different formulation additives, factors influencing their incorporation, role of formulation development and processing, new developments in excipient science. Design of experiments – factorial design for product and process development. 12 Hrs

3 Solubility: Importance, experimental determination, phase-solubility analysis, pH-solubility profile, solubility techniques to improve solubility and utilization of analytical methods – cosolvency, salt formation, complexation, solid dispersion, micellar solubilization and hydrotropy. 12 Hrs

4 Dissolution: Theories, mechanisms of dissolution, in-vitro dissolution testing models – sink and non-sink. Factors influencing dissolution and intrinsic dissolution studies. Dissolution test apparatus – designs, dissolution testing for conventional and controlled release products. Data handling and correction factor. Biorelevent media, in-vitro and in-vivo correlations, levels of correlations. 12 Hrs

5	Product Stability: Degradation kinetics, mechanisms, stability testing of drugs and pharmaceuticals, factors influencing-media effects and pH effects, accelerated stability studies, interpretation of kinetic data (API & tablets). Solid state stability and shelf life assignment. Stability protocols, reports and ICH guidelines.	12 Hrs

REFERENCES

1. Lachman L, Lieberman HA, Kanig JL. The Theory and Practice Of Industrial Pharmacy, 3rd ed., Varghese Publishers, Mumbai 1991.
2. Sinko PJ. Martin's physical pharmacy and pharmaceutical sciences, 5th ed., B.I. Publications Pvt. Ltd, Noida, 2006.
3. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms: tablets Vol. I-III, 2nd ed., CBS Publishers & distributors, New Delhi, 2005.
4. Conners KA. A Text book of pharmaceutical analysi Wells JI. Pharmaceutical preformulation: The physicochemical properties of drug substances. Ellis Horwood Ltd., England, 1998.
5. Yalkowsky SH. Techniques of solubilization of drugs. Vol-12. Marcel Dekker Inc., New York, 1981
6. Dressman J, Kramer J. Pharmaceutical dissolution testing. Saurah printer pvt. Ltd., New Delhi,2005.
7. Sethi PD. Quantitative analysis of drugs in pharmaceutical formulations, 3rd ed., CBS publications, New Delhi, 2008.
8. Carstensen JT, Rhodes CT. Drug stability principles and practices, 3rd ed., CBS Publishers & distributors, New Delhi, 2005.
9. Yoshioka S, Stella VJ. Stability of drugs and dosage forms, Springer (India) Pvt. Ltd., New Delhi, 2006.
10. Banker GS, Rhodes CT. Modern Pharmaceutics, 4th ed., Marcel Dekker Inc, New York, 2005.
11. W. Grimm - Stability testing of drug products.
12. Mazzo DJ. International stability testing. Eastern Press Pvt. Ltd., Bangalore, 1999. 13. Beckett AH, Stenlake JB. Practical pharmaceutical chemistry, Part I & II., 4th ed., CBS Publishers & distributors, New Delhi, 2004.
14. Indian Pharmacopoeia. Controller of Publication. Delhi, 1996.
15. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2008.
16. United States Pharmacopoeia. United States Pharmacopeial Convention, Inc, USA, 2003.
17. Encyclopaedia of Pharm. Technology, Vol I – III.
18. Wells J. I. Pharmaceutical Preformulation : The physicochemical properties of drug substances, Ellis Horwood Ltd. England, 1988.

NOVEL DRUG DELIVERY SYSTEMS
(MIP 103T)

Scope

This course is designed to impart knowledge and skills necessary to train the students in the area of novel drug delivery systems.

Objective

On completion of this course it is expected that students will be able to understand,

- The need, concept, design and evaluation of various customized, sustained and controlled release dosage forms.
- To formulate and evaluate various novel drug delivery systems

THEORY 60 Hrs

1. Concept & Models for NDDS: Classification of rate controlled drug delivery systems (DDS), rate programmed release, activation modulated & feedback regulated DDS, effect of system parameters in controlled drug delivery, computation of desired release rate and dose for controlled release DDS, pharmacokinetic design for DDS – intermittent, zero order & first order release. 12 Hrs

   Carriers for Drug Delivery: Polymers / co-polymers-introduction, classification, characterization, polymerization techniques, application in CDDS / NDDS, biodegradable & natural polymers.

2 Study of Various DDS: Concepts, design, formulation & evaluation of controlled release oral DDS, Mucoadhesive DDS (buccal, nasal, pulmonary) Pulsatile, colon specific, liquid sustained release systems, Ocular delivery systems 12 Hrs

3 Transdermal Drug Delivery Systems: Theory, design, formulation & evaluation including iontophoresis and other latest developments in skin delivery systems. 08 Hrs

4 Sub Micron Cosmeceuticals: Biology, formulation science and evaluation of various cosmetics for skin, hair, nail, eye etc and it's regulatory aspects. 04 Hrs

5	Targeted Drug Delivery Systems: Importance, concept, biological process and events involved in drug targeting, design, formulation & evaluation, methods in drug targeting – nanoparticles, liposomes, niosomes, pharmacosomes, resealed erythrocytes, microspheres, magnetic microspheres. Specialized pharmaceutical emulsions – multiple emulsions, micro-emulsions.	12 Hrs
6	Protein / Peptide Drug Delivery Systems: Concepts, delivery techniques, formulation, stability testing, causes of protein destabilization, stabilization methods.	
7	Biotechnology in Drug Delivery Systems: Brief review of major areas-recombinant DNA technology, monoclonal antibodies, gene therapy.	06 Hrs
8	New trends for Personalized Medicine: Introduction, Definition, Pharmacogenetics, Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.	06 Hrs

REFERENCES

1. Novel Drug Delivery System, Y.W. Chein, Vol 50, Marcel Dekker, NY.
2. Controlled Drug Delivery Systems, Robinson, Vol 29, Marcel Dekker, NY.
3. Transdermal Controlled Systemic Medications, YW Chein, Vol 31, Marcel Dekker, NY.
4. Bioadhesive DDS, E. Mathiowitz, Vol 98, Marcel Dekker, NY.
5. Nasal System Drug Delivery, K.S.E. Su, Vol 39, Marcel Dekker, NY.
6. Drug Delivery Devices, Vol 32, P Tyle Marcel Dekker, NY.
7. Polymers for Controlled Drug Delivery, P.J. Tarcha, CRC Press.
8. Pharmaceutical Biotechnology, Vyas, CBS, Delhi.
9. Biotechnology of Industrial Antibiotics, E.J. Vandamme, Marcel Dekker, NY.
10. Protein Formulation & Delivery, E.J. McNally, Vol 99, Marcel Dekker, NY.
11. Drug Targeting, M.H. Rubinstein, John Wiley, NY.

INTELLECTUAL PROPERTY RIGHTS
(MIP 104T)

Scope

This course is designed to impart knowledge and skills necessary to train the students to be on par with the routine of Industrial activities in drug regulatory affairs

Objectives

On completion of this course it is expected that students will be able to understand,

- Assist in Regulatory Audit process.
- Establish regulatory guidelines for drug and drug products
- The Regulatory requirements for contract research organization

THEORY		60 Hrs
1.	Definition, Need for patenting, Types of Patents, Conditions to be satisfied by an invention to be patentable, Introduction to patent search. Parts of patents. Filling of patents. The essential elements of patent; Guidelines for preparation of laboratory note book, Non-obviousness in Patent.	12 Hrs
2	Role of GATT, TRIPS, and WIPO	12 Hrs
3	Brief introduction to Trademark protection and WHO Patents. IPR's and its types, Major bodies regulating Indian Pharmaceutical sector.	12 Hrs
4	Brief introduction to CDSCO. WHO, USFDA, EMEA, TGA, MHRA, MCC, ANVISA	12 Hrs
5	Regulatory requirements for contract research organization. Regulations for Biosimilars.	12 Hrs

REFERENCES :

1. Pharmaceutical Process Validation: By Fra R. Berry and Robert A. Nash, Vol 57, 2nd Edition
2. Applied Production and Operation Management By Evans, Anderson and Williams
3. GMP for pharmaceuticals Material Management by K.K. Ahuja Published by CBS publishers
4. ISO 9000-Norms and explanations
5. GMP for pharmaceuticals- Willing S.H. Marcel and Dekker

INDUSTRIAL PHARMACY PRACTICAL - I
(MIP 105P)

1. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC / GC
4. Estimation of riboflavin/quinine sulphate by fluorimetry
5. Estimation of sodium/potassium by flame photometry
6. Effect of surfactants on the solubility of drugs.
7. Effect of pH on the solubility of drugs.
8. Stability testing of solution and solid dosage forms for photo degradation..
9. Stability studies of drugs in dosage forms at 25 ^{o}C, 60% RH and 40 ^{o}C, 75% RH.
10. Compatibility evaluation of drugs and excipients (DSC & FTIR).
11. Preparation and evaluation of different polymeric membranes.
12. Formulation and evaluation of sustained release oral matrix tablet/ oral reservoir system.
13. Formulation and evaluation of microspheres / microcapsules.
14. Formulation and evaluation of transdermal drug delivery systems.
15. Design and evaluation of face wash, body- wash, creams, lotions, shampoo, toothpaste, lipstick.
16. Electrophoresis of protein solution.
17. Preparation and evaluation of Liposome delivery system.

ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MIP 201T)

Scope

This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply Biopharmaceutics theories in practical problem solving.

Objectives

On completion of this course it is expected that students will be able to understand,

- The basic concepts in Biopharmaceutics and pharmacokinetics.
- The use of raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.
- To critically evaluate Biopharmaceutics studies involving drug product equivalency.
- To design and evaluate dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.

THEORY 60 Hrs

1. Drug Absorption From The Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting, pH–partition theory, Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form ,Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form ,Dissolution methods ,Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data. Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction Complex. Solubility: Experimental methods. Permeability: In-vitro, in-situ and In-vivo methods. 12 Hrs

2 Biopharmaceutic Considerations in Drug Product Design and In Vitro Drug Product Performance: Introduction, Biopharmaceutic Factors Affecting Drug Bioavailability, Rate-Limiting Steps in Drug Absorption, Physicochemical Nature of the 12 Hrs

	Drug Formulation Factors Affecting Drug Product Performance, In Vitro: Dissolution and Drug Release Testing, Compendial Methods of Dissolution, Alternative Methods of Dissolution Testing, Meeting Dissolution Requirements, Problems of Variable Control in Dissolution Testing Performance of Drug Products: In Vitro–In Vivo Correlation, Dissolution Profile Comparisons, Drug Product Stability, Considerations in the Design of a Drug Product.	
3	Pharmacokinetics: Basic considerations, Pharmacokinetic models, Compartment modeling: One compartment model- IV bolus, IV infusion, Extra-vascular; Multi Compartment model: Two compartment - model in brief, Non-Linear Pharmacokinetics: Cause of non-linearity, Michaelis – Menten equation, Estimation Kmax and Vmax. Drug interactions: Introduction, The effect of protein-binding interactions, The effect of tissue-binding interactions, Cytochrome P450-based drug interactions, Drug interactions linked to transporters.	12 Hrs
4	Drug Product Performance, In Vivo: Bioavailability and Bioequivalence: Drug Product Performance, Purpose of Bioavailability Studies, Relative and Absolute Availability, , Methods for Assessing Bioavailability, Bioequivalence Studies, Design and Evaluation of Bioequivalence Studies, Study Designs, Crossover Study Designs, Evaluation of the Data, Bioequivalence Example, Study Submission and Drug Review Process, The Biopharmaceutics Classification System, Generic Biologics (Biosimilar Drug Products),Clinical Significance of Bioequivalence Studies, Special Concerns in Bioavailability and Bioequivalence Studies, Generic Substitution.	12 Hrs
5	Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Relationship between Pharmacokinetics including Pharmacodynamics: Generation of a pharmacokinetic-pharmacodynamic (PKPD) equation, Pharmacokinetic and pharmacodynamic, interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs: Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy),Gene therapies.	12 Hrs

REFERENCES

1. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 4th edition,Philadelphia, Lea and Febiger, 1991
2. Biopharmaceutics and Pharmacokinetics, A. Treatise, D .M. Brahmankar and Sunil B.J aiswal., Vallab Prakashan, Pitampura, Delhi
3. Applied Biopharmaceutics and Pharmacokinetics by Shargel. Land YuABC, 2nd edition, Connecticut Appleton Century Crofts, 1985
4. Textbook of Biopharmaceutics and Pharmacokinetics, Dr. Shobha Rani R. Hiremath,Prism Book
5. Pharmacokinetics by Milo Gibaldi and D. Perrier, 2nd edition, Marcel Dekker Inc.,New York, 1982
6. Current Concepts in Pharmaceutical Sciences: Biopharmaceutics, Swarbrick. J, Lea and Febiger, Philadelphia, 1970
7. Clinical Pharmacokinetics, Concepts and Applications 3rd edition by Malcolm Rowland and Thom~ N. Tozer, Lea and Febiger, Philadelphia, 1995
8. Dissolution, Bioavailability and Bioequivalence, Abdou. H.M, Mack Publishing Company, Pennsylvania 1989
9. Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition, revised and expande by Robert. E. Notari, Marcel Dekker Inc, New York and Basel,1987.
10. Biopharmaceutics and Relevant Pharmacokinetics by John. G Wagner and M.Pemarowski, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
11. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.
12. Basic Pharmacokinetics,1 st edition, Sunil S Jambhekar and Philip J Breen,pharmaceutical press, RPS Publishing,2009.
13. Absorption and Drug Development- Solubility, Permeability, and Charge State, Alex Avdeef, John Wiley & Sons, Inc,2003.

SCALE UP AND TECHNOLOGY TRANSFER
(MIP 202T)

Scope

This course is designed to impart knowledge and skills necessary to train the students to be on scale up, technology transfer process and industrial safety issues.

Objectives:

On completion of this course it is expected that students will be able to understand,

- Manage the scale up process in pharmaceutical industry.
- Assist in technology transfer.
- To establish safety guidelines, which prevent industrial hazards.

	THEORY	60 Hrs
1.	**Pilot plant design:** Basic requirements for design, facility, equipment selection, for tablets, capsules, liquid orals, parentral and semisolid preparations. **Scale up:** Importance, Technology transfer from R & D to pilot plant to plant scale, process scale up for tablets, capsules, liquid orals, semisolids, parentral, NDDS products – stress on formula, equipments, product uniformity, stability, raw materials, physical layout, input, in-process and finished product specifications, problems encountered during transfer of technology	12 Hrs
2	**Validation:** General concepts, types, procedures & protocols, documentation, VMF. Analytical method validation, cleaning validation and vender qualification.	12 Hrs
3	**Equipment Qualification:** Importance, IQ, OQ, PQ for equipments – autoclave, DHS, membrane filter, rapid mixer granulator, cone blender, FBD, tablet compression machine, liquid filling and sealing machine. Aseptic room validation.	12 Hrs
4	**Process validation:** Importance, validation of mixing, granulation, drying, compression, tablet coating, liquid filling and sealing, sterilization, water process systems, environmental control.	12 Hrs

5	Industrial safety: Hazards – fire, mechanical, electrical, chemical and pharmaceutical, Monitoring & prevention systems, industrial effluent testing & treatment. Control of environmental pollution.	12 Hrs

REFERENCES

1. Pharmaceutical process validation, JR Berry, Nash, Vol 57, Marcel Dekker, NY.
2. Pharmaceutical Production facilities, design and applications, by GC Cole, Taylor and Francis.
3. Pharmaceutical project management, T.Kennedy, Vol 86, Marcel Dekker, NY.
4. The theory & Practice of Industrial Pharmacy, L.Lachman, H.A.Lieberman, Varghese Publ. Bombay.
5. Tablet machine instruments in pharmaceuticals, PR Watt, John Wiloy.
6. Pharmaceutical dosage forms, Tablets, Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
7. Pharmaceutical dosage forms, Parentral medications, Vol 1, 2 by K.E. Avis, Marcel Dekker, NY.
8. Dispersed system Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
9. Subrahmanyam, CVS, Pharmaceutical production and Management, 2007, Vallabh Prakashan,Dehli.

PHARMACEUTICAL PRODUCTION TECHNOLOGY
(MIP 203T)

Scope

This course is designed to impart knowledge and skills necessary to train the students to be on par with the routine of Industrial activities in Production

Objectives

On completion of this course it is expected that students will be able to understand,

Handle the scheduled activities in a Pharmaceutical firm.
Manage the production of large batches of pharmaceutical formulations.

THEORY 60 Hrs

1.	Improved Tablet Production: Tablet production process, unit operation improvements, granulation and pelletization equipments, continuous and batch mixing, rapid mixing granulators, rota granulators, spheronizers and marumerisers, and other specialized granulation and drying equipments. Problems encountered. Coating Technology: Process, equipments, particle coating, fluidized bed coating, application techniques. Problems encountered.	12 Hrs
2	Parenteral Production: Area planning & environmental control, wall and floor treatment, fixtures and machineries, change rooms, personnel flow, utilities & utilities equipment location, engineering and maintenance.	12 Hrs
3	Lyophilization & Spray drying Technology: Principles, process, freeze-drying and spray drying equipments.	12 Hrs
4	Capsule Production: Production process, improved capsule manufacturing and filling machines for hard and soft gelatin capsules. Layout and problems encountered. Disperse Systems Production: Production processes, applications of mixers, mills, disperse equipments including fine solids dispersion, problems encountered.	12 Hrs

Packaging Technology: Types of packaging materials, machinery, labeling, package printing for different dosage forms.

5 Air Handling Systems: Study of AHUs, humidity & temperature control, air filtration systems, dust collectors. Water Treatment Process: Techniques and maintenance – RO, DM, ultra – filtration, WFI. 12 Hrs

REFERENCES

1. The Theory & Practice of Industrial Pharmacy, L. Lachman, Varghese Publ, Bombay.
2. Modern Pharmaceutics by Banker, Vol 72, Marcel Dekker, NY.
3. Pharmaceutical Dosage Forms, Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
4. Pharmaceutical Dosage Forms, Parentral medications, Vol 1, 2 by K.E. Avis, Marcel Dekker, NY.
5. Pharmaceutical Production Facilities, design and applications, by G.C. Cole, Taylor and Francis.
6. Dispersed System Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
7. Product design and testing of polymeric materials by N.P. Chezerisionoff.
8. Pharmaceutical Project Management, T.Kennedy, Vol 86, Marcel Dekker, NY.
9. Packaging Pharmaceutical and Health Care, H.Lockhard.
10. Quality Control of Packaging Materials in Pharmaceutical Industy, .Kharburn, Marcel Dekker, NY.
11. Freeze drying / Lyophilization of Pharmaceuticals & Biological Products, L. Ray, Vol 96, Marcel Dekker, NY.
12. Tablet Machine Instrumentation In Pharmaceuticals, PR Watt, Ellis Horwoods, UK.

ENTREPRENEURSHIP MANAGEMENT
(MIP 204T)

Scope

This course is designed to impart knowledge and skills necessary to train the students on entrepreneurship management.

Objectives:

On completion of this course it is expected that students will be able to understand,

- The Role of enterprise in national and global economy
- Dynamics of motivation and concepts of entrepreneurship
- Demands and challenges of Growth Strategies And Networking

THEORY 60 Hrs

1.	Conceptual Frame Work: Concept need and process in entrepreneurship development. Role of enterprise in national and global economy. Types of enterprise – Merits and Demerits. Government policies and schemes for enterprise development. Institutional support in enterprise development and management.	12 Hrs
2	Entrepreneur: Entrepreneurial motivation – dynamics of motivation. Entrepreneurial competency –Concepts. Developing Entrepreneurial competencies - requirements and understanding the process of entrepreneurship development, self-awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur role.	12 Hrs
3	Launching And Organising An Enterprise: Environment scanning – Information, sources, schemes of assistance, problems. Enterprise selection, market assessment, enterprise feasibility study, SWOT Analysis. Resource mobilisation - finance, technology, raw material, site and manpower. Costing and marketing management and quality control. Feedback, monitoring and evaluation.	12 Hrs
4	Growth Strategies And Networking: Performance appraisal and assessment. Profitability and control measures, demands and challenges. Need for diversification. Future Growth – Techniques of expansion and diversification, vision strategies. Concept and dynamics. Methods, Joint venture, co-ordination and feasibility study.	12 Hrs

5	Preparing Project Proposal To Start On New Enterprise Project work – Feasibility report; Planning, resource mobilisation and implementation.	12 Hrs

REFERENCES

1. Akhauri, M.M.P.(1990): Entrepreneurship for Women in India, NIESBUD, New Delhi.
2. Hisrich, R.D & Brush, C.G.(1996) The Women Entrepreneurs, D.C. Health & Co., Toranto.
3. Hisrich, R.D. and Peters, M.P. (1995): Entrepreneurship – Starting, Developing and Managing a New Enterprise, Richard D., Inwin, INC, USA.
4. Meredith, G.G. etal (1982): Practice of Entrepreneurship, ILO, Geneva.
5. Patel, V.C. (1987): Women Entrepreneurship – Developing New Entrepreneurs, Ahmedabad EDII.

INDUSTRIAL PHARMACY PRACTICAL - II
(MIP 205P)

1. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.
2. Comparison of dissolution of two different marketed products /brands
3. Protein binding studies of a highly protein bound drug & poorly protein bound drug
4. Bioavailability studies of Paracetamol (Animal).
5. Pharmacokinetic and IVIVC data analysis by WinnolineR software
6. In vitro cell studies for permeability and metabolism
7. Formulation and evaluation of tablets
8. Formulation and evaluation of capsules
9. Formulation and evaluation of injections
10. Formulation and evaluation of emulsion
11. Formulation and evaluation of suspension.
12. Formulation and evaluation of enteric coating tablets.
13. Preparation and evaluation of a freeze dried formulation.
14. Preparation and evaluation of a spray dried formulation.

PHARMACEUTICALCHEMISTRY(MPC)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES
(MPC 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know about chemicals and excipients

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY 60 Hrs

1. a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. — 10 Hrs

   b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.

   c. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence (Characterestics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

   d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy. — 10 Hrs

3	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	10 Hrs
4	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography	10 Hrs
5	a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	10 Hrs
6	a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. b. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation	10 Hrs

and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis - Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry - Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods - Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

ADVANCED ORGANIC CHEMISTRY - I
(MPC 102T)

Scope

The subject is designed to provide in-depth knowledge about advances in organic chemistry, different techniques of organic synthesis and their applications to process chemistry as well as drug discovery.

Objectives

Upon completion of course, the student shall be to understand

- The principles and applications of reterosynthesis
- The mechanism & applications of various named reactions
- The concept of disconnection to develop synthetic routes for small target molecule.
- The various catalysts used in organic reactions
- The chemistry of heterocyclic compounds

THEORY 60 Hrs

1. Basic Aspects of Organic Chemistry: 12 Hrs
   1. Organic intermediates: Carbocations, carbanions, free radicals, carbenes and nitrenes. Their method of formation, stability and synthetic applications.
   2. Types of reaction mechanisms and methods of determining them,
   3. Detailed knowledge regarding the reactions, mechanisms and their relative reactivity and orientations.

   Addition reactions

   a) Nucleophilic uni- and bimolecular reactions (SN1 and SN2)
   b) Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule)
   c) Rearrangement reaction

2 Study of mechanism and synthetic applications of following named Reactions: 12 Hrs

Ugi reaction, Brook rearrangement, Ullmann coupling reactions, Dieckmann Reaction, Doebner-Miller Reaction, Sandmeyer Reaction, Mitsunobu reaction, Mannich reaction, Vilsmeyer-Haack Reaction, Sharpless asymmetric epoxidation, Baeyer-Villiger oxidation, Shapiro & Suzuki reaction, Ozonolysis and Michael addition reaction

3 Synthetic Reagents & Applications: 12 Hrs

Aluminiumisopropoxide, N-bromosuccinamide, diazomethane, dicyclohexylcarbodimide, Wilkinson reagent, Witting reagent. Osmium tetroxide, titanium chloride, diazopropane, diethyl azodicarboxylate, Triphenylphosphine, Benzotriazol-1-yloxy) tris (dimethylamino) phosphonium hexafluoro-phosphate (BOP).

Protecting groups

a. Role of protection in organic synthesis
b. Protection for the hydroxyl group, including 1,2-and1,3-diols: ethers, esters, carbonates, cyclic acetals & ketals
c. Protection for the Carbonyl Group: Acetals and Ketals
d. Protection for the Carboxyl Group: amides and hydrazides, esters
e. Protection for the Amino Group and Amino acids: carbamates and amides

4 Heterocyclic Chemistry: 12 Hrs

Organic Name reactions with their respective mechanism and application involved in synthesis of drugs containing five, six membered and fused hetrocyclics such as Debus-Radziszewski imidazole synthesis, Knorr Pyrazole Synthesis Pinner Pyrimidine Synthesis, Combes Quinoline Synthesis, Bernthsen Acridine Synthesis, Smiles rearrangement and Traube purine synthesis.

Synthesis of few representative drugs containing these hetrocyclic nucleus such as Ketoconazole, Metronidazole, Miconazole, celecoxib, antipyrin, Metamizole sodium, Terconazole, Alprazolam, Triamterene, Sulfamerazine, Trimethoprim, Hydroxychloroquine, Quinine, Chloroquine, Quinacrine, Amsacrine, Prochlorpherazine, Promazine, Chlorpromazine,Theophylline , Mercaptopurine and Thioguanine.

5 Synthon approach and retrosynthesis applications 12 Hrs

i. Basic principles, terminologies and advantages of retrosynthesis; guidelines for dissection of molecules. Functional group interconvertion and addition (FGI and FGA)
ii. C-X disconnections; C-C disconnections – alcohols and carbonyl compounds; 1,2-, 1,3-,1,4-, 1,5-, 1,6-difunctionalized compounds
iii. Strategies for synthesis of three, four, five and six-membered ring.

REFERENCES

1. "Advanced Organic chemistry, Reaction, Mechanisms and Structure", J March, John Wiley and Sons, New York.
2. "Mechanism and Structure in Organic Chemistry", ES Gould, Hold Rinchart and Winston, New York.
3. "Organic Chemistry" Clayden, Greeves, Warren and Woihers., Oxford University Press 2001.
4. "Organic Chemistry" Vol I and II. I.L. Finar. ELBS, Pearson Education Lts, Dorling Kindersley 9India) Pvt. Ltd.,.
5. A guide to mechanisms in Organic Chemistry, Peter Skyes (Orient Longman, New Delhi).
6. Reactive Intermediates in Organic Chemistry, Tandom and Gowel, Oxford & IBH Publishers.
7. Combinational Chemistry – Synthesis and applications – Stephen R Wilson & Anthony W Czarnik, Wiley – Blackwell.
8. Carey, Organic Chemistry, 5th Edition (Viva Books Pvt. Ltd.)
9. Organic Synthesis - The Disconnection Approach, S. Warren, Wily India
10. Principles of Organic Synthesis, ROC Norman and JM Coxan, Nelson Thorns.
11. Organic Synthesis – Special Techniques. VK Ahluwalia and R Agarwal, Narosa Publishers.
12. Organic Reaction Mechanisms IVth Edtn, VK Ahluwalia and RK Parashar, Narosa Publishers.

ADVANCED MEDICINAL CHEMISTRY
(MPC 103T)

Scope

The subject is designed to impart knowledge about recent advances in the field of medicinal chemistry at the molecular level including different techniques for the rational drug design.

Objectives

At completion of this course it is expected that students will be able to understand

- Different stages of drug discovery
- Role of medicinal chemistry in drug research
- Different techniques for drug discovery
- Various strategies to design and develop new drug like molecules for biological targets
- Peptidomimetics

THEORY 60 Hrs

1. Drug discovery: Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets. 12 Hrs

   Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonists vs antagonists, artificial enzymes.

2 Prodrug Design and Analog design: 12 Hrs

   a) Prodrug design: Basic concept, Carrier linked prodrugs/ Bioprecursors, Prodrugs of functional group, Prodrugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design.

   b) Combating drug resistance: Causes for drug resistance, strategies to combat drug resistance in antibiotics and anticancer therapy, Genetic principles of drug resistance.

   c) Analog Design: Introduction, Classical & Non classical, Bioisosteric replacement strategies, rigid analogs,

alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance.

3 a) Medicinal chemistry aspects of the following class of drugs 12 Hrs

Systematic study, SAR, Mechanism of action and synthesis of new generation molecules of following class of drugs:

a) Anti-hypertensive drugs, Psychoactive drugs, Anticonvulsant drugs, H1 & H2 receptor antagonist, COX1 & COX2 inhibitors, Adrenergic & Cholinergic agents, Antineoplastic and Antiviral agents.

b) Stereochemistry and Drug action: Realization that stereo selectivity is a pre-requisite for evolution. Role of chirality in selective and specific therapeutic agents. Case studies, Enantio selectivity in drug adsorption, metabolism, distribution and elimination.

4 Rational Design of Enzyme Inhibitors 12 Hrs

Enzyme kinetics & Principles of Enzyme inhibitors, Enzyme inhibitors in medicine, Enzyme inhibitors in basic research, rational design of non-covalently and covalently binding enzyme inhibitors.

5 Peptidomimetics 12 Hrs

Therapeutic values of Peptidomimetics, design of peptidomimetics by manipulation of the amino acids, modification of the peptide backbone, incorporating conformational constraints locally or globally. Chemistry of prostaglandins, leukotrienes and thromboxones.

REFERENCES

1. Medicinal Chemistry by Burger, Vol I –VI.
2. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th Edition, Lppincott Williams & Wilkins, Woltess Kluwer (India) Pvt.Ltd, New Delhi.
3. Comprehensive Medicinal Chemistry – Corwin and Hansch.
4. Computational and structural approaches to drug design edited by Robert M Stroud and Janet. F Moore

5. Introduction to Quantitative Drug Design by Y.C. Martin.
6. Principles of Medicinal Chemistry by William Foye, 7th Edition, Ippincott Williams & Wilkins, Woltess Kluwer (India) Pvt.Ltd, New Delhi.
7. Drug Design Volumes by Arienes, Academic Press, Elsevier Publishers, Noida, Uttar Pradesh..
8. Principles of Drug Design by Smith.
9. The Organic Chemistry of the Drug Design and Drug action by Richard B.Silverman, II Edition, Elsevier Publishers, New Delhi.
10. An Introduction to Medicinal Chemistry, Graham L.Patrick, III Edition, Oxford University Press, USA.
11. Biopharmaceutics and pharmacokinetics, DM.Brahmankar, Sunil B. Jaiswal II Edition, 2014, Vallabh Prakashan, New Delhi.
12. Peptidomimetics in Organic and Medicinal Chemistry by Antonio Guarna and Andrea Trabocchi, First edition, Wiley publishers.

CHEMISTRY OF NATURAL PRODUCTS
(MPC 104T)

Scope

The subject is designed to provide detail knowledge about chemistry of medicinal compounds from natural origin and general methods of structural elucidation of such compounds. It also emphasizes on isolation, purification and characterization of medicinal compounds from natural origin.

Objectives

At completion of this course it is expected that students will be able to understand-

- Different types of natural compounds and their chemistry and medicinal importance
- The importance of natural compounds as lead molecules for new drug discovery
- The concept of rDNA technology tool for new drug discovery
- General methods of structural elucidation of compounds of natural origin
- Isolation, purification and characterization of simple chemical constituents from natural source

THEORY 60 Hrs

1. Study of Natural products as leads for new pharmaceuticals for the following class of drugs — 12 Hrs
   a) Drugs Affecting the Central Nervous System: Morphine Alkaloids
   b) Anticancer Drugs: Paclitaxel and Docetaxel, Etoposide, and Teniposide
   c) Cardiovascular Drugs: Lovastatin, Teprotide and Dicoumarol
   d) Neuromuscular Blocking Drugs: Curare alkaloids
   e) Anti-malarial drugs and Analogues
   f) Chemistry of macrolid antibiotics (Erythromycin, Azithromycin, Roxithromycin, and Clarithromycin) and β - Lactam antibiotics (Cephalosporins and Carbapenem)
2. a) Alkaloids — 12 Hrs
   General introduction, classification, isolation, purification, molecular modification and biological activity of alkaloids, general methods of structural determination of alkaloids, structural elucidation and stereochemistry of ephedrine, morphine, ergot, emetine and reserpine.

b) Flavonoids

Introduction, isolation and purification of flavonoids, General methods of structural determination of flavonoids; Structural elucidation of quercetin.

c) Steroids

General introduction, chemistry of sterols, sapogenin and cardiac glycosides. Stereochemistry and nomenclature of steroids, chemistry of contraceptive agents male & female sex hormones (Testosterone, Estradiol, Progesterone), adrenocorticoids (Cortisone), contraceptive agents and steroids (Vit – D).

3 a) Terpenoids 12 Hrs

Classification, isolation, isoprene rule and general methods of structural elucidation of Terpenoids; Structural elucidation of drugs belonging to mono (citral, menthol, camphor), di(retinol, Phytol, taxol) and tri terpenoids (Squalene,Ginsenoside) carotinoids (β carotene).

b) Vitamins

Chemistry and Physiological significance of Vitamin A, B1, B2, B12, C, E, Folic acid and Niacin.

4 a). Recombinant DNA technology and drug discovery 12 Hrs

rDNA technology, hybridoma technology, New pharmaceuticals derived from biotechnology; Oligonucleotide therapy. Gene therapy: Introduction, Clinical application and recent advances in gene therapy, principles of RNA & DNA estimation

b). Active constituent of certain crude drugs used in Indigenous system Diabetic therapy – Gymnema sylvestre, Salacia reticulate, Pterocarpus marsupiam, Swertia chirata, Trigonella foenum graccum; Liver dysfunction – Phyllanthus niruri; Antitumor – Curcuma longa Linn.

5 Structural Characterization of natural compounds 12 Hrs

Structural characterization of natural compounds using IR, 1HNMR, 13CNMR and MS Spectroscopy of specific drugs e.g., Penicillin, Morphine, Camphor, Vit-D, Quercetin and Digitalis glycosides.

REFERENCES

1. Modern Methods of Plant Analysis, Peech and M.V.Tracey, Springer – Verlag, Berlin, Heidelberg.
2. Phytochemistry Vol. I and II by Miller, Jan Nostrant Rein Hld.
3. Recent advances in Phytochemistry Vol. I to IV – Scikel Runeckles, Springer Science & Business Media.
4. Chemistry of natural products Vol I onwards IWPAC.
5. Natural Product Chemistry Nakanishi Gggolo, University Science Books, California.
6. Natural Product Chemistry "A laboratory guide" – Rapheal Khan.
7. The Alkaloid Chemistry and Physiology by RHF Manske, Academic Press.
8. Introduction to molecular Phytochemistry – CHJ Wells, Chapmannstall.
9. Organic Chemistry of Natural Products Vol I and II by Gurdeep and Chatwall, Himalaya Publishing House.
10. Organic Chemistry of Natural Products Vol I and II by O.P. Agarwal, Krishan Prakashan.
11. Organic Chemistry Vol I and II by I.L. Finar, Pearson education.
12. Elements of Biotechnology by P.K. Gupta, Rastogi Publishers.
13. Pharmaceutical Biotechnology by S.P.Vyas and V.K.Dixit, CBS Publishers.
14. Biotechnology by Purohit and Mathur, Agro-Bios, 13th edition.
15. Phytochemical methods of Harborne, Springer, Netherlands.
16. Burger's Medicinal Chemistry.

PHARMACEUTICAL CHEMISTRY PRACTICAL - I
(MPC 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer, RNA & DNA estimation
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on Column chromatography
4. Experiments based on HPLC
5. Experiments based on Gas Chromatography
6. Estimation of riboflavin/quinine sulphate by fluorimetry
7. Estimation of sodium/potassium by flame photometry

To perform the following reactions of synthetic importance

1. Purification of organic solvents, column chromatography
2. Claisen-schimidt reaction.
3. Benzyllic acid rearrangement.
4. Beckmann rearrangement.
5. Hoffmann rearrangement
6. Mannich reaction
7. Synthesis of medicinally important compounds involving more than one step along with purification and Characterization using TLC, melting point and IR spectroscopy (4 experiments)
8. Estimation of elements and functional groups in organic natural compounds
9. Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis, co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data.
10. Some typical degradation reactions to be carried on selected plant constituents

ADVANCED SPECTRAL ANALYSIS
(MPC 201T)

Scope

This subject deals with various hyphenated analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are LC-MS, GC-MS, ATR-IR, DSC etc.

Objectives

At completion of this course it is expected that students will be able to understand-

- Interpretation of the NMR, Mass and IR spectra of various organic compounds
- Theoretical and practical skills of the hyphenated instruments
- Identification of organic compounds

THEORY 60Hrs

1. UV and IR spectroscopy: 12 Hrs
   Wood ward – Fieser rule for 1,3- butadienes, cyclic dienes and α, β-carbonyl compounds and interpretation compounds of enones. ATR-IR, IR Interpretation of organic compounds.

2 NMR spectroscopy: 12 Hrs
   1-D and 2-D NMR, NOESY and COSY, HECTOR, INADEQUATE techniques, Interpretation of organic compounds.

3 Mass Spectroscopy 12 Hrs
   Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, Mc Lafferty rearrangement, Ring rule, Isotopic peaks, Interpretation of organic compounds.

4 Chromatography: 12 Hrs
   Principle, Instrumentation and Applications of the following :
   a) GC-MS b) GC-AAS c) LC-MS d) LC-FTIR e) LC-NMR f) CE-MS g) High Performance Thin Layer chromatography h) Super critical fluid chromatography i) Ion Chromatography j) I-EC (Ion-Exclusion Chromatography) k) Flash chromatography

5 a). Thermal methods of analysis 12 Hrs

Introduction, principle, instrumentation and application of DSC, DTA and TGA.

b). Raman Spectroscopy

Introduction, Principle, Instrumentation and Applications.

c). Radio immuno assay

Biological standardization , bioassay, ELISA, Radioimmuno assay of digitalis and insulin.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
5. Quantitative analysis of Pharmaceutical formulations by HPTLC - P D Sethi, CBS Publishers, New Delhi.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series

ADVANCED ORGANIC CHEMISTRY - II
(MPC 202T)

Scope

The subject is designed to provide in-depth knowledge about advances in organic chemistry, different techniques of organic synthesis and their applications to process chemistry as well as drug discovery.

Objectives

Upon completion of course, the student shall able to understand

- The principles and applications of Green chemistry
- The concept of peptide chemistry.
- The various catalysts used in organic reactions
- The concept of stereochemistry and asymmetric synthesis.

THEORY 60 Hrs

1. Green Chemistry: 12 Hrs
   a. Introduction, principles of green chemistry
   b. Microwave assisted reactions: Merit and demerits of its use, increased reaction rates, mechanism, superheating effects of microwave, effects of solvents in microwave assisted synthesis, microwave technology in process optimization, its applications in various organic reactions and heterocycles synthesis
   c. Ultrasound assisted reactions: Types of sonochemical reactions, homogenous, heterogeneous liquid-liquid and liquid-solid reactions, synthetic applications
   d. Continuous flow reactors: Working principle, advantages and synthetic applications.
2. Chemistry of peptides 12 Hrs
   a. Coupling reactions in peptide synthesis
   b. Principles of solid phase peptide synthesis, t-BOC and FMOC protocols, various solid supports and linkers: Activation procedures, peptide bond formation, deprotection and cleavage from resin, low and high HF cleavage protocols, formation of free peptides and peptide amides, purification and case studies, site-specific chemical modifications of peptides
   c. Segment and sequential strategies for solution phase peptide synthesis with any two case studies
   d. Side reactions in peptide synthesis: Deletion peptides, side

reactions initiated by proton abstraction, protonation, over-activation and side reactions of individual amino acids.

3 Photochemical Reactions 12 Hrs

Basic principles of photochemical reactions. Photo-oxidation, photo-addition and photo-fragmentation.

Pericyclic reactions

Mechanism, Types of pericyclic reactions such as cyclo addition, electrocyclic reaction and sigmatrophic rearrangement reactions with examples

4 Catalysis: 12 Hrs

a. Types of catalysis, heterogeneous and homogenous catalysis, advantages and disadvantages
b. Heterogeneous catalysis – preparation, characterization, kinetics, supported catalysts, catalyst deactivation and regeneration, some examples of heterogeneous catalysis used in synthesis of drugs.
c. Homogenous catalysis, hydrogenation, hydroformylation, hydrocyanation, Wilkinson catalysts, chiral ligands and chiral induction, Ziegler-Natta catalysts, some examples of homogenous catalysis used in synthesis of drugs
d. Transition-metal and Organo-catalysis in organic synthesis: Metal-catalyzed reactions
e. Biocatalysis: Use of enzymes in organic synthesis, immobilized enzymes/cells in organic reaction.
f. Phase transfer catalysis - theory and applications

5 Stereochemistry & Asymmetric Synthesis 12 Hrs

a. Basic concepts in stereochemistry – optical activity, specific rotation, racemates and resolution of racemates, the Cahn, Ingold, Prelog (CIP) sequence rule, meso compounds, pseudo asymmetric centres, axes of symmetry, Fischers D and L notation, cis-trans isomerism, E and Z notation.
b. Methods of asymmetric synthesis using chiral pool, chiral auxiliaries and catalytic asymmetric synthesis, enantiopure separation and Stereo selective synthesis with examples.

REFERENCES

1. "Advanced Organic chemistry, Reaction, mechanisms and structure", J March, John Wiley and sons, New York.
2. "Mechanism and structure in organic chemistry", ES Gould, Hold Rinchart and Winston,NewYork.
3. "Organic Chemistry" Clayden, Greeves, Warren and Woihers., Oxford University Press 2001.
4. "Organic Chemistry" Vol I and II. I.L. Finar. ELBS, Sixth ed., 1995.
5. Carey, Organic chemistry, 5th edition (Viva Books Pvt. Ltd.)
6. Organic synthesis-the disconnection approach, S. Warren, Wily India
7. Principles of organic synthesis, ROCNorman and JMCoxan, Nelson thorns
8. Organic synthesis- Special techniques VK Ahluwalia and R Aggarwal, Narosa Publishers.
9. Organic reaction mechanisms IV edtn, VK Ahluwalia and RK Parashar, Narosa Publishers.

COMPUTER AIDED DRUG DESIGN
(MPC 203T)

Scope

The subject is designed to impart knowledge on the current state of the art techniques involved in computer assisted drug design.

Objectives

At completion of this course it is expected that students will be able to understand

- Role of CADD in drug discovery
- Different CADD techniques and their applications
- Various strategies to design and develop new drug like molecules.
- Working with molecular modeling softwares to design new drug molecules
- The in silico virtual screening protocols

Theory — 60 Hrs

1. Introduction to Computer Aided Drug Design (CADD) — 12 Hrs

   History, different techniques and applications.

   Quantitative Structure Activity Relationships: Basics

   History and development of QSAR: Physicochemical parameters and methods to calculate physicochemical parameters: Hammett equation and electronic parameters (sigma), lipophilicity effects and parameters (log P, pi-substituent constant), steric effects (Taft steric and MR parameters) Experimental and theoretical approaches for the determination of these physicochemical parameters.

2 Quantitative Structure Activity Relationships: Applications — 12 Hrs

   Hansch analysis, Free Wilson analysis and relationship between them, Advantages and disadvantages; Deriving 2D-QSAR equations.

   3D-QSAR approaches and contour map analysis.

   Statistical methods used in QSAR analysis and importance of statistical parameters.

3 Molecular Modeling and Docking — 12 Hrs

   a) Molecular and Quantum Mechanics in drug design.

   b) Energy Minimization Methods: comparison between global

minimum conformation and bioactive conformation

c) Molecular docking and drug receptor interactions: Rigid docking, flexible docking and extra-precision docking. Agents acting on enzymes such as DHFR, HMG-CoA reductase and HIV protease, choline esterase (AchE & BchE)

4 Molecular Properties and Drug Design 12 Hrs

a) Prediction and analysis of ADMET properties of new molecules and its importance in drug design.

b) De novo drug design: Receptor/enzyme-interaction and its analysis, Receptor/enzyme cavity size prediction, predicting the functional components of cavities, Fragment based drug design.

c) Homology modeling and generation of 3D-structure of protein.

5 Pharmacophore Mapping and Virtual Screening 12 Hrs

Concept of pharmacophore, pharmacophore mapping, identification of Pharmacophore features and Pharmacophore modeling; Conformational search used in pharmacophore mapping.

In Silico Drug Design and Virtual Screening Techniques

Similarity based methods and Pharmacophore based screening, structure based In-silico virtual screening protocols.

REFERENCES

1. Computational and structural approaches to drug discovery, Robert M Stroud and Janet. F Moore, RCS Publishers.
2. Introduction to Quantitative Drug Design by Y.C. Martin, CRC Press, Taylor & Francis group..
3. Drug Design by Ariens Volume 1 to 10, Academic Press, 1975, Elsevier Publishers.
4. Principles of Drug Design by Smith and Williams, CRC Press, Taylor & Francis.
5. The Organic Chemistry of the Drug Design and Drug action by Richard B. Silverman, Elsevier Publishers.
6. Medicinal Chemistry by Burger, Wiley Publishing Co.

7. An Introduction to Medicinal Chemistry –Graham L. Patrick, Oxford University Press.
8. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Ippincott Williams & Wilkins.
9. Comprehensive Medicinal Chemistry – Corwin and Hansch, Pergamon Publishers.
10. Computational and structural approaches to drug design edited by Robert M Stroud and Janet. F Moore

PHARMACEUTICAL PROCESS CHEMISTRY
(MPC 204T)

Scope

Process chemistry is often described as scale up reactions, taking them from small quantities created in the research lab to the larger quantities that are needed for further testing and then to even larger quantities required for commercial production. The goal of a process chemist is to develop synthetic routes that are safe, cost-effective, environmentally friendly, and efficient. The subject is designed to impart knowledge on the development and optimization of a synthetic route/s and the pilot plant procedure for the manufacture of Active Pharmaceutical Ingredients (APIs) and new chemical entities (NCEs) for the drug development phase.

Objectives

At completion of this course it is expected that students will be able to understand

- The strategies of scale up process of apis and intermediates
- The various unit operations and various reactions in process chemistry

THEORY — 60 Hrs

1. Process chemistry — 12 Hrs

Introduction, Synthetic strategy

Stages of scale up process: Bench, pilot and large scale process.

In-process control and validation of large scale process.

Case studies of some scale up process of APIs.

Impurities in API, types and their sources including genotoxic impurities

2 Unit operations — 12 Hrs

a) Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction.
b) Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration,
c) Distillation: azeotropic and steam distillation
d) Evaporation: Types of evaporators, factors affecting evaporation.
e) Crystallization: Crystallization from aqueous, non-aqueous solutions factors affecting crystallization, nucleation. Principle and general methods of Preparation of polymorphs, hydrates, solvates and amorphous APIs.

3 Unit Processes - I 12 Hrs

a) Nitration: Nitrating agents, Aromatic nitration, kinetics and mechanism of aromatic nitration, process equipment for technical nitration, mixed acid for nitration,

b) Halogenation: Kinetics of halogenations, types of halogenations, catalytic halogenations. Case study on industrial halogenation process.

c) Oxidation: Introduction, types of oxidative reactions, Liquid phase oxidation with oxidizing agents. Nonmetallic Oxidizing agents such as H_2O_2, sodium hypochlorite, Oxygen gas, ozonolysis.

4 Unit Processes - II 12 Hrs

a) Reduction: Catalytic hydrogenation, Heterogeneous and homogeneous catalyst; Hydrogen transfer reactions, Metal hydrides. Case study on industrial reduction process.

b) Fermentation: Aerobic and anaerobic fermentation. Production of

i. Antibiotics; Penicillin and Streptomycin,
ii. Vitamins: B2 and B12
iii. Statins: Lovastatin, Simvastatin

c) Reaction progress kinetic analysis

i. Streamlining reaction steps, route selection,
ii. Characteristics of expedient routes, characteristics of cost-effective routes, reagent selection, families of reagents useful for scale-up.

5 Industrial Safety 12 Hrs

a) MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal Protection Equipment (PPE)

b) Fire hazards, types of fire & fire extinguishers

c) Occupational Health & Safety Assessment Series 1800 (OHSAS-1800) and ISO-14001(Environmental Management System), Effluents and its management

REFERENCES

1. Process Chemistry in the Pharmaceutical Industry: Challenges in an Ever-Changing Climate-An Overview; K. Gadamasetti, CRC Press.
2. Pharmaceutical Manufacturing Encyclopedia, 3rd edition, Volume 2.
3. Medicinal Chemistry by Burger, 6th edition, Volume 1-8.
4. W.L. McCabe, J.C Smith, Peter Harriott. Unit operations of chemical engineering, 7th edition, McGraw Hill
5. Polymorphism in Pharmaceutical Solids .Dekker Series Volume 95 Ed: H G Brittain (1999)
6. Regina M. Murphy: Introduction to Chemical Processes: Principles, Analysis, Synthesis
7. Peter J. Harrington: Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up
8. P.H.Groggins: Unit processes in organic synthesis (MGH)
9. F.A.Henglein: Chemical Technology (Pergamon)
10. M.Gopal: Dryden's Outlines of Chemical Technology, WEP East-West Press
11. Clausen,Mattson: Principle of Industrial Chemistry, Wiley Publishing Co.,
12. Lowenheim & M.K. Moran: Industrial Chemicals
13. S.D. Shukla & G.N. Pandey: A text book of Chemical Technology Vol. II, Vikas Publishing House
14. J.K. Stille: Industrial Organic Chemistry (PH)
15. Shreve: Chemical Process, Mc Grawhill.
16. B.K.Sharma: Industrial Chemistry, Goel Publishing House
17. ICH Guidelines
18. United States Food and Drug Administration official website www.fda.gov

PHARMACEUTICAL CHEMISTRY PRACTICALS – II
(MPC 205P)

1. Synthesis of organic compounds by adapting different approaches involving (3 experiments)
   a) Oxidation
   b) Reduction/hydrogenation
   c) Nitration
2. Comparative study of synthesis of APIs/intermediates by different synthetic routes (2 experiments)
3. Assignments on regulatory requirements in API (2 experiments)
4. Comparison of absorption spectra by UV and Wood ward – Fieser rule
5. Interpretation of organic compounds by FT-IR
6. Interpretation of organic compounds by NMR
7. Interpretation of organic compounds by MS
8. Determination of purity by DSC in pharmaceuticals
9. Identification of organic compounds using FT-IR, NMR, CNMR and Mass spectra
10. To carry out the preparation of following organic compounds
11. Preparation of 4-chlorobenzhydrylpiperazine. (an intermediate for cetirizine HCl).
12. Preparation of 4-iodotolene from p-toluidine.
13. $NaBH_4$ reduction of vanillin to vanillyl alcohol
14. Preparation of umbelliferone by Pechhman reaction
15. Preparation of triphenyl imidazole
16. To perform the Microwave irradiated reactions of synthetic importance (Any two)
17. Determination of log P, MR, hydrogen bond donors and acceptors of selected drugs using softwares
18. Calculation of ADMET properties of drug molecules and its analysis using softwares
    Pharmacophore modeling
19. 2D-QSAR based experiments
20. 3D-QSAR based experiments
21. Docking study based experiment
22. Virtual screening based experiment

PHARMACEUTICALANALYSIS(MPA)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPA 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know about chemicals and excipients

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

	THEORY	60 Hrs
1.	a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. c. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence (Characterestics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	10 Hrs
2	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy.	10 Hrs
3	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass	10

	Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	Hrs
4	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: a. Thin Layer chromatography b. High Performance Thin Layer Chromatography c. Ion exchange chromatography d. Column chromatography e. Gas chromatography f. High Performance Liquid chromatography g. Ultra High Performance Liquid chromatography h. Affinity chromatography i. Gel Chromatography	10 Hrs
5	a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction	10 Hrs
6	Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation	10 Hrs

and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

ADVANCED PHARMACEUTICAL ANALYSIS
(MPA 102T)

Scope

This subject deals with the various aspects of Impurity, Impurities in new drug products, in residual solvents, Elemental impurities, Impurity profiling and characterization of degradents, Stability testing of phytopharmaceuticals and their protocol preparation. It also covers the biological testing of various vaccines and their principle and procedure.

Objective

After completion of the course students shall able to know,

- Appropriate analytical skills required for the analytical method development.
- Principles of various reagents used in functional group analysis that renders necessary support in research methodology and demonstrates its application in the practical related problems.
- Analysis of impurities in drugs, residual solvents and stability studies of drugs and biological products

THEORY 60 Hrs

1. Impurity and stability studies: 10 Hrs

Definition, classification of impurities in drug Substance or Active Pharmaceutical Ingredients and quantification of impurities as per ICH guidelines

Impurities in new drug products:

Rationale for the reporting and control of degradation products, reporting degradation products content of batches, listing of degradation products in specifications, qualification of degradation products

Impurities in residual solvents:

General principles, classification of residual solvents, Analytical procedures, limits of residual solvents, reporting levels of residual solvents

2 Elemental impurities: 10 Hrs

Element classification, control of elemental impurities, Potential Sources of elemental Impurities, Identification of Potential Elemental Impurities, analytical procedures, instrumentation & C, H, N and S analysis

Stability testing protocols:

Selection of batches, container orientation, test parameters, sampling frequency, specification, storage conditions, recording of results, concept of stability, commitment etc. Important mechanistic and stability related information provided by results of study of factors like temperature, pH, buffering species ionic strength and dielectric constant etc. on the reaction rates. With practical considerations.

3	Impurity profiling and degradent characterization: Method development, Stability studies and concepts of validation accelerated stability testing & shelf life calculation, WHO and ICH stability testing guidelines, Stability zones, steps in development, practical considerations. Basics of impurity profiling and degradent characterization with special emphasis. Photostability testing guidelines, ICH stability guidelines for biological products	10 Hrs
4	Stability testing of phytopharmaceuticals: Regulatory requirements, protocols, HPTLC/HPLC finger printing, interactions and complexity.	10 Hrs
5	Biological tests and assays of the following: a. Adsorbed Tetanus vaccine b. Adsorbed Diphtheria vaccine c. Human anti haemophilic vaccine d. Rabies vaccine e. Tetanus Anti toxin f. Tetanus Anti serum g. Oxytocin h. Heparin sodium IP i. Antivenom. PCR, PCR studies for gene regulation, instrumentation (Principle and Procedures)	10 Hrs
6	Immunoassays (IA) Basic principles, Production of antibodies, Separation of bound and unbound drug, Radioimmunoassay, Optical IA, Enzyme IA, Fluoro IA, Luminiscence IA, Quantification and applications of IA.	10 Hrs

REFERENCES

1. Vogel's textbook of quantitative chemical analysis - Jeffery J Bassett, J. Mendham, R. C. Denney, 5th edition, ELBS, 1991.
2. Practical Pharmaceutical Chemistry - Beckett and Stenlake, Vol II, 4th Edition, CBS publishers, New Delhi, 1997.
3. Textbook of Pharmaceutical Analysis - K A Connors, 3rd Edition, John Wiley & Sons, 1982.

4. Pharmaceutical Analysis - Higuchi, Brochmman and Hassen, 2nd Edition, Wiley – Inter science Publication, 1961.
5. Quantitative Analysis of Drugs in Pharmaceutical formulation – P D Sethi, 3rd Edition, CBS Publishers New Delhi, 1997.
6. Pharmaceutical Analysis- Modern methods - J W Munson – Part B, Volume 11, Marcel Dekker Series.
7. The Quantitative analysis of Drugs - D C Carratt, 3rd edition, CBS Publishers, NewDelhi, 1964.
8. Indian Pharmacopoeia Vol I , II & III 2007, 2010, 2014.
9. Methods of sampling and microbiological examination of water, first revision, BIS
10. Practical HPLC method development – Snyder, Kirkland, Glajch, 2nd edition, John Wiley & Sons.
11. Analytical Profiles of drug substances – Klaus Florey, Volume 1 – 20, Elsevier, 2005
12. Analytical Profiles of drug substances and Excipients – Harry G Brittan, Volume 21 – 30, Elsevier, 2005.
13. The analysis of drugs in biological fluids - Joseph Chamberlain, 2nd edition, CRC press, London.
14. ICH Guidelines for impurity profiles and stability studies.

PHARMACEUTICAL VALIDATION
(MPA 103T)

Scope

The main purpose of the subject is to understand about validation and how it can be applied to industry and thus to improve the quality of the products. The subject covers the complete information about validation, types, methodology and application.

Objectives

Upon completion of the subject student shall be able to

- Explain the aspect of validation
- Carryout validation of manufacturing processes
- Apply the knowledge of validation to instruments and equipments
- Validate the manufacturing facilities

THEORY 60 Hrs

1.	Introduction: Definition of Qualification and Validation, Advantage of Validation, Streamlining of Qualification & Validation process and Validation Master Plan. Qualification: User Requirement Specification, Design Qualification, Factory Acceptance Test (FAT)/ Site Acceptance Test (SAT), Installation Qualification, Operational Qualification, Performance Qualification, Re- Qualification (Maintaining status- Calibration Preventive Maintenance, Change management), Qualification of Manufacturing Equipments, Qualification of Analytical Instruments and Laboratory equipments.	12 Hrs
2	Qualification of analytical instruments: Electronic balance, pH meter, UV-Visible spectrophotometer, FTIR, GC, HPLC, HPTLC Qualification of Glassware: Volumetric flask, pipette, Measuring cylinder, beakers and burette.	12 Hrs
3	Validation of Utility systems: Pharmaceutical Water System & pure steam, HVAC system, Compressed air and nitrogen. Cleaning Validation: Cleaning Validation - Cleaning Method development, Validation and validation of analytical method used in cleaning. Cleaning of Equipment, Cleaning of Facilities. Cleaning in place (CIP).	12 Hrs
4	Analytical method validation: General principles, Validation of analytical method as per ICH guidelines and USP.	12 Hrs

Computerized system validation: Electronic records and digital significance-21 CFR part 11 and GAMP 5.

5	General Principles of Intellectual Property: Concepts of Intellectual Property (IP), Intellectual Property Protection (IPP), Intellectual Property Rights (IPR); Economic importance, mechanism for protection of Intellectual Property –patents, Copyright, Trademark; Factors affecting choice of IP protection; Penalties for violation; Role of IP in pharmaceutical industry; Global ramification and financial implications. Filing a patent applications; patent application forms and guidelines. Types patent applications-provisional and non-provisional, PCT and convention patent applications; International patenting requirement procedures and costs; Rights and responsibilities of a patentee; Practical aspects regarding maintaining of a Patent file; Patent infringement meaning and scope. Significance of transfer technology (TOT), IP and ethics-positive and negative aspects of IPP; Societal responsibility, avoiding unethical practices.	12 Hrs

REFERENCES

1. B. T. Loftus & R. A. Nash, "Pharmaceutical Process Validation", Drugs and Pharm Sci. Series, Vol. 129, 3rd Ed., Marcel Dekker Inc., N.Y.
2. The Theory & Practice of Industrial Pharmacy, 3rd edition, Leon Lachman, Herbert A. Lieberman, Joseph. L. Karig, Varghese Publishing House, Bombay.
3. Validation Master plan by Terveeks or Deeks, Davis Harwood International publishing.
4. Validation of Aseptic Pharmaceutical Processes, 2nd Edition, by Carleton & Agalloco, (Marcel Dekker).
5. Michael Levin, Pharmaceutical Process Scale-Up‖, Drugs and Pharm. Sci. Series, Vol. 157,2nd Ed., Marcel Dekker Inc., N.Y.
6. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider
7. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. Cloud, Interpharm Press
8. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2nd Ed.
9. Analytical Method validation and Instrument Performance Verification by Churg Chan, Heiman Lam, Y.C. Lee, Yue. Zhang, Wiley Inter Science.

FOOD ANALYSIS
(MPA 104T)

Scope

This course is designed to impart knowledge on analysis of food constituents and finished food products. The course includes application of instrumental analysis in the determination of pesticides in variety of food products.

Objectives

At completion of this course student shall be able to understand various analytical techniques in the determination of

- Food constituents
- Food additives
- Finished food products
- Pesticides in food
- And also student shall have the knowledge on food regulations and legislations

THEORY 60 Hrs

1. Carbohydrates: classification and properties of food carbohydrates, General methods of analysis of food carbohydrates, Changes in food carbohydrates during processing, Digestion, absorption and metabolism of carbohydrates, Dietary fibre, Crude fibre and application of food carbohydrates 12 Hrs
   Proteins: Chemistry and classification of amino acids and proteins, Physico-Chemical properties of protein and their structure, general methods of analysis of proteins and amino acids, Digestion, absorption and metabolism of proteins.

2 Lipids: Classification, general methods of analysis, refining of fats and oils; hydrogenation of vegetable oils, Determination of adulteration in fats and oils, Various methods used for measurement of spoilage of fats and fatty foods. 12 Hrs
   Vitamins: classification of vitamins, methods of analysis of vitamins, Principles of microbial assay of vitamins of B-series.

3 Food additives: Introduction, analysis of Preservatives, antioxidants, artificial sweeteners, flavors, flavor enhancers, stabilizers, thickening and jelling agents. 12 Hrs
   Pigments and synthetic dyes: Natural pigments, their occurrence and characteristic properties, permitted synthetic

dyes, Non-permitted synthetic dyes used by industries, Method of detection of natural, permitted and non-permitted dyes.

4	General Analytical methods for milk, milk constituents and milk products like ice cream, milk powder, butter, margarine, cheese including adulterants and contaminants of milk. Analysis of fermentation products like wine, spirits, beer and vinegar.	12 Hrs
5	Pesticide analysis: Effects of pest and insects on various food, use of pesticides in agriculture, pesticide cycle, organophosphorus and organochlorine pesticides analysis, determination of pesticide residues in grain, fruits, vegetables, milk and milk products. Legislation regulations of food products with special emphasis on BIS, Agmark, FDA and US-FDA.	12 Hrs

REFERENCES

1. The chemical analysis of foods – David Pearson, Seventh edition, Churchill Livingstone, Edinburgh London, 1976
2. Introduction to the Chemical analysis of foods – S. Nielsen, Jones & Bartlett publishers, Boston London, 1994.
3. Official methods of analysis of AOAC International, sixth edition, Volume I & II, 1997.
4. Analysis of Food constituents – Multon, Wiley VCH.
5. Dr. William Horwitz, Official methods of analysis of AOAC International, 18th edition, 2005.

PHARMACEUTICAL ANALYSIS PRACTICALS - II
(MPA 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. Assay of official compounds by different titrations
8. Assay of official compounds by instrumental techniques.
9. Quantitative determination of hydroxyl group.
10. Quantitative determination of amino group
11. Colorimetric determination of drugs by using different reagents
12. Imupurity profiling of drugs
13. Calibration of glasswares
14. Calibration of pH meter
15. Calibration of UV-Visible spectrophotometer
16. Calibration of FTIR spectrophotometer
17. Calibration of GC instrument
18. Calibration of HPLC instrument
19. Cleaning validation of any one equipment
20. Determination of total reducing sugar
21. Determination of proteins
22. Determination of saponification value, Iodine value, Peroxide value, Acid value in food products
23. Determination of fat content and rancidity in food products
24. Analysis of natural and synthetic colors in food
25. Determination of preservatives in food
26. Determination of pesticide residue in food products
27. Analysis of vitamin content in food products
28. Determination of density and specific gravity of foods
29. Determination of food additives

ADVANCED INSTRUMENTAL ANALYSIS
(MPA 201T)

Scope

This subject deals with various hyphenated analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are LC-MS, GC-MS, and hyphenated techniques.

Objectives

After completion of course student is able to know,

- interpretation of the NMR, Mass and IR spectra of various organic compounds
- theoretical and practical skills of the hyphenated instruments
- identification of organic compounds

THEORY 60 Hrs

1.	HPLC: Principle, instrumentation, pharmaceutical applications, peak shapes, capacity factor, selectivity, plate number, plate height, resolution, band broadening, pumps, injector, detectors, columns, column problems, gradient HPLC, HPLC solvents, trouble shooting, sample preparation, method development, New developments in HPLC-role and principles of ultra, nano liquid chromatography in pharmaceutical analysis. Immobilized polysaccharide CSP's: Advancement in enantiomeric separations, revised phase Chiral method development and HILIC approaches. HPLC in Chiral analysis of pharmaceuticals. Preparative HPLC, practical aspects of preparative HPLC.	12 Hrs
2	Biochromatography: Size exclusion chromatography, ion exchange chromatography, ion pair chromatography, affinity chromatography general principles, stationary phases and mobile phases. Gas chromatography: Principles, instrumentation, derivatization, head space sampling, columns for GC, detectors, quantification. High performance Thin Layer chromatography: Principles, instrumentation, pharmaceutical applications.	12 Hrs
3	Super critical fluid chromatography: Principles, instrumentation, pharmaceutical applications. Capillary electrophoresis: Overview of CE in pharmaceutical analysis, basic configuration, CE characteristics, principles of CE, methods and modes of CE. General considerations and method	12 Hrs

development in CE, Crown ethers as buffer additives in capillary electrophoresis. CE-MS hyphenation.

4 Mass spectrometry: Principle, theory, instrumentation of mass spectrometry, different types of ionization like electron impact, chemical, field, FAB and MALD, APCI, ESI, APPI mass fragmentation and its rules, meta stable ions, isotopic peaks and applications of mass spectrometry. LC-MS hyphenation and DART MS analysis. Mass analysers (Quadrpole, Time of flight, FT-ICR, ion trap and Orbitrap) instruments. MS/MS systems (Tandem: QqQ, TOF-TOF;Q-IT, Q-TOF, LTQ-FT, LTQ-Orbitrap. 12 Hrs

5 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR with reference to 13CNMR: Spin spin and spin lattice relaxation phenomenon. 13C NMR, 1-D and 2-D NMR, NOESY and COSY techniques, Interpretation and Applications of NMR spectroscopy. LC-NMR hyphenations. 12 Hrs

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
5. Quantitative analysis of Pharmaceutical formulations by HPTLC - P D Sethi, CBS Publishers, New Delhi.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series.
8. Organic Spectroscopy by Donald L. Paviya, 5th Edition.

MODERN BIO-ANALYTICAL TECHNIQUES
(MPA 202T)

Scope

This subject is designed to provide detailed knowledge about the importance of analysis of drugs in biological matrices.

Objectives

Upon completion of the course, the student shall be able to understand

- Extraction of drugs from biological samples
- Separation of drugs from biological samples using different techniques
- Guidelines for BA/BE studies.

THEORY 60 Hrs

1. Extraction of drugs and metabolites from biological matrices: General need, principle and procedure involved in the Bioanalytical methods such as Protein precipitation, Liquid - Liquid extraction and Solid phase extraction and other novel sample preparation approach. Bioanalytical method validation: USFDA and EMEA guidelines. — 12 Hrs

2 Biopharmaceutical Consideration: Introduction, Biopharmaceutical Factors Affecting Drug Bioavailability, In Vitro: Dissolution and Drug Release Testing, Alternative Methods of Dissolution Testing Transport models, Biopharmaceutics Classification System. Solubility: Experimental methods. Permeability: In-vitro, in-situ and In-vivo methods. — 12 Hrs

3 Pharmacokinetics and Toxicokinetics: Basic consideration, Drug interaction (PK-PD interactions), The effect of protein-binding interactions, The effect of tissue-binding interactions, Cytochrome P450-based drug interactions, Drug interactions linked to transporters. Microsomal assays Toxicokinetics-Toxicokinetic evaluation in preclinical studies, Importance and applications of toxicokinetic studies. LC-MS in bioactivity screening and proteomics. — 12 Hrs

4 Cell culture techniques Basic equipments used in cell culture lab. Cell culture media, various types of cell culture, general procedure for cell cultures; isolation of cells, subculture, cryopreservation, characterization of — 12 Hrs

cells and their applications. Principles and applications of cell viability assays (MTT assays), Principles and applications of flow cytometry.

5 Metabolite identification: 12 Hrs

In-vitro / in-vivo approaches, protocols and sample preparation. Microsomal approaches (Rat liver microsomes (RLM) and Human liver microsomes (HLM) in Met –ID. Regulatory perspectives. In-vitro assay of drug metabolites & drug metabolizing enzymes.

Drug Product Performance, In Vivo: Bioavailability and Bioequivalence:

Drug Product Performance, Purpose of Bioavailability Studies, Relative and Absolute Availability. Methods for Assessing Bioavailability, Bioequivalence Studies, Design and Evaluation of Bioequivalence Studies, Study Designs, Crossover Study Designs, Generic Biologics (Biosimilar Drug Products), Clinical Significance of Bioequivalence Studies.

REFERENCES

1. Analysis of drugs in Biological fluids - Joseph Chamberlain, 2nd Edition. CRC Press, Newyork. 1995.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Pharmaceutical Analysis - Higuchi, Brochmman and Hassen, 2nd Edition, Wiley – Interscience Publications, 1961.
4. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series
5. Practical HPLC method Development – Snyder, Kirkland, Glaich, 2nd Edition, John Wiley & Sons, New Jercy. USA.
6. Chromatographic Analysis of Pharmaceuticals – John A Adamovics, 2nd Edition, Marcel Dekker, Newyork, USA. 1997.
7. Chromatographic methods in clinical chemistry & Toxicology – Roger L Bertholf, Ruth E Winecker, John Wiley & Sons, New Jercy, USA. 2007.
8. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69, Marcel Dekker Series, 1995.
9. Good laboratory Practice Regulations – Allen F. Hirsch, Volume 38, Marcel Dekker Series, 1989.
10. ICH, USFDA & CDSCO Guidelines.
11. Palmer

QUALITY CONTROL AND QUALITY ASSURANCE
(MPA 203T)

Scope

This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

Objectives

At the completion of this subject it is expected that the student shall be able to know

- the cGMP aspects in a pharmaceutical industry
- to appreciate the importance of documentation
- to understand the scope of quality certifications applicable to Pharmaceutical industries
- to understand the responsibilities of QA & QC departments

THEORY 60 hrs

1. Concept and Evolution of Quality Control and Quality Assurance — 12 Hrs
   Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines.
   Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation.

2. cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention (PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice. CPCSEA guidelines. — 12 Hrs

3. Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3) — 12 Hrs

Purchase specifications and maintenance of stores for raw materials. In process quality control and finished products quality control for following formulation in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias), Quality control test for containers, closures and secondary packing materials.

4. Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Formula Record, Batch Formula Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data. 12 Hrs

5. Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging. 12 Hrs

REFERENCES

1. Quality Assurance Guide by organization of Pharmaceutical Procedures of India, 3rd revised edition, Volume I & II, Mumbai, 1996.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69, Marcel Dekker Series, 1995.
3. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2nd edition, WHO Publications, 1999.
4. How to Practice GMP's – P P Sharma, Vandana Publications, Agra, 1991.
5. The International Pharmacopoeia – vol I, II, III, IV & V - General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excepients and Dosage forms, 3rd edition, WHO, Geneva, 2005.
6. Good laboratory Practice Regulations – Allen F. Hirsch, Volume 38, Marcel Dekker Series, 1989.
7. ICH guidelines
8. ISO 9000 and total quality management

9. The drugs and cosmetics act 1940 – Deshpande, Nilesh Gandhi, 4th edition, Susmit Publishers, 2006.
10. QA Manual – D.H. Shah, 1st edition, Business Horizons, 2000.
11. Good Manufacturing Practices for Pharmaceuticals a plan for total quality control – Sidney H. Willig, Vol. 52, 3rd edition, Marcel Dekker Series.
12. Steinborn L. GMP/ISO Quality Audit Manual for Healthcare Manufacturers and Their Suppliers, Sixth Edition, (Volume 1 - With Checklists and Software Package). Taylor & Francis; 2003.
13. Sarker DK. Quality Systems and Controls for Pharmaceuticals. John Wiley & Sons; 2008.

HERBAL AND COSMETIC ANALYSIS
(MPA 204T)

Scope

This course is designed to impart knowledge on analysis of herbal products. Regulatory requirements, herbal drug interaction with monographs. Performance evaluation of cosmetic products is included for the better understanding of the equipments used in cosmetic industries for the purpose.

Objectives

At completion of this course student shall be able to understand

- Determination of herbal remedies and regulations
- Analysis of natural products and monographs
- Determination of Herbal drug-drug interaction
- Principles of performance evaluation of cosmetic products.

THEORY 60 Hrs

1. Herbal remedies- Toxicity and Regulations: Herbals vs Conventional drugs, Efficacy of herbal medicine products, Validation of Herbal Therapies, Pharmacodynamic and Pharmacokinetic issues. Herbal drug standardization: WHO and AYUSH guidelines. — 12 Hrs

2 Adulteration and Deterioration: Introduction, types of adulteration/substitution of herbal drugs, Causes and Measure of adulteration, Sampling Procedures, Determination of Foreign Matter, DNA Finger printing techniques in identification of drugs of natural origin, heavy metals, pesticide residues, phototoxin and microbial contamination in herbal formulations. — 12 Hrs

Regulatory requirements for setting herbal drug industry: Global marketing management, Indian and international patent law as applicable herbal drugs and natural products and its protocol.

3 Testing of natural products and drugs: Effect of herbal medicine on clinical laboratory testing, Adulterant Screening using modern analytical instruments, Regulation and dispensing of herbal drugs, Stability testing of natural products, protocol. — 12 Hrs

Monographs of Herbal drugs: Study of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic

Pharmacopoeia, American herbal Pharmacopoeia, British herbal Pharmacopoeia, Siddha and Unani Pharmacopoeia, WHO guidelines in quality assessment of herbal drugs.

4 Herbal drug-drug interaction: WHO and AYUSH guidelines for safety monitoring of natural medicine, Spontaneous reporting schemes for bio drug adverse reactions, bio drug-drug and bio drug-food interactions with suitable examples. Challenges in monitoring the safety of herbal medicines. 12 Hrs

5 Evaluation of cosmetic products: Determination of acid value, ester value, saponification value, iodine value, peroxide value, rancidity, moisture, ash, volatile matter, heavy metals, fineness of powder, density, viscosity of cosmetic raw materials and finished products. Study of quality of raw materials and general methods of analysis of raw material used in cosmetic manufacture as per BIS.

Indian Standard specification laid down for sampling and testing of various cosmetics in finished forms such as baby care products, skin care products, dental products, personal hygiene preparations, lips sticks. Hair products and skin creams by the Bureau Indian Standards. 12 Hrs

REFERENCES

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Quality Control Methods for Medicinal Plant, WHO, Geneva
4. Pharmacognosy & Pharmacobiotechnology by Ashutosh Kar
5. Essential of Pharmacognosy by Dr.S.H.Ansari
6. Cosmetics – Formulation, Manufacturing and Quality Control, P.P. Sharma, 4th edition, Vandana Publications Pvt. Ltd., Delhi
7. Indian Standard specification, for raw materials, BIS, New Delhi.
8. Indian Standard specification for 28 finished cosmetics BIS, New Delhi
9. Harry's Cosmeticology 8th edition
10. Suppliers catalogue on specialized cosmetic excipients
11. Wilkinson, Moore, seventh edition, George Godwin. Poucher's Perfumes, Cosmetics and Soaps
12. Hilda Butler, 10th Edition, Kluwer Academic Publishers. Handbook of Cosmetic Science and Technology, 3rd Edition,

PHARMACEUTICAL ANALYSIS PRACTICALS - I
(MPA 205P)

1. Comparison of absorption spectra by UV and Wood ward – Fiesure rule
2. Interpretation of organic compounds by FT-IR
3. Interpretation of organic compounds by NMR
4. Interpretation of organic compounds by MS
5. Determination of purity by DSC in pharmaceuticals
6. Identification of organic compounds using FT-IR, NMR, CNMR and Mass spectra
7. Bio molecules separation utilizing various sample preparation techniques and Quantitative analysis of components by gel electrophoresis.
8. Bio molecules separation utilizing various sample preparation techniques and Quantitative analysis of components by HPLC techniques.
9. Isolation of analgesics from biological fluids (Blood serum and urine).
10. Protocol preparation and performance of analytical/Bioanalytical method validation.
11. Protocol preparation for the conduct of BA/BE studies according to guidelines.
12. In process and finished product quality control tests for tablets, capsules, parenterals and creams
13. Quality control tests for Primary and secondary packing materials
14. Assay of raw materials as per official monographs
15. Testing of related and foreign substances in drugs and raw materials
16. Preparation of Master Formula Record.
17. Preparation of Batch Manufacturing Record.
18. Quantitative analysis of rancidity in lipsticks and hair oil
19. Determination of aryl amine content and Developer in hair dye
20. Determination of foam height and SLS content of Shampoo.
21. Determination of total fatty matter in creams (Soap, skin and hair creams)
22. Determination of acid value and saponification value.
23. Determination of calcium thioglycolate in depilatories

PHARMACEUTICALQUALITYASSURANCE(MQA)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MQA 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know about chemicals and excipients

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY 60 Hrs

1. a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. — 12 Hrs

   b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.

   c. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence (Characterestics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

   d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy. — 12 Hrs

3	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	12 Hrs
4	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: • Thin Layer chromatography • High Performance Thin Layer Chromatography • Ion exchange chromatography • Column chromatography • Gas chromatography • High Performance Liquid chromatography • Ultra High Performance Liquid chromatography • Affinity chromatography • Gel Chromatography	12 Hrs
5	a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	12 Hrs
6	a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. b. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation	12 Hrs

and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis - Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry - Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods - Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.
10. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

QUALITY MANAGEMENT SYSTEMS
(MQA 102T)

Scope

This course is designed to impart fundamental knowledge and concepts about various quality management principles and systems utilized in the manufacturing industry. It also aids in understanding the quality evaluation in the pharmaceutical industries.

Objectives

At completion of this course it is expected that students will be able to understand-

- The importance of quality
- ISO management systems
- Tools for quality improvement
- Analysis of issues in quality
- Quality evaluation of pharmaceuticals
- Stability testing of drug and drug substances
- Statistical approaches for quality

THEORY 60 Hrs

1. Introduction to Quality: Evolution of Quality, Definition of Quality, Dimensions of Quality 12 Hrs

   Quality as a Strategic Decision: Meaning of strategy and strategic quality management, mission and vision statements, quality policy, Quality objectives, strategic planning and implementation, McKinsey 7s model, Competitive analysis, Management commitment to quality

   Customer Focus: Meaning of customer and customer focus, Classification of customers, Customer focus, Customer perception of quality, Factors affecting customer perception, Customer requirements, Meeting customer needs and expectations, Customer satisfaction and Customer delight, Handling customer complaints, Understanding customer behavior, concept of internal and external customers. Case studies.

   Cost of Quality: Cost of quality, Categories of cost of Quality, Models of cost of quality, Optimising costs, Preventing cost of quality.

2	Pharmaceutical quality Management: Basics of Quality Management, Total Quality Management (TQM), Principles of Six sigma, ISO 9001:2008, 9001:2015, ISO 14001:2004, Pharmaceutical Quality Management – ICH Q10, Knowledge management, Quality Metrics, Operational Excellence and Quality Management Review. OSHAS guidelines, NABL certification and accreditation, CFR-21 part 11, WHO-GMP requirements.	12 Hrs
3	Six System Inspection model: Quality Management system, Production system, Facility and Equipment system, Laboratory control system, Materials system, Packaging and labeling system. Concept of self inspection. Quality systems: Change Management/ Change control. Deviations, Out of Specifications (OOS), Out of Trend (OOT), Complaints - evaluation and handling, Investigation and determination of root cause, Corrective & Preventive Actions (CAPA), Returns and Recalls, Vendor Qualification, Annual Product Reviews, Batch Review and Batch Release. Concept of IPQC, area clearance/ Line clearance.	12 Hrs
4	Drug Stability: ICH guidelines for stability testing of drug substances and drug products. Study of ICH Q8, Quality by Design and Process development report Quality risk management: Introduction, risk assessment, risk control, risk review, risk management tools, HACCP, risk ranking and filtering according to ICH Q9 guidelines.	12 Hrs
5	Statistical Process control (SPC): Definition and Importance of SPC, Quality measurement in manufacturing, Statistical control charts - concepts and general aspects, Advantages of statistical control, Process capability, Estimating Inherent or potential capability from a control chart analysis, Measuring process control and quality improvement, Pursuit of decreased process variability.	8 Hrs
6	Regulatory Compliance through Quality Management and development of Quality Culture Benchmarking: Definition of benchmarking, Reasons for benchmarking, Types of Benchmarking, Benchmarking process, Advantages of benchmarking, Limitations of benchmarking.	4 Hrs

REFERENCES

1. Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results, By Al Endres, Wiley, 2000
2. Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, By Jiju Antony; David Preece, Routledge, 2002
3. Organizing for High Performance: Employee Involvement, TQM, Reengineering, and Knowledge Management in the Fortune 1000: The CEO Report By Edward E. Lawler; Susan Albers Mohrman; George Benson, Jossey-Bass, 2001
4. Corporate Culture and the Quality Organization By James W. Fairfield-Sonn, Quorum Books, 2001
5. The Quality Management Sourcebook: An International Guide to Materials and Resources By Christine Avery; Diane Zabel, Routledge, 1997
6. The Quality Toolbox, Second Edition, Nancy R. Tague, ASQ Publications
7. Juran's Quality Handbook, Sixth Edition, Joseph M. Juran and Joseph A. De Feo, ASQ Publications
8. Root Cause Analysis, The Core of Problem Solving and Corrective Action, Duke Okes, 2009, ASQ Publications.

QUALITY CONTROL AND QUALITY ASSURANCE
(MQA 103T)

Scope

This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

Objectives

Upon completion of this course the student should be able to

- Understand the cGMP aspects in a pharmaceutical industry
- To appreciate the importance of documentation
- To understand the scope of quality certifications applicable to Pharmaceutical industries
- To understand the responsibilities of QA & QC departments.

THEORY 60 Hrs

1. Introduction: Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines. 12 Hrs

   Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines.

2 cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice. 12 Hrs

3 Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials. 12 Hrs

In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias).

4 Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. 12 Hrs

Submission documents for regulators DMFs, as Common Technical Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non regulated markets.

5 Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal. 12 Hrs

Introduction, scope and importance of intellectual property rights. Concept of trade mark, copyright and patents.

REFERENCES

1. Quality Assurance Guide by organization of Pharmaceutical Procedures of India, 3rd revised edition, Volume I & II, Mumbai, 1996.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69, Marcel Dekker Series, 1995.
3. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2nd edition, WHO Publications, 1999.
4. How to Practice GMP's – P P Sharma, Vandana Publications, Agra, 1991.

5. The International Pharmacopoeia – vol I, II, III, IV & V - General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excepients and Dosage forms, 3rd edition, WHO, Geneva, 2005.
6. Good laboratory Practice Regulations – Allen F. Hirsch, Volume 38, Marcel Dekker Series, 1989.
7. ICH guidelines
8. ISO 9000 and total quality management
9. The drugs and cosmetics act 1940 – Deshpande, Nilesh Gandhi, 4th edition, Susmit Publishers, 2006.
10. QA Manual – D.H. Shah, 1st edition, Business Horizons, 2000.
11. Good Manufacturing Practices for Pharmaceuticals a plan for total quality control – Sidney H. Willig, Vol. 52, 3rd edition, Marcel Dekker Series.
12. Steinborn L. GMP/ISO Quality Audit Manual for Healthcare Manufacturers and Their Suppliers, Sixth Edition, (Volume 1 - With Checklists and Software Package). Taylor & Francis; 2003.
13. Sarker DK. Quality Systems and Controls for Pharmaceuticals. John Wiley & Sons; 2008.
14. Packaging of Pharmaceuticals.
15. Schedule M and Schedule N.

PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER
(MQA 104T)

Scope

This deal with technology transfer covers the activities associated with Drug Substance, Drug Product and analytical tests and methods, required following candidate drug selection to completion of technology transfer from R&D to the first receiving site and technology transfer related to post-marketing changes in manufacturing places.

Objectives

Upon completion of this course the student should be able to

- To understand the new product development process
- To understand the necessary information to transfer technology from R&D to actual manufacturing by sorting out various information obtained during R&D
- To elucidate necessary information to transfer technology of existing products between various manufacturing places

THEORY		60 Hrs
1.	Principles of Drug discovery and development: Introduction, Clinical research process. Development and informational content for Investigational New Drugs Application (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA), Scale Up Post Approval Changes (SUPAC) and Bulk active chemical Post approval changes (BACPAC), Post marketing surveillance, Product registration guidelines - CDSCO, USFDA.	12 Hrs
2	Pre-formulation studies: Introduction/concept, organoleptic properties, purity, impurity profiles, particle size, shape and surface area. Solubility, Methods to improve solubility of Drugs: Surfactants & its importance, co-solvency. Techniques for the study of Crystal properties and polymorphism. Pre-formulation protocol, Stability testing during product development.	12 Hrs
3	Pilot plant scale up: Concept, Significance, design, layout of pilot plant scale up study, operations, large scale manufacturing techniques (formula, equipment, process, stability and quality control) of solids, liquids, semisolid and parenteral dosage forms. New era of drug products: opportunities and challenges.	12 Hrs

4	Pharmaceutical packaging: Pharmaceutical dosage form and their packaging requirments, Pharmaceutical packaging materials, Medical device packaging, Enteral Packaging, Aseptic packaging systems, Container closure systems, Issues facing modern drug packaging, Selection and evaluation of Pharmaceutical packaging materials. Quality control test: Containers, closures and secondary packing materials.	12 Hrs
5	Technology transfer: Development of technology by R & D, Technology transfer from R & D to production, Optimization and Production, Qualitative and quantitative technology models. Documentation in technology transfer: Development report, technology transfer plan and Exhibit.	12 Hrs

REFERENCES

1. The process of new drug discovery and development. I and II Edition (2006) by Charles G. Smith, James T and O. Donnell. CRC Press, Group of Taylor and Francis.
2. Leon Lac Lachman, Herbert A. Liberman, Theory and Practice of Industrial Pharmacy. Marcel Dekker Inc. New York.
3. Sidney H Willing, Murray M, Tuckerman. Williams Hitchings IV, Good manufacturing of pharmaceuticals (A Plan for total quality control) 3rd Edition. Bhalani publishing house Mumbai.
4. Tablets Vol. I, II, III by Leon Lachman, Herbert A. Liberman, Joseph B. Schwartz, 2nd Edn. (1989) Marcel Dekker Inc. New York.
5. Text book of Bio- Pharmaceutics and clinical Pharmacokinetics by Milo Gibaldi, 3rd Edn, Lea & Febriger, Philadelphia.
6. Pharmaceutical product development. Vandana V. Patrevale. John I. Disouza. Maharukh T.Rustomji. CRC Press, Group of Taylor and Francis.
7. Dissolution, Bioavailability and Bio-Equivalence by Abdou H.M, Mack Publishing company, Eastern Pennsylvania.
8. Remingtons Pharmaceutical Sciences, by Alfonso & Gennaro, 19th Edn.(1995)OO2C Lippincott; Williams and Wilkins A Wolters Kluwer Company, Philadelphia.
9. The Pharmaceutical Sciences; the Pharma Path way 'Pure and applied Pharmacy' by D. A Sawant, Pragathi Books Pvt. Ltd.
10. Pharmaceutical Packaging technology by D.A. Dean. E.R. Evans, I.H. Hall. 1st Edition(Reprint 2006). Taylor and Francis. London and New York.

QUALITY ASSURANCE PRACTICAL - I
(MQA 105P)

PRACTICALS

1. Analysis of Pharmacopoeial compounds in bulk and in their formulations (tablet/ capsules/ semisolids) by UV Vis spectrophotometer
2. Simultaneous estimation of multi-drug component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry or AAS
7. Case studies on
   - Total Quality Management
   - Six Sigma
   - Change Management/ Change control. Deviations,
   - Out of Specifications (OOS)
   - Out of Trend (OOT)
   - Corrective & Preventive Actions (CAPA)
   - Deviations
8. Development of Stability study protocol
9. Estimation of process capability
10. In process and finished product quality control tests for tablets, capsules, parenterals and semisolid dosage forms.
11. Assay of raw materials as per official monographs
12. Testing of related and foreign substances in drugs and raw materials
13. To carry out pre formulation study for tablets, parenterals (2 experiment).
14. To study the effect of pH on the solubility of drugs, (1 experiment)
15. Quality control tests for Primary and secondary packaging materials
16. Accelerated stability studies (1 experiment)
17. Improved solubility of drugs using surfactant systems (1 experiment)
18. Improved solubility of drugs using co-solvency method (1 experiment)
19. Determination of Pka and Log p of drugs.

HAZARDS AND SAFETY MANAGEMENT
(MQA 201T)

Scope

This course is designed to convey the knowledge necessary to understand issues related to different kinds of hazard and their management. Basic theoretical and practical discussions integrate the proficiency to handle the emergency situation in the pharmaceutical product development process and provides the principle based approach to solve the complex tribulations.

Objectives

At completion of this course it is expected that students will be able to

- Understand about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the industry environment.
- Ensure safety standards in pharmaceutical industry
- Provide comprehensive knowledge on the safety management
- Empower an ideas to clear mechanism and management in different kinds of hazard management system
- Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.

THEORY 60Hrs

1. Multidisciplinary nature of environmental studies: Natural Resources, Renewable and non-renewable resources, Natural resources and associated problems, 12 Hrs

   a) Forest resources; b) Water resources; c) Mineral resources; d) Energy resources; e) Land resources

   Ecosystems: Concept of an ecosystem and Structure and function of an ecosystem. Environmental hazards: Hazards based on Air, Water, Soil and Radioisotopes.

2 Air based hazards: Sources, Types of Hazards, Air circulation maintenance industry for sterile area and non sterile area, Preliminary Hazard Analysis (PHA) Fire protection system: Fire prevention, types of fire extinguishers and critical Hazard management system. 12 Hrs

3 Chemical based hazards: Sources of chemical hazards, Hazards of Organic synthesis, sulphonating hazard, Organic solvent hazard, Control measures for chemical hazards, 12 Hrs

Management of combustible gases, Toxic gases and Oxygen displacing gases management, Regulations for chemical hazard, Management of over-Exposure to chemicals and TLV concept.

4 Fire and Explosion: Introduction, Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Fire protection system: Fire prevention, types of fire extinguishers and critical Hazard management system mechanical and chemical explosion, multiphase reactions, transport effects and global rates. Preventive and protective management from fires and explosion-electricity passivation, ventilation, and sprinkling, proofing, relief systems -relief valves, flares, scrubbers. 12 Hrs

5 Hazard and risk management: Self-protective measures against workplace hazards. Critical training for risk management, Process of hazard management, ICH guidelines on risk assessment and Risk management methods and Tools
Factory act and rules, fundamentals of accident prevention, elements of safety programme and safety management, Physicochemical measurements of effluents, BOD, COD, Determination of some contaminants, Effluent treatment procedure, Role of emergency services. 12 Hrs

REFERENCES

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries, Centre for Chemical Process safety.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Hazardous Chemicals: Safety Management and Global Regulations, T.S.S. Dikshith, CRC press

PHARMACEUTICAL VALIDATION
(MQA 202T)

Scope

The main purpose of the subject is to understand about validation and how it can be applied to industry and thus improve the quality of the products. The subject covers the complete information about validation, types, methodology and application.

Objectives

At completion of this course, it is expected that students will be able to understand

- The concepts of calibration, qualification and validation
- The qualification of various equipments and instruments
- Process validation of different dosage forms
- Validation of analytical method for estimation of drugs
- Cleaning validation of equipments employed in the manufacture of pharmaceuticals

THEORY 60 Hrs

1. Introduction to validation: Definition of Calibration, Qualification and Validation, Scope, frequency and importance. Difference between calibration and validation. Calibration of weights and measures. Advantages of Validation, scope of Validation, Organization for Validation, Validation Master plan, Types of Validation, Streamlining of qualification & Validation process and Validation Master Plan. 10 Hrs

   Qualification: User requirement specification, Design qualification, Factory Acceptance Test (FAT)/Site Acceptance Test (SAT), Installation qualification, Operational qualification, Performance qualification, Re-Qualification (Maintaining status-Calibration Preventive Maintenance, Change management).

2 Qualification of manufacturing equipment: Dry Powder Mixers, Fluid Bed and Tray dryers, Tablet Compression (Machine), Dry heat sterilization/Tunnels, Autoclaves, Membrane filtration, Capsule filling machine. 10 Hrs

   Qualification of analytical instruments: UV-Visible spectrophotometer, FTIR, DSC, GC, HPLC, HPTLC, LC-MS.

3	Qualification of laboratory equipments: Hardness tester, Friability test apparatus, tap density tester, Disintegration tester, Dissolution test apparatus Validation of Utility systems: Pharmaceutical water system & pure steam, HVAC system, Compressed air and nitrogen.	10 Hrs
4	Process Validation: Concept, Process and documentation of Process Validation. Prospective, Concurrent & Retrospective Validation, Re validation criteria, Process Validation of various formulations (Coated tablets, Capsules, Ointment/Creams, Liquid Orals and aerosols.), Aseptic filling: Media fill validation, USFDA guidelines on Process Validation- A life cycle approach. Analytical method validation: General principles, Validation of analytical method as per ICH guidelines and USP.	10 Hrs
5	Cleaning Validation: Cleaning Method development, Validation of analytical method used in cleaning, Cleaning of Equipment, Cleaning of Facilities. Cleaning in place (CIP). Validation of facilities in sterile and non-sterile plant. Computerized system validation: Electronic records and digital signature - 21 CFR Part 11 and GAMP	10 Hrs
6	General Principles of Intellectual Property: Concepts of Intellectual Property (IP), Intellectual Property Protection (IPP), Intellectual Property Rights (IPR); Economic importance, mechanism for protection of Intellectual Property –patents, Copyright, Trademark; Factors affecting choice of IP protection; Penalties for violation; Role of IP in pharmaceutical industry; Global ramification and financial implications. Filing a patent applications; patent application forms and guidelines. Types patent applications-provisional and non provisional, PCT and convention patent applications; International patenting requirement procedures and costs; Rights and responsibilities of a patentee; Practical aspects regarding maintaining of a Patent file; Patent infringement meaning and scope. Significance of transfer technology (TOT), IP and ethics-positive and negative aspects of IPP; Societal responsibility, avoiding unethical practices.	10 Hrs

REFERENCES

1. B. T. Loftus & R. A. Nash, "Pharmaceutical Process Validation", Drugs and Pharm Sci. Series, Vol. 129, 3rd Ed., Marcel Dekker Inc., N.Y.
2. The Theory & Practice of Industrial Pharmacy, 3rd edition, Leon Lachman, Herbert A. Lieberman, Joseph. L. Karig, Varghese Publishing House, Bombay.
3. Validation Master plan by Terveeks or Deeks, Davis Harwood International publishing.
4. Validation of Aseptic Pharmaceutical Processes, 2nd Edition, by Carleton & Agalloco,
5. (Marcel Dekker).
6. Michael Levin, Pharmaceutical Process Scale-Up", Drugs and Pharm. Sci. Series, Vol. 157,2nd Ed., Marcel Dekker Inc., N.Y.
7. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider
8. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. Cloud, Interpharm Press
9. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker
10. Analytical Method validation and Instrument Performance Verification by Churg Chan, Heiman Lam, Y.C. Lee, Yue. Zhang, Wiley Interscience.
11. Huber L. Validation and Qualification in Analytical Laboratories. Informa Healthcare
12. Wingate G. Validating Corporate Computer Systems: Good IT Practice for Pharmaceutical Manufacturers. Interpharm Press
13. LeBlanc DA. Validated Cleaning Technologies for Pharmaceutical Manufacturing. Interpharm Press

AUDITS AND REGULATORY COMPLIANCE
(MPA 203T)

Scope

This course deals with the understanding and process for auditing in pharmaceutical industries. This subject covers the methodology involved in the auditing process of different in pharmaceutical industries.

Objectives

Upon completion of this course the student should be able to

- To understand the importance of auditing
- To understand the methodology of auditing
- To carry out the audit process
- To prepare the auditing report
- To prepare the check list for auditing

THEORY 60 Hrs

1.	Introduction: Objectives, Management of audit, Responsibilities, Planning process, information gathering, administration, Classifications of deficiencies	12 Hrs
2	Role of quality systems and audits in pharmaceutical manufacturing environment: cGMP Regulations, Quality assurance functions, Quality systems approach, Management responsibilities, Resource, Manufacturing operations, Evaluation activities, Transitioning to quality system approach, Audit checklist for drug industries.	12 Hrs
3	Auditing of vendors and production department: Bulk Pharmaceutical Chemicals and packaging material Vendor audit, Warehouse and weighing, Dry Production: Granulation, tableting, coating, capsules, sterile production and packaging.	12 Hrs
4	Auditing of Microbiological laboratory: Auditing the manufacturing process, Product and process information, General areas of interest in the building raw materials, Water, Packaging materials.	12 Hrs

5	Auditing of Quality Assurance and engineering department: Quality Assurance Maintenance, Critical systems: HVAC, Water, Water for Injection systems, ETP.	12 Hrs

REFERENCES

1. Compliance auditing for Pharmaceutical Manufacturers. Karen Ginsbury and Gil Bismuth, Interpharm/CRC, Boca Raton, London New York, Washington D.C.
2. Pharmaceutical Manufacturing Handbook, Regulations and Quality by Shayne Cox Gad. Wiley-Interscience, A John Wiley and sons, Inc., Publications.
3. Handbook of microbiological Quality control. Rosamund M. Baird, Norman A. Hodges, Stephen P. Denyar. CRC Press. 2000.
4. Laboratory auditing for quality and regulatory compliance. Donald C. Singer, Raluca-loana Stefan, Jacobus F. Van Staden. Taylor and Francis (2005).

PHARMACEUTICAL MANUFACTURING TECHNOLOGY
(MQA 204T)

Scope

This course is designed to impart knowledge and skills necessary to train the students with the industrial activities during Pharmaceutical Manufacturing.

Objectives

At completion of this course it is expected that students will be able to understand,

- The common practice in the pharmaceutical industry developments, plant layout and production planning
- Will be familiar with the principles and practices of aseptic process technology, non sterile manufacturing technology and packaging technology.
- Have a better understanding of principles and implementation of Quality by design (QbD) and process analytical technology (PAT) in pharmaceutical manufacturing

THEORY 60 Hrs

1. Pharmaceutical industry developments: Legal requirements and Licenses for API and formulation industry, Plant location-Factors influencing. 12 Hrs

   Plant layout: Factors influencing, Special provisions, Storage space requirements, sterile and aseptic area layout.

   Production planning: General principles, production systems, calculation of standard cost, process planning, routing, loading, scheduling, dispatching of records, production control.

2 Aseptic process technology: Manufacturing, manufacturing flowcharts, in process-quality control tests for following sterile dosage forms: Ointment, Suspension and Emulsion, Dry powder, Solution (Small Volume & large Volume). 12 Hrs

   Advanced sterile product manufacturing technology : Area planning & environmental control, wall and floor treatment, fixtures and machineries, change rooms, personnel flow, utilities & utilities equipment location, engineering and maintenance.

   Process Automation in Pharmaceutical Industry: With specific reference to manufacturing of sterile semisolids, Small Volume Parenterals & Large Volume Parenterals (SVP & LVP), Monitoring of Parenteral manufacturing facility, Cleaning in Place (CIP),

Sterilization in Place (SIP), Prefilled Syringe, Powdered Jet, Needle Free Injections, and Form Fill Seal Technology (FFS). Lyophilization technology: Principles, process, equipment.

3	Non sterile manufacturing process technology: Manufacturing, manufacturing flowcharts, in process-quality control tests for following Non-Sterile solid dosage forms: Tablets (compressed & coated), Capsules (Hard & Soft). Advance non-sterile solid product manufacturing technology: Process Automation in Pharmaceutical Industry with specific reference to manufacturing of tablets and coated products, Improved Tablet Production: Tablet production process, granulation and pelletization equipments, continuous and batch mixing, rapid mixing granulators, rota granulators, spheronizers and marumerisers, and other specialized granulation and drying equipments. Problems encountered. Coating technology: Process, equipments, particle coating, fluidized bed coating, application techniques. Problems encountered.	12 Hrs
4	Containers and closures for pharmaceuticals: Types, performance, assuring quality of glass; types of plastics used, Drug plastic interactions, biological tests, modification of plastics by drugs; different types of closures and closure liners; film wrapper; blister packs; bubble packs; shrink packaging; foil / plastic pouches, bottle seals, tape seals, breakable seals and sealed tubes; quality control of packaging material and filling equipment, flexible packaging, product package compatibility, transit worthiness of package, Stability aspects of packaging. Evaluation of stability of packaging material.	12 Hrs
5	Quality by design (QbD) and process analytical technology (PAT): Current approach and its limitations. Why QbD is required, Advantages, Elements of QbD, Terminology: QTPP. CMA, CQA, CPP, RLD, Design space, Design of Experiments, Risk Assessment and mitigation/minimization. Quality by Design, Formulations by Design, QbD for drug products, QbD for Drug Substances, QbD for Excipients, Analytical QbD. FDA initiative on process analytical technology. PAT as a driver for improving quality and reducing costs: quality by design (QbD), QA, QC and GAMP. PAT guidance, standards and regulatory requirements.	12 Hrs

REFERENCES

1. Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy, 3rd ed., Varghese Publishers, Mumbai 1991.
2. Sinko PJ. Martin's physical pharmacy and pharmaceutical sciences, 5th ed., B.I. Publications Pvt. Ltd, Noida, 2006.
3. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms: tablets Vol. I-III, 2nd ed., CBS Publishers & distributors, New Delhi, 2005.
4. Banker GS, Rhodes CT. Modern Pharmaceutics, 4th ed., Marcel Dekker Inc, New York, 2005.
5. Sidney H Willing, Murray M, Tuckerman. Williams Hitchings IV, Good manufacturing of pharmaceuticals (A Plan for total quality control) 3rd Edition. Bhalani publishing house Mumbai.
6. Indian Pharmacopoeia. Controller of Publication. Delhi, 1996.
7. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2008.
8. United States Pharmacopoeia. United States Pharmacopeial Convention, Inc, USA, 2003.
9. Dean D A, Evans E R and Hall I H. Pharmaceutical Packaging Technology. London, Taylor & Francis, 1st Edition. UK.
10. Edward J Bauer. Pharmaceutical Packaging Handbook. 2009. Informa Health care USA Inc. New york.
11. Shaybe Cox Gad. Pharmaceutical Manufacturing Handbook. John Willey and Sons, New Jersey, 2008.

QUALITY ASSURANCE PRACTICAL – II PRACTICALS
(MQA 205P)

1. Organic contaminants residue analysis by HPLC
2. Estimation of Metallic contaminants by Flame photometer
3. Identification of antibiotic residue by TLC
4. Estimation of Hydrogen Sulphide in Air.
5. Estimation of Chlorine in Work Environment.
6. Sampling and analysis of SO_2 using Colorimetric method
7. Qualification of following Pharma equipment
   a. Autoclave
   b. Hot air oven
   c. Powder Mixer (Dry)
   d. Tablet Compression Machine
8. Validation of an analytical method for a drug
9. Validation of a processing area
10. Qualification of at least two analytical instruments
11. Cleaning validation of one equipment
12. Qualification of Pharmaceutical Testing Equipment (Dissolution testing apparatus, Friability Apparatus, Disintegration Tester)
13. Check list for Bulk Pharmaceutical Chemicals vendors
14. Check list for tableting production.
15. Check list for sterile production area
16. Check list for Water for injection.
17. Design of plant layout: Sterile and non-sterile
18. Case study on application of QbD
19. Case study on application of PAT

PHARMACEUTICALREGULATORY AFFAIRS(MRA)

GOOD REGULATORY PRACTICES (MRA 101T)

Scope

This course is designed to impart fundamental knowledge on various Good Regulatory Practices viz., cGMP, GLP, GALP and GDP for Pharmaceuticals, Cosmetics, Food & Nutraceuticals, Medical devices, In-vitro Diagnostic Medical Devices (IVDs) and biological products and understand the rationale behind these requirements and will propose ways and means of complying with them.

Objectives

At completion of this course it is expected that students will be able to understand,

- The key regulatory and compliance elements with respect to Good Manufacturing Practices, Good Laboratory Practices, Good Automated Laboratory Practices and Good Documentation Practices.
- Prepare and implement the check lists and SOPs for various Good Regulatory Practices
- Implement Good Regulatory Practices in the Healthcare and related Industries
- Prepare for the readiness and conduct of audits and inspections.

THEORY 60 Hrs

1.	Current Good Manufacturing Practices: Introduction, US cGMP Part 210 and Part 211.EC Principles of GMP (Directive 91/356/EEC) Article 6 to Article 14 and WHO cGMP guidelines GAMP-5; Medical device and IVDs Global Harmonization Task Force(GHTF) Guidance docs.	12 Hrs
2	Good Laboratory Practices: Introduction, USFDA GLP Regulations (Subpart A to Subpart K), Controlling the GLP inspection process, Documentation, Audit, goals of Laboratory Quality Audit, Audit tools, Future of GLP regulations, relevant ISO and Quality Council of India(QCI) Standards	12 Hrs
3	Good Automated Laboratory Practices: Introduction to GALP, Principles of GALP, GALP Requirements, SOPs of GALP, Training Documentation,21 CFR Part 11, General check list of 21CFR Part 11, Software Evaluation checklist, relevant ISO and QCI Standards.	12 Hrs

4	Good Distribution Practices: Introduction to GDP, Legal GDP requirements put worldwide, Principles, Personnel, Documentation, Premises and Equipment, Deliveries to Customers, Returns, Self-Inspection, Provision of information, Stability testing principles, WHO GDP, USP GDP (Supply chain integrity), relevant CDSCO guidance and ISO standards	12 Hrs
5	Quality management systems: Concept of Quality, Total Quality Management, Quality by design, Six Sigma concept, Out of Specifications (OOS), Change control. Validation: Types of Validation, Types of Qualification, Validation master plan (VMP), Analytical Method Validation. Validation of utilities, [Compressed air, steam, water systems, Heat Ventilation and Air conditioning (HVAC)]and Cleaning Validation. The International Conference on Harmonization (ICH) process, ICH guidelines to establish quality, safety and efficacy of drug substances and products, ISO 13485, Sch MIII and other relevant CDSCO regulatory guidance documents.	12 Hrs

REFERENCES

1. Good Laboratory Practice Regulations, by Sandy Weinberg, Fourth Edition Drugs and the Pharmaceutical Sciences, Vol.168
2. Good Pharmaceutical Manufacturing practice, Rational and compliance by John Sharp, CRC Press
3. Establishing a cGMP Laboratory Audit System, A practical Guide by David M.Bleisner, Wiley Publication.
4. How to practice GLP by PP Sharma, Vandana Publications.
5. Laboratory Auditing for Quality and Regulatory compliance bu Donald C.Singer, Drugs and the Pharmaceutical Sciences, Vol.150.
6. Drugs & Cosmetics Act, Rules & Amendments

DOCUMENTATION AND REGULATORY WRITING
(MRA 102T)

Scope

This course is designed to impart fundamental knowledge on documentation and general principles involved in regulatory writing and submission to agencies.

Objectives

Upon completion of the course the student shall be able to,

- Know the various documents pertaining to drugs in pharmaceutical industry
- Understand the basics of regulatory compilation
- Create and assemble the regulation submission as per the requirements of agencies
- Follow up the submissions and post approval document requirements

THEORY 60 Hrs

1. Documentation in pharmaceutical industry: Exploratory Product Development Brief (EPDB) for Drug substance and Drug product, Product Development Plan (PDP), Product Development Report (PDR), Master Formula Record, Batch Manufacturing Record and its calculations, Batch Reconciliation, Batch Packaging Records, Print pack specifications, Distribution records, Certificate of Analysis (CoA), Site Master File and Drug Master Files (DMF). 12 Hrs

2 Dossier preparation and submission: Introduction and overview of dossiers, contents and organization of dossier, binders and sections, compilation and review of dossier. Paper submissions, overview and modules of CTD, electronic CTD submissions; Electronic submission: Planning electronic submission, requirements for submission, regulatory bindings and requirements, Tool and Technologies, electronic dossier submission process and validating the submission, Electronic Submission Gateway (ESG). Non eCTD electronic submissions (NeeS), Asian CTD formats (ACTD) submission. Organizing, process and validation of submission. Submission in Sugam system of CDSCO. 12 Hrs

3	Audits: Introduction, Definition, Summary, Types of audits, GMP compliance audit, Audit policy, Internal and External Audits, Second Party Audits, External third party audits, Auditing strategies, Preparation and conducting audit, Auditing strategies, audit analysis, audit report, audit follow up. Auditing/inspection of manufacturing facilities by regulatory agencies. Timelines for audits/inspection. GHTF study group 4 guidance document. ISO 13485.	12 Hrs
4	Inspections: Pre-approval inspections, Inspection of pharmaceutical manufacturers, Inspection of drug distribution channels, Quality systems requirements for national good manufacturing practice inspectorates, inspection report, model certificate of good manufacturing practices, Root cause analysis, Corrective and Preventive action (CAPA).	12 Hrs
5	Product life cycle management: Prior Approval Supplement (PAS), Post Approval Changes [SUPAC], Changes Being Effected in 30 Days (CBE-30), Annual Report, Post marketing Reporting Requirements, Post approval Labeling Changes, Lifecycle Management, FDA Inspection and Enforcement, Establishment Inspection Report (EIR), Warning Letters, Recalls, Seizure and Injunctions. ISO Risk Management Standard	12 Hrs

REFERENCES

1. Compliance auditing for Pharmaceutical Manufacturers. Karen Ginsbury and Gil Bismuth, Interpharm/CRC, Boca Raton, London New York, Washington D.C.
2. Pharmaceutical Manufacturing Handbook, Regulations and Quality by Shayne Cox Gad. Wiley-Interscience, A John Wiley and sons, Inc., Publications.
3. Handbook of microbiological Quality control. Rosamund M. Baird, Norman A. Hodges, Stephen P. Denyar. CRC Press. 2000.
4. Laboratory auditing for quality and regulatory compliance. Donald C. Singer, Raluca-loana Stefan, Jacobus F. Van Staden. Taylor and Francis (2005).
5. Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results, By Al Endres, Wiley, 2000
6. Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, By Jiju Antony; David Preece, Routledge, 2002

7. Organizing for High Performance: Employee Involvement, TQM, Reengineering, and Knowledge Management in the Fortune 1000: The CEO Report By Edward E. Lawler; Susan Albers Mohrman; George Benson, Jossey-Bass, 2001
8. Corporate Culture and the Quality Organization By James W. Fairfield-Sonn, Quorum Books, 2001
9. The Quality Management Sourcebook: An International Guide to Materials and Resources By Christine Avery; Diane Zabel, Routledge, 1997
10. The Quality Toolbox, Second Edition, Nancy R. Tague, ASQ Publications
11. Juran's Quality Handbook, Sixth Edition, Joseph M. Juran and Joseph A. De Feo, ASQ Publications
12. Root Cause Analysis, The Core of Problem Solving and Corrective Action, Duke Okes, 2009, ASQ Publications
13. International Medical Device Regulators Forum (IMDRF) Medical Device Single Audit Program (MDSAP)

CLINICAL RESEARCH REGULATIONS
(MRA 103T)

Scope

This course is designed to impart the fundamental knowledge on the clinical development process of drugs, pharmaceuticals and Medical Devices, phases and conduct of clinical trials and research, regulations and guidance governing the conduct of clinical research in India, USA and EU. It prepares the students to learn in detail on various laws, legislations and guidance related to safety, efficacy, ethical conduct and regulatory approval of clinical research.

Objectives

Upon completion of the course, the student shall be able to (know, do and appreciate)

- History, origin and ethics of clinical and biomedical research and evaluation
- Clinical drug, medical device development process and different types and phases of clinical trials
- Regulatory requirements and guidance for conduct of clinical trials and research

Theory — 60 Hrs

1. Clinical Drug Development Process — 12 Hrs
   - Different types of Clinical Studies
   - Phases of clinical trials, Clinical Trial protocol
   - Phase 0 studies
   - Phase I and subtype studies (single ascending, multiple ascending, dose escalation, methods, food effect studies, drug – drug interaction, PK end points
   - Phase II studies (proof of concept or principle studies to establish efficacy)
   - Phase III studies (Multi ethnicity, global clinical trial, registration studies)
   - Phase IV studies (Post Marketing Studies; PSUR)

   Clinical Investigation and Evaluation of Medical Devices & IVDs

   Different Types of Studies
   Key Concepts of Medical Device Clinical Evaluation
   Key concepts of Clinical Investigation

2 Ethics in Clinical Research: 12 Hrs

- Historical Perspectives: Nuremberg Code, Thalidomide study , Nazis Trials, Tuskegee Syphilis Study, The Belmont Report, The declaration of Helsinki
- Origin of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines.
- The ethics of randomized clinical trials
- The role of placebo in clinical trials
- Ethics of clinical research in special population
- Institutional Review Board/Independent Ethics Committee/Ethics Committee – composition, roles, responsibilities, review and approval process and ongoing monitoring of safety data
- Data safety monitoring boards.
- Responsibilities of sponsor, CRO, and investigator in ethical conduct of clinical research
    - Ethical principles governing informed consent process
    - Patient Information Sheet and Informed Consent Form
    - The informed consent process and documentation

3 Regulations governing Clinical Trials 12 Hrs

India: Clinical Research regulations in India – Schedule Y & Medical Device Guidance

USA: Regulations to conduct drug studies in USA (FDA)

- NDA 505(b)(1) of the FD&C Act (Application for approval of a new drug)
- NDA 505(b)(2) of the FD&C Act (Application for approval of a new drug that relies, at least in part, on data not developed by the applicant)
- ANDA 505(j) of the FD&C Act (Application for approval of a generic drug product)
- FDA Guidance for Industry - Acceptance of Foreign Clinical Studies
- FDA Clinical Trials Guidance Document: Good Clinical Practice

EU: Clinical Research regulations in European Union (EMA)

4 Clinical Research Related Guidelines 12 Hrs

- Good Clinical Practice Guidelines (ICH GCP E6)
- Indian GCP Guidelines
- ICMR Ethical Guidelines for Biomedical Research
- CDSCO guidelines

GHTF study group 5 guidance documents

Regulatory Guidance on Efficacy and Safety ICH Guidance's

- E4 – Dose Response Information to support Drug Registration
- E7 – Studies in support of General Population: Geriatrics
- E8 – General Considerations of Clinical Trials
- E10 – Choice of Control Groups and Related Issues in Clinical Trials,
- E 11 – Clinical Investigation of Medicinal Products in the Pediatric Population
- General biostatics principle applied in clinical research

5 USA & EU Guidance 12 Hrs

USA: FDA Guidance

- CFR 21Part 50: Protection of Human Subjects
- CFR 21Part 54: Financial Disclosure by Clinical Investigators
- CFR 21Part 312: IND Application
- CFR 21Part 314: Application for FDA Approval to Market a New Drug
- CFR 21Part 320: Bioavailability and bioequivalence requirements
- CFR 21Part 812: Investigational Device Exemptions
- CFR 21Part 822: Post-market surveillance
- FDA Safety Reporting Requirements for INDs and BA/BE Studies
- FDA Med Watch
- Guidance for Industry: Good Pharmacovigilance Practices and Pharmacoepidemiologic Assessment

European Union: EMA Guidance

- EU Directives 2001
- EudraLex (EMEA) Volume 3 – Scientific guidelines for medicinal products for human use
- EU Annual Safety Report (ASR)
- Volume 9A – Pharmacovigilance for Medicinal Products for Human Use
- EU MDD with respect to clinical research
- ISO 14155

REFERENCES

1. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
2. HIPAA and Human Subjects Research: A Question and Answer Reference Guide By Mark Barnes, JD, LLM and Jennifer Kulynych, JD, PhD
3. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
4. Reviewing Clinical Trials: A Guide for the Ethics Committee; Johan PE Karlberg and Marjorie A Speers; Karlberg, Johan Petter Einar, Hong Kong.
5. International Pharmaceutical Product Registration: Aspects of Quality, Safety and Efficacy; Anthony C. Cartwright; Taylor & Francis Inc., USA.
6. New Drug Approval Process: The Global Challenge; Guarino, Richard A; Marcel Dekker Inc., NY.
7. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics; Douglas J. Pisano, David Mantus; CRC Press, USA
8. Country Specific Guidelines from official websites.
9. Drugs & Cosmetics Act & Rules and Amendments

RECOMMENDED WEBSITES:

1. EU Clinical Research Directive 2001: http://www.eortc.be/services/doc/clinical-eudirective-04-april-01.pdf
2. Code of Federal Regulations, FDA: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm
3. Guidelines of International Conference on Harmonization: http://www.ich.org/products/guidelines.html
4. Eudralex Guidelines: http://www.gmpcompliance.info/euguide.htm
5. FDA New Drug Application:
6. http://www.fda.gov/regulatoryinformation/legislation/FederalFoodDrugandCosmeticActFDCAct/FDCActChapterVDrugsandDevices/ucm108125.htm
7. Medicines and Healthcare products Regulatory Agency: http://www.mhra.gov.uk
8. Central Drugs Standard Control Organization Guidance for Industry: http://cdsco.nic.in/CDSCO-GuidanceForIndustry.pdf
9. ICMR Ethical Guidelines for Biomedical Research: http://icmr.nic.in/ethical_guidelines.pdf

REGULATIONS AND LEGISLATION FOR DRUGS & COSMETICS, MEDICAL DEVICES, BIOLOGICALS & HERBALS, AND FOOD & NUTRACEUTICALS IN INDIA AND INTELLECTUAL PROPERTY RIGHTS

(MRA 104T)

Scope

This course is designed to impart fundamental knowledge on regulations and legislation in India w.r.t. Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals. It prepares the students for basic regulatory requirements in India of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals. for manufacture, import & registration, export, sale, marketing authorization, clinical trials and intellectual property rights.

Objectives

Upon the completion of the course the student shall be able to:

- Know different Acts and guidelines that regulate Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals industry in India.
- Understand the approval process and regulatory requirements for Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals

THEORY 60 Hrs

1. Biologicals & Herbals, and Food & Nutraceuticals Acts and Rules (with latest amendments): 12 Hrs

    1. Drugs and Cosmetics Act 1940 and Rules 1945: DPCO and NPPA
    2. Other relevant provisions (rules schedules and guidelines for approval of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals in India

    Other relevant Acts: Narcotics Drugs and Psychotropic Substances Act; Medicinal and Toilet Preparations (Excise Duties) Act, 1955; Pharmacy Act, 1948; Drugs and Magic Remedies (Objectionable Advertisements) Act, 1955; Prevention of Cruelty to Animals Act.

2	Regulatory requirements and approval procedures for Drugs & Cosmetics Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals CDSCO (Central Drug Standard Control Organization) and State Licensing Authority: Organization, Responsibilities • Rules, regulations, guidelines and standards for regulatory filing of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals • Format and contents of Regulatory dossier filing Clinical trial/ investigations	12 Hrs
3	Indian Pharmacopoeial Standards, BIS standards and ISO and other relevant standards	12 Hrs
4	Bioavailability and Bioequivalence data (BA &BE), BCS Classification of Drugs, Regulatory Requirements for Bioequivalence study Stability requirements: ICH and WHO Guidelines for Drug testing in animals/Preclinical Studies Animal testing: Rationale for conducting studies, CPCSEA Guidelines Ethical guidelines for human participants ICMR-DBT Guidelines for Stem Cell Research	12 Hrs
5	Intellectual Property Rights: Patent, Trademark, Copyright, Industrial Designs and Geographical Indications, Indian Patent Scenario. IPR vs Regulatory Affairs	12 Hrs

REFERENCES

1. Manual of Patent Practice & Procedure, 3rd Edition, by The Patent Office of India
2. Patent Failure How Judges, Bureaucrats, and Lawyers put innovators at risk by James Bessen and Michael J. Meurer
3. Principles and Practice of Clinical Trial Medicine by Richard Chin and Bruce Y. Lee
4. Ethical Guidelines for Biomedical Research on Human Participants by Indian Council of Medical Research New delhi 2006.
5. CPCSEA Guidelines for Laboratory Animal Facility by Committee for the purpose of control and supervision on experiments on animals (CPCSEA)

6. ICH E6 Guideline — Good Clinical Practice‖ by ICH Harmonised Tripartite
7. Guidance for Industry on Submission of Clinical Trial Application for Evaluating Safety and Efficacy by CDSCO (Central Drug Standard Control Organisation)
8. Guidance for Industry on Requirement of Chemical & Pharmaceutical Information including Stability Study Data before approval of clinical trials / BE studies by CDSCO
9. Guidelines for Import and Manufacture of Medical Devices by CDSCO
10. Guidelines from official website of CDSCO

REGULATORY AFFAIRS PRACTICAL - I
(MRA 105P)

1. Case studies (4 Nos.) of each of Good Pharmaceutical Practices.
2. Documentation for in process and finished products Quality control tests for Solid, liquid, Semisolid and Sterile preparations.
3. Preparation of SOPs, Analytical reports (Stability and validation)
4. Protocol preparation for documentation of various types of records (BMR, MFR, DR)
5. Labeling comparison between brand & generics.
6. Preparation of clinical trial protocol for registering trial in India
7. Registration for conducting BA/ BE studies in India
8. Import of drugs for research and developmental activities
9. Preparation of regulatory dossier as per Indian CTD format and submission in SUGAM
10. Registering for different Intellectual Property Rights in India
11. GMP Audit Requirements as per CDSCO
12. Preparation and documentation for Indian Patent application.
13. Preparation of checklist for registration of IND as per ICH CTD format.
14. Preparation of checklist for registration of NDA as per ICH CTD format.
15. Preparation of checklist for registration of ANDA as per ICH CTD format.
16. Case studies on response with scientific rationale to USFDA Warning Letter
17. Preparation of submission checklist of IMPD for EU submission.
18. Comparison study of marketing authorization procedures in EU.
19. Comparative study of DMF system in US, EU and Japan
20. Preparation of regulatory submission using eCTD software
21. Preparation of Clinical Trial Application (CTA) for US submission
22. Preparation of Clinical Trial Application (CTA) for EU submission
23. Comparison of Clinical Trial Application requirements of US, EU and Japan of a dosage form.
24. Regulatory requirements checklist for conducting clinical trials in India.
25. Regulatory requirements checklist for conducting clinical trials in Europe.
26. Regulatory requirements checklist for conducting clinical trials in USA

SEMESTER II

REGULATORY ASPECTS OF DRUGS & COSMETICS

(MRA 201T)

Scope

This course is designed to impart the fundamental knowledge on the drug development process, regulatory requirements for approval of new drugs, drug products and cosmetics in regulated and semi-regulated countriesIt prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products and cosmetics in regulated and semi-regulated countries.

Objectives

Upon completion of the course, the student shall be able to know

- process of drug discovery and development and generic product development
- regulatory approval process and registration procedures for API and drug products in US, EU
- Cosmetics regulations in regulated and semi-regulated countries
- A comparative study of India with other global regulated markets

Theory 60 Hrs

1. USA & CANADA: Organization structure and functions of FDA. Federal register and Code of Federal Regulations (CFR), History and evolution of United States Federal, Food, Drug and Cosmetic Act (FFDCA), Hatch Waxman act and Orange book, Purple book, Drug Master Files (DMF) system in US, Regulatory Approval Process for Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA); Regulatory requirements for Orphan drugs and Combination Products, Changes to an approved NDA / ANDA. Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in USA. Legislation and regulations for import, manufacture, distribution and sale of cosmetics in USA and Canada. 12 Hrs

2 European Union & Australia: Organization and structure of EMA & EDQM, General guidelines, Active Substance Master Files (ASMF) system in EU, Content and approval process of IMPD, Marketing Authorization procedures in EU (Centralized procedure, 12 Hrs

	Decentralized procedure, Mutual recognition procedure and National Procedure). Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in EU, Eudralex directives for human medicines, Variations & extensions, Compliance of European Pharmacopoeia (CEP)/ Certificate of Suitability (CoS), Marketing Authorization (MA) transfers, Qualified Person (QP) in EU. Legislation and regulations for import, manufacture, distribution and sale of cosmetics in European Union & Australia.	
3	Japan: Organization of the PMDA, Pharmaceutical Laws and regulations, types of registration applications, DMF system in Japan, drug regulatory approval process, Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in Japan, Post marketing surveillance in Japan. Legislation and regulations for import, manufacture, distribution and sale of cosmetics in Japan	12 Hrs
4	Emerging Market: Introduction, Countries covered, Study of the world map,study of various committees across the globe (ASEAN, APEC, EAC, GCC, PANDRH, SADC) WHO: WHO, GMP, Regulatory Requirements for registration of drugs and post approval requirements in WHO through prequalification programme, Certificate of Pharmaceutical Product (CoPP) - General and Country Specific (South Africa, Egypt, Algeria and Morocco, Nigeria, Kenya and Botswana)	12 Hrs
5	Brazil, ASEAN, CIS and GCC Countries: ASIAN Countries: Introduction to ACTD, Regulatory Requirements for registration of drugs and post approval requirements in China and South Korea & Association of Southeast Asian Nations (ASEAN) Region i.e. Vietnam, Malaysia, Philippines, Singapore and Thailand. CIS (Commonwealth Independent States): Regulatory pre-requisites related to Marketing authorization requirements for drugs and post approval requirements in CIS countries i.e. Russia, Kazakhstan and Ukraine GCC (Gulf Cooperation Council) for Arab states: Regulatory pre-requisites related to Marketing authorization requirements for drugs and post approval requirements in Saudi Arabia and UAE Legislation and regulations for import, manufacture, distribution and sale of cosmetics in Brazil, ASEAN, CIS and GCC Countries.	12 Hrs

REFERENCES :

1. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
2. The Pharmaceutical Regulatory Process, Edited by Ira R. Berry Marcel Dekker Series, Vol.144
3. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185 Informa Health care Publishers.
4. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
5. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
6. Drugs: From Discovery to Approval, Second Edition By Rick Ng
7. New Drug Development: A Regulatory Overview, Eighth Edition By Mark Mathieu
8. Pharmaceutical Risk Management By Jeffrey E. Fetterman, Wayne L. Pines and Gary H. Slatko
9. Preparation and Maintenance of the IND Application in eCTD Format By William K. Sietsema
10. Country Specific Guidelines from official websites.
11. http://www.who.int/medicines/areas/quality_safety/regulation_legislation/ListMRAWebsites.pdf
12. Roadmap to an ASEAN economic community Edited by Denis Hew. ISEAS Publications, Singapore 2005, ISBN981-230-347-2
13. ASEAN, Rodolfo C. Severino, ISEAS Publications, Singapore 2005, ISBN 978-981-230-750-7
14. Building a Future with Brics: The Next Decade for Offshoring, Mark Kobayashi-Hillary, Springer
15. Outsourcing to India: The Offshore Advantage, Mark Kobayashi-Hillary, Springer Trade performance and Regional Integration of the CIS Countries, Lev Freinkman,
16. The world Bank, Washington, DC, ISBN: 0-8212-5896-0
17. Global Pharmaceutical Policy: Ensuring Medicines for Tomorrow's World ByFrederick M. Abbott, Graham Dukes, Maurice Nelson Graham Dukes 139
18. The Gulf Cooperation Council: A Rising Power and Lessons for ASEAN by Linda Low and Lorraine Carlos Salazar (Nov 22, 2010)
19. Doing Business in the Asean Countries, Balbir Bhasin, Business Expert Press ISBN:13:978-1-60649-108-9
20. Realizing the ASEAN Economic Community: A Comprehensive Assessment, Michael G Plummer (Editor), Chia Siow Yue (Editor), Instute of South east asian studies, Singapore

REGULATORY ASPECTS OF HERBAL AND BIOLOGICALS
(MRA 202T)

Scope

This course is designed to impart fundamental knowledge on Regulatory Requirements, Licensing and Registration, Regulation on Labelling of Biologics in India, USA and Europe

It prepares the students to learn in detail on Regulatory Requirements for biologics, Vaccines and Blood Products

Objectives

Upon the completion of the course the student shall be able to :

- Know the regulatory Requirements for Biologics and Vaccines
- Understand the regulation for newly developed biologics and biosimilars
- Know the pre-clinical and clinical development considerations of biologics
- Understand the Regulatory Requirements of Blood and/or Its Components Including Blood Products and label requirements

Theory 60 Hrs

1. India : Introduction, Applicable Regulations and Guidelines , Principles for Development of Similar Biologics, Data Requirements for Preclinical Studies, Data Requirements for Clinical Trial Application, Data Requirements for Market Authorization Application, Post-Market Data for Similar Biologics, Pharmacovigilance. GMP and GDP. — 12 Hrs

2 USA: Introduction to Biologics; biologics, biological and biosimilars, different biological products, difference between generic drug and biosimilars, laws, regulations and guidance on biologics/ biosimilars, development and approval of biologics and biosimilars (IND, PMA, BLA, NDA, 510(k), pre-clinical and clinical development considerations, advertising, labelling and packing of biologics — 12 Hrs

3 European Union: Introduction to Biologics; directives, scientific guidelines and guidance related to biologics in EU, comparability/ biosimilarity assessment, Plasma master file, TSE/ BSE evaluation, development and regulatory approval of biologics (Investigational medicinal products and biosimilars), pre-clinical — 12 Hrs

	and clinical development considerations; stability, safety, advertising, labelling and packing of biologics in EU	
4	Vaccine regulations in India, US and European Union: Clinical evaluation, Marketing authorisation, Registration or licensing, Quality assessment, Pharmacovigilance, Additional requirements Blood and Blood Products Regulations in India, US and European Union: Regulatory Requirements of Blood and/or Its Components Including Blood Products, Label Requirements, ISBT (International Society of Blood Transfusion) and IHN (International Haemovigilence Network)	12 Hrs
5	Herbal Products: Quality, safety and legislation for herbal products in India, USA and European Union.	12 Hrs

REFERENCES

1. FDA Regulatory Affairs: A Guide for Prescription Drugs, Medical Devices, and Biologics, Douglas J. Pisano , David S. Mantus ; Informa ,2008
2. Biological Drug Products: Development and Strategies; Wei Wang , Manmohan Singh ; wiley ,2013
3. Development of Vaccines: From Discovery to Clinical Testing; Manmohan Singh , Indresh K. Srivastava ;Wiley, 2011
4. www.who.int/biologicals/en
5. www.fda.gov/BiologicsBloodVaccines/GuidanceComplianceRegulatoryInformation/
6. www.ihn-org.com
7. www.isbtweb.org
8. Guidelines on Similar Biologics: Regulatory Requirements for Marketing Authorization in India
9. www.cdsco.nic.in
10. www.ema.europa.eu › scientific guidelines › Biologicals
11. www.fda.gov/biologicsbloodVaccines/GuidanceCompliance Regulatory Information (Biologics)

REGULATORY ASPECTS OF MEDICAL DEVICES
(MRA 203T)

Scope

This course is designed to impart the fundamental knowledge on the medical devices and in vitro diagnostics, basis of classification and product life cycle of medical devices, regulatory requirements for approval of medical devices in regulated countries like US, EU and Asian countries along with WHO regulations. It prepares the students to learn in detail on the harmonization initiatives, quality and ethical considerations, regulatory and documentation requirements for marketing medical devices and IVDs in regulated countries.

Objectives

Upon completion of the course, the student shall be able to know

- basics of medical devices and IVDs, process of development, ethical and quality considerations
- harmonization initiatives for approval and marketing of medical devices and IVDs
- regulatory approval process for medical devices and IVDs in India, US, Canada, EU, Japan and ASEAN
- clinical evaluation and investigation of medical devices and IVDs

Theory — 60 Hrs

1. Medical Devices: Introduction, Definition, Risk based classification and Essential Principles of Medical Devices and IVDs. Differentiating medical devices IVDs and Combination Products from that of pharmaceuticals, History of Medical Device Regulation, Product Lifecycle of Medical Devices and Classification of Medical Devices. — 12 Hrs

   IMDRF/GHTF: Introduction, Organizational Structure, Purpose and Functions, Regulatory Guidelines, Working Groups, Summary Technical Document (STED), Global Medical Device Nomenclature (GMDN).

2. Ethics: Clinical Investigation of Medical Devices, Clinical Investigation Plan for Medical Devices, Good Clinical Practice for Clinical Investigation of medical devices (ISO 14155:2011) — 12 Hrs

   Quality: Quality System Regulations of Medical Devices: ISO 13485, Quality Risk Management of Medical Devices: ISO 14971, Validation and Verification of Medical device, Adverse Event Reporting of Medical device

3	USA: Introduction, Classification, Regulatory approval process for Medical Devices (510k) Premarket Notification, Pre-Market Approval (PMA), Investigational Device Exemption (IDE) and In vitro Diagnostics, Quality System Requirements 21 CFR Part 820, Labeling requirements 21 CFR Part 801, Post marketing surveillance of MD and Unique Device Identification (UDI). Basics of In vitro diagnostics, classification and approval process.	12 Hrs
4	European Union: Introduction, Classification, Regulatory approval process for Medical Devices (Medical Device Directive, Active Implantable Medical Device Directive) and In vitro Diagnostics (In Vitro Diagnostics Directive), CE certification process. Basics of In vitro diagnostics, classification and approval process.	12 Hrs
5	ASEAN, China & Japan: Medical Devices and IVDs, Regulatory registration procedures, Quality System requirements and clinical evaluation and investigation. IMDRF study groups and guidance documents.	12 Hrs

REFERENCES

1. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics by Douglas J. Pisano, David Mantus.
2. Medical Device Development: A Regulatory Overview by Jonathan S. Kahan
3. Medical Product Regulatory Affairs: Pharmaceuticals, Diagnostics, Medical Devices by John J. Tobin and Gary Walsh
4. Compliance Handbook for Pharmaceuticals, Medical Devices and Biologics by Carmen Medina
5. Country Specific Guidelines from official websites.

REGULATORY ASPECTS OF FOOD & NUTRACEUTICALS
(MRA 204T)

Scope

This course is designed to impart the fundamental knowledge on Regulatory Requirements, Registration and Labeling Regulations of Nutraceuticals in India, USA and Europe.

It prepares the students to learn in detail on Regulatory Aspects for nutraceuticals and food supplements.

Objectives

Upon completion of the course, the student shall be able to

- Know the regulatory Requirements for nutraceuticals
- Understand the regulation for registration and labeling of nutraceuticals and food supplements in India, USA and Europe.

Theory		60 Hrs
1.	Nutraceuticals: Introduction, History of Food and Nutraceutical Regulations, Meaning of Nutraceuticals, Dietary Supplements, Functional Foods, Medical Foods, Scope and Opportunities in Nutraceutical Market.	12 Hrs
2	Global Aspects: WHO guidelines on nutrition. NSF International: Its Role in the Dietary Supplements and Nutraceuticals Industries, NSF Certification, NSF Standards for Food And Dietary Supplements. Good Manufacturing Practices for Nutraceuticals.	12 Hrs
3	India : Food Safety and Standards Act, Food Safety and Standards Authority of India: Organization and Functions, Regulations for import, manufacture and sale of nutraceutical products in India, Recommended Dietary Allowances (RDA) in India.	12 Hrs
4	USA: US FDA Food Safety Modernization Act, Dietary Supplement Health and Education Act. U.S. regulations for manufacture and sale of nutraceuticals and dietary supplements, Labelling Requirements and Label Claims for Dietary Supplements, Recommended Dietary Allowances (RDA) in the U.S	12 Hrs

5	European Union: European Food Safety Authority (EFSA): Organization and Functions. EU Directives and regulations for manufacture and sale of nutraceuticals and dietary supplements. Nutrition labelling. European Regulation on Novel Foods and Novel Food Ingredients. Recommended Dietary Allowances (RDA) in Europe.	12 Hrs

REFERENCES

1. Regulation of Functional Foods and Nutraceuticals: A Global Perspective by Clare M. Hasler (Wiley Online Library)
2. Nutraceutical and Functional Food Regulations in the United States and Around the World by Debasis Bagchi (Academic Press, Elsevier)
3. http://www.who.int/publications/guidelines/nutrition/en/
4. http://www.europarl.europa.eu/RegData/etudes/STUD/2015/536324/IPOL_STU(2015)536324_EN.pdf
5. Handbook of Nutraceuticals by Yashwant Pathak (CRC Press)
6. Food Regulation: Law, Science, Policy and Practice by Neal D. Fortin (Wiley)
7. Country Specific Guidelines from official websites.

REGULATORY AFFAIRS PRACTICAL - II
(MRA 205P)

1. Case studies on
2. Change Management/ Change control. Deviations
3. Corrective & Preventive Actions (CAPA)
4. Documentation of raw materials analysis as per official monographs
5. Preparation of audit checklist for various agencies
6. Preparation of submission to FDA using eCTD software
7. Preparation of submission to EMA using eCTD software
8. Preparation of submission to MHRA using eCTD software
9. Preparation of Biologics License Applications (BLA)
10. Preparation of documents required for Vaccine Product Approval
11. Comparison of clinical trial application requirements of US, EU and India of Biologics
12. Preparation of Checklist for Registration of Blood and Blood Products
13. Registration requirement comparison study in 5 emerging markets (WHO) and preparing check list for market authorization
14. Registration requirement comparison study in emerging markets (BRICS) and preparing check list for market authorization
15. Registration requirement comparison study in emerging markets (China and South Korea) and preparing check list for market authorization
16. Registration requirement comparison study in emerging markets (ASEAN) and preparing check list for market authorization
17. Registration requirement comparison study in emerging markets (GCC) and preparing check list for market authorization
18. Checklists for 510k and PMA for US market
19. Checklist for CE marking for various classes of devices for EU
20. STED Application for Class III Devices
21. Audit Checklist for Medical Device Facility
22. Clinical Investigation Plan for Medical Devices

PHARMACEUTICALBIOTECHNOLOGY(MPB)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPB 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know,

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY 60 Hrs

1. a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy. 12 Hrs

   IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy

   b. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

   c. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy. 12 Hrs

3	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy	12 Hrs
4	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Affinity chromatography	12 Hrs
5	a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder diffration technique, Types of crystals and applications of X-ray diffraction.	12 Hrs

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series

MICROBIAL AND CELLULAR BIOLOGY
(MPB 102T)

Scope

This subject is designed to provide the advanced knowledge to the biotechnology students in invaluable areas of advanced microbiology which plays a crucial role in determining its future use and applications in medicine, drug discovery and in pharmaceutical industry.

Objective

At the completion of this course it is expected that the students will get an understanding about the following aspects;

- Importance of Microorganisms in Industry
- Central dogma of molecular biology
- Structure and function of cell and cell communication
- Cell culture technology and its applications in pharmaceutical industries.
- Microbial pathogenesis and correlating it to rational use of antimicrobial agents.

THEORY 60Hrs

1. Microbiology 12 Hrs

Introduction – Prokaryotes and Eukaryotes. Bacteria, fungi, actionomycetes and virus - structure, chemistry and morphology, cultural, physiological and reproductive features. Methods of isolation, cultivation and maintenance of pure cultures. Industrially important microorganisms - examples and applications

2 Molecular Biology: Structure of nucleus and chromosome, Nucleic acids and composition, structure and types of DNA and RNA. Central dogma of molecular biology: Replication, Transcription and translation. 12 Hrs

Gene regulation

Gene copy number, transcriptional control and translational control.

RNA processing

Modification and Maturation, RNA splicing, RNA editing, RNA amplification. Mutagenesis and repair mechanisms, types of mutants, application of mutagenesis in stain improvement, gene mapping of plasmids- types purification and application. Phage genetics, geneticorganization, phage mutation and lysogeny.

3	Cell structure and function Cell organelles, cytoskeleton & cell movements, basic aspectsof cell regulation, bioenergetics and fuelling reactions of aerobics and anaerobics,secondary metabolism & its applications. Cell communication, cell cycle and apoptosis, mechanism of cell division. Celljunctions/adhesion and extra cellular matrix, germ cells and fertilization, histology – thelife and death of cells in tissues. Cell Cycle and Cytoskeleton Cell Division and its Regulation, G-Protein CoupledReceptors, Kinases, Nuclear receptors, Cytoskeleton & cell movements, IntermediateFilaments. Apoptosis and Oncogenes Programmed Cell Death, Tumor cells, carcinogens & repair. Differentiation and Developmental Biology Fertilization, Events of Fertilization, In vitro Fertilization, Embryonic Germ Cells, Stem Cells and its Application.	12 Hrs
4	Principles of microbial nutrition Physical and chemical environment for microbial growth, Stability and degeneration of microbial cultures. Growth of animal cells in culture General procedure for cell culture, Nutrient composition, Primary, established and transformed cell cultures, applications of cell cultures in pharmaceutical industry and research. Growth of viruses in cell culture propagation and enumeration. In-vitro screening techniques- cytotoxicity, anti-tumor, anti-viral assays.	12 Hrs
5	Microbial pathology Identifying the features of pathogenic bacteria, fungi and viruses. Mechanism of microbial pathogenicity, etiology and pathology of common microbial diseases and currently recommended therapies for common bacterial, fungal & viral infections. Mechanism of action of antimicrobial agents and possible sites of chemotherapy.	12 Hrs

REFERENCES

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn, Industrial Microbiology, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. David Freifelder, Molecular Biology, 2nd edition, Narosa Publishing House.
5. R. Ian Freshney, Culture of animal cells – A manual of Basic techniques, 6th edition, Wileys publication house.
6. David Baltimore,Molecular cell biology, W H Freeman & Co publishers.
7. Cell biology vol-I,II,III by Julio E.Cells
8. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company.

BIOPROCESS ENGINEERING AND TECHNOLOGY
(MPB 103T)

Scope

This paper has been designed to provide the knowledge to the biotechnology students in invaluable areas of bioprocess technology to develop skills to modify, design and operate different types of fermenters, to understand and implement various fermentation procedures, to train students in scale up fermentation operations.

Objective

At the completion of this subject it is expected that students will be able to,

- Understand basics and design of fermentation technology
- Scale up and scale down processing of fermentation technology
- Bioprocessing of the industrially important microbial metabolites in industries and R & D organizations.
- Regulation governing the manufacturing of biological products
- Understand and conduct fermentation process kinetics.

	THEORY	60 Hrs
1.	Introduction to fermentation technology Basic principles of fermentation Study of the design and operation of bioreactor Ancillary parts and function, impeller design and agitation, power requirements on measurements and control of dissolved oxygen, carbon dioxide, temperature, pH and foam. Types of bioreactor CSTR, tower, airlift, bubble column, packed glass bead, hollow fiber, configuration and application Computer control of fermentation process System configuration and application	12 Hrs
2	Mass transfer Theory, diffusional resistance to oxygen requirements of microorganisms, measurements of mass transfer co- efficient and factor affecting them, effects of aeration and agitation on mass transfer, supply of air, air compressing, cleaning and sterilization of air and plenum ventilation, air sampling and testing standards for air purity.	12 Hrs

Rheology

Rheological properties of fermentation system and their importance in bioprocessing.

3 Scale up of fermentation process — 12 Hrs

Principles, theoretical considerations, techniques used, media for fermentation, HTST sterilization, advantage and disadvantage, liquid sterilization.

Cultivation and immobilized culture system

Cultivation system - batch culture, continuous culture, synchronous cultures, fed batch culture. Graphical plot representing the above systems.

Introduction to immobilization

Techniques, immobilization of whole cell, immobilized culture system to prepare fine chemicals. Immobilization of enzymes and their applications in the industry. Reactors for immobilized systems and perspective of enzyme engineering.

4 Scale down of fermentation process — 12 Hrs

Theory, equipment design and operation, methods of filtration, solvent extraction, chromatographic separation, crystallization turbidity analysis and cell yield determination, metabolic response assay, enzymatic assay, bioautographic techniques and disruption of cells for product recovery.

Isolation and screening

Primary and secondary, maintenance of stockculture, strain improvement for increased yield.

5 Bioprocessing of the industrially important microbial metabolites — 12 Hrs

a) Organic solvents – Alcohol and Glycerol
b) Organic acids - Citric acids, Lactic acids,
c) Amino acids - Glutamic acids, Lysine, Cyclic AMP and GMP
d) Antibiotics - Penicillin, Streptomycin, Griseofulvin,
e) Vitamins - B12, Riboflavin and Vitamin C

Biosynthetic pathways for some secondary metabolites, microbial transformation of steroids and alkaloids

Regulation governing the manufacturing of biological products .

REFERENCES

1. Peter Stanbury, Allan Whitaker, Stephen Hall, Principles of Fermentation technology, Elsevier stores.
2. L.E. Casida, Industrial Microbiology, John Wiley & sons Inc.
3. F.M. Asubel, Current protocols in molecular biology, volume I and II, John Wiley Publishers.
4. Biotol Board, Bioreactor design and product yield, Butterworth and Helhemann Publishers.
5. H. Patel, Industrial microbiology, Macmillan India Limited.

ADVANCED PHARMACEUTICAL BIOTECHNOLOGY
(MPB 104T)

Scope

This paper has been designed to provide the knowledge to the students to develop skills of advanced techniques of isolation and purification of enzymes, to enrich students with current status of development of vaccines and economic importance of biotechnology products.

Objective

At the completion of this subject it is expected that students will be able to

- Understand about the latest technology development in biotechnology technique, tools and their uses in drug and vaccine development.
- Identify appropriate sources of enzymes.
- Understand and perform genetic engineering techniques in gene manipulation, r-DNA technology and gene amplification.
- Understand the overview of pharmacogenomics.
- Learn the regulatory approval process and key regulatory agencies for new drugs, biologics, devices, and drug-device combinations.

THEORY 60 Hrs

1. Enzyme Technology 12 Hrs

Classification, general properties of enzymes, dynamics of enzymatic activity,sources of enzymes, extraction and purification, pharmaceutical,therapeutic and clinical application. Production of amyloglucosidase, glucose isomerase,amylase and trypsin.

2 Genetic Engineering 12 Hrs

Techniques of gene manipulation, cloning strategies,procedures, cloning vectors expression vectors, recombinant selection andscreening, expression in E.coli and yeast.

Site directed mutagenesis, polymerase chain reaction, and analysis of DNAsequences.

Gene library and cDNA

Applications of the above technique in the production of,

- Regulatory proteins - Interferon, Interleukins
- Blood products - Erythropoietin
- Vaccines - Hepatitis-B
- Hormones - Insulin

3	Therapeutic peptides Study on controlled and site specified delivery of therapeutic peptides and proteins through various routes of administration. Transgenic animals Production of useful proteins in transgenic animals and gene therapy. Human Genome The human genome project-a brief study, Human chromosome – Structure and classification, chromosomal abnormalities – Syndromes	12 Hrs
4	Signal transduction Introduction, cell signaling pathways, Ion channels, Sensors and effectors, ON and OFF mechanisms, Spatial and temporal aspects of signaling, cellular process, development, cell cycle and proliferation, neuronal signaling, cell stress, inflammatory responses and cell death, signaling defects and diseases. Oncogenes Introduction, definition, various oncogenes and their proteins.	12 Hrs
5	Microbial Biotransformation Biotransformation for the synthesis of chiral drugs and steroids. Microbial Biodegradation Biodegradation of xenobiotics, chemical and industrial wastes, Production of single-cell protein, Applications of microbes in environmental monitoring. Biosensors Definition, characteristics of ideal biosensors, types of biosensors, biological recognition elements, transducers, application of biosensors.	12 Hrs

REFERENCES

1. Biotechnology-The biological principles: MD Trevan, S Boffey, KH Goulding and P.F. Stanbury.
2. Immobilization of cells and enzymes: HosevearKennadycabral& Bicker staff
3. Principles of Gene Manipulating: RW Old and S.B.Primrose.
4. Molecular Cell Biology: Harvey Lodish, David Baltimore, Arnold Berk, S LawenceZipursky, Paul Matsudaira, James Darnell.
5. Modern Biotechnology: S.B Primrose

6. Gene transfer and expression protocols-methods in Molecular Biology, vol. VII, Edit E.T. Murray
7. Current protocols in Molecular Biology, Vo1.I & II:F.M. Asubel, John wiley Publishers
8. Current protocols in cellular biology, Vo1.1 & II John wiley publishers.
9. Principles of human genetics; by Curt Stern, published by W.H. Freeman.

PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL - I
(MPB 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. Isolation and Purification of microorganism from the soil
8. Microbial contamination of Water and biochemical parameters.
9. Determination of Minimum Inhibitory concentration by gradient plate technique and serial dilution method.
10. UV- survival curve and Dark repair
11. Sterility test for pharmaceutical preparations
12. Sub culturing of cells and cytotoxicity assays.
13. Construction of growth curve and determination of specific growth rate and doubling time
14. Fermentation process of alcohol and wine production
15. Fermentation of vitamins and antibiotics
16. Whole cell immobilization engineering
17. Thermal death kinetics of bacteria
18. Replica plating
19. Bio-autography.
20. Isolation and estimation of DNA
21. Isolation and estimation of RNA
22. Isolation of plasmids
23. Agarose gel electrophoresis.
24. Transformation techniques
25. SDS - polyacrylamide gel electrophoresis for proteins
26. Polymerase chain reaction technique.

PROTEINS AND PROTEIN FORMULATIONS
(MPB 201T)

Scope

This course is designed to impart knowledge and skills necessary for knowing fundamental aspects of proteins and their formulations is a part of drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of information for protein formulation and design are provided to help the students to clarify the various biological concepts of protein.

Objective

At the completion of this course it is expected that students will be able to understand,

- Various methods of purification of proteins
- Peptides in drug development
- Protein identification and characterization
- Protein based formulations
- Sequencing proteins

THEORY 60 Hrs

1. Protein engineering — 12 Hrs

   Concepts for protein engineering. Isolation and purification of proteins, Stability and activity based approaches of protein engineering, Chemical and Physical Considerations in Protein and Peptide Stability, Different methods for protein engineering, gene shuffling, and direct evolution.

2 Peptidomimetics — 12 Hrs

   Introduction, classification; Conformationally restricted peptides, design, pseudopeptides, peptidomimetics and transition state analogs; Biologically active template; Amino acid replacements; Peptidomimetics and rational drug design; CADD techniques in peptidomimetics; Development of non peptide peptidomimetics.

3 Proteomics — 12 Hrs

   Protein identification and characterization: Methods/strategies, protein identification, de novo protein characterization, Isotope labelling, N- and C-terminal tags.

2-Dimensional gel electrophoresis

Methods including immobilized pH gradients (IPGs), resolution, reproducibility and image analysis, future developments

4	Protein formulation Different strategies used in the formulation of DNA and proteins, Analytical and biophysical parameters of proteins and DNA in pre-formulation, Liposomes, Neon-spears, Neon-particulate system, PEGylation, Biological Activity, Biophysical Characterization Techniques, Forced degradation studies of protein.	12 Hrs
5	Methods of protein sequencing Various methods of protein sequencing, characterisation, Edman degradation, Tryptic and/or Chymotryptic Peptide Mapping.	12 Hrs

REFERENCES

1. H. Lodhishet. Al. Molecular Cell Biology, W. H. Freeman and Company
2. Protein Purification – Hand Book, Amersham pharmacia biotech
3. EngelbertBuxbaum, Fundamentals of Protein Structure and Function, Springer Science
4. Sheldon J. Park, Jennifer R. Cochran, Protein Engineering and Design, CRC press.
5. Robert K. Skopes. Protein purification, principle and practice, springer link.
6. David Whitford, Proteins-Structure and Function, John Wiley & Sons Ltd.
7. James Swarbrick, Protein Formulation and Delivery Informa Healthcare USA,Inc.
8. Rodney Pearlman, Y. John Wang Formulation, Characterization, and Stability of Protein Drugs, Kluwer Academic Publishers.

IMMUNOTECHNOLOGY
(MPB 202T)

Scope

This course is designed to impart knowledge on production and engineering of antibodies, the application of antigens, the design of (recombinant) vaccines, strategies for immune intervention, etc. The Immunotechnology - based techniques will be used for therapeutics and diagnostics, industries in the production, quality control and quality assurance, and in R&D.

Objective

After this course, the students will be able to:-

- Understand the techniques like immunodiagnostic tests,
- Characterization of lymphocytes, purification of antigens and antibody, etc.
- Access health problems with immunological background;
- Develop approaches for the immune intervention of diseases

THEORY 60 Hrs

1. Fundamental aspects of immunology 12 Hrs

Introduction, cells and organs of the immune system, cellular basis of Immune response, primary and secondary lymphoid organs, antigen antibody and their structure.

Types of immune responses, anatomy of immune response.

Overview of innate and adaptive Immunity.

Humoral Immunity

B - Lymphocytes and their activation. Structure and function of immunoglobulins, idiotypes and anti idiotypic antibodies.

Cell mediated Immunity

Thymus derived lymphocytes (T cells) - their ontogeny and types, MHC complex, antigen presenting cells (APC), mechanisms of T cell activation, macrophages, dendritic cells, langerhans cells, mechanism of phagocytosis

2 Immune Regulation and Tolerance 12 Hrs

Complement activation and types and their biological functions, cytokines and their role in immune response.

Hypersensitivity

Hypersensitivity Types I-IV, Hypersensitivity reactions and treatment

Autoimmune diseases

3 Vaccine technology 12 Hrs

Vaccine and their types, conventional vaccines, novel methods for vaccine production, antiidiotype vaccine, DNA vaccine, genetically engineered vaccine, iscoms, synthetic peptides, and immunodiagnostics.

Stem cell technology

Stem cell technology and applications to immunology

4 Hybridoma Technology 12 Hrs

Hybridoma techniques – fusion methods for myeloma cells and B-Lymphocytes, selection and screening techniques. Production and purification of monoclonal antibodies and their applications in Pharmaceutical industry.

5 Immunological Disorder 12 Hrs

Autoimmune disorders and types, pathogenic mechanisms, treatment, experimental models of auto immune diseases, primary and secondary immunodeficiency disorders.

Immunodiagnosis

Antigen antibody interaction – Precipitation reaction, Agglutination reactions, Principles and applications of ELISA, Radio Immuno Assay, Western blot analysis, immune-electrophoresis, immuno fluorescence, chemiluminescence assay, complement fixation reaction.

REFERENCES

1. J. Kubey, Immunology – an Introduction.
2. S.C. Rastogi, Immunodiagonstics, New Age International.
3. Ashim Chakravarthy, Immunology and Immunotechnology, Oxford University Press.
4. E. Benjamini, Molecular Immunology.

BIOINFORMATICS AND COMPUTATIONAL BIOTECHNOLOGY
(MPB 203T)

Scope

This paper has been designed to provide the advanced knowledge to the biotechnology students in invaluable areas of advanced bioinformatics which plays a crucial role in determining its future use and applications in medicine, drug discovery and in pharmaceutical industry.

Objectives

Upon completion of this course it is expected that the students will be able to understand,

- Use of computers in developing a new drugs
- Biological concepts for bioinformatics
- Proteins and their diversity
- Various gene finding methods
- Searching the biological databases
- Target searching
- Various methods of drug designing

THEORY 60 Hrs

1. Introduction to Bioinformatics — 12 Hrs

Definition and History of Bioinformatics, Internet and Bioinformatics, Introduction to Data Mining, Applications of Data Mining to Bioinformatics,

Biological Database

Protein and nucleic acid databases. Structural data bases. Collecting and storing the sequence and Applications of Bioinformatics.

2 Sequence analysis — 12 Hrs

Sequence alignment, pair wise alignment techniques, multiple sequence analysis, multiple sequence alignment; Flexible sequence similarity searching with the FAST3 program package, the use of CLUSTAL W and CLUSTAL X for the multiple sequence alignment. Tools used for sequence analysis.

3 Protein informatics — 12 Hrs

Introduction; Force field methods; Energy, buried and exposed residues, side chains and neighbours; Fixed regions, hydrogen bonds, mapping properties onto surfaces; Fitting monomers, R &

S fit of conformers, assigning secondary structures; Sequence alignment-methods, evaluation, scoring; Protein completion, backbone construction and side chain addition; Small peptide methodology, software accessibility, building peptides; Protein displays; Substructure manipulations, annealing.

Protein structure prediction

Protein folding and model generation; Secondary structure prediction, analyzing secondary structures; Protein loop searching, loop generating methods, loop analysis; Homology modeling, concepts of homology modeling, potential applications, description, methodology, homologous sequence identification; Align structures, align model sequence; Construction of variable and conserved regions, threading techniques, Topology fingerprint approach for prediction, evaluation of alternate models; Structure prediction on a mystery sequence, structure aided sequence techniques of structure prediction, structural profiles, alignment algorithms, mutation tables, prediction, validation, sequence based methods of structure prediction, prediction using inverse folding, fold prediction; Significance analysis, scoring techniques, sequence- sequence scoring.

Docking

Docking problems, methods for protein- ligand docking, validation studies and applications; Screening small molecule databases, docking of combinatorial libraries, input data, analyzing docking results.

4 Diversity of Genomes 12 Hrs

Prokaryotic and Eukaryotic Gene Families. Genome Analysis: Introduction, Gene prediction methods, Gene mapping and applications- Genetic and Physical Mapping, Integrated map, Sequence assembly and gene expression.

Completed Genomes

Bacterium, Nematode, Plant and Human

Evolution of Genomes

Lateral or Horizontal Transfer among Genomes, Transcriptome and Proteome-General Account

Phylogenetic analysis

Evolutionary Change in Nucleotide Sequences, Rates and Patterns of Nucleotide Substitution, Models for Nucleotide Substitution, Construction of Phylogenetic Tree, Genome Annotation technique.

5	Target searching and Drug Designing Target and lead, timeline for drug development, target discovery, target modulators, In-silico gene expression, microarray, and lead discovery, libraries of ligands, active site analysis, and prediction of drug quality.	12 Hrs

REFERENCES

1. David W. Mount, Bioinformatics Sequence and Genome Analysis, CBS Publishers and Distributors
2. S. C. Rastogiet. al. Bioinformatics- Concepts Skill and Applications, CBS Publishers and Distributors
3. T. E. Creighton, Protein Structure and Molecular Properties, W. H.Freeman and Company
4. Andreas D. Baxevanis, B. F. Francis Ouellette, Bioinformatics; A Practical Guide to the Analysis of Genes and Proteins, John Wiley & Sons, Inc.
5. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press.
6. Shui Qing Ye. Bioinformatics: A Practical Approach, Chapman & Hall/CRC.
7. David Posada, Bioinformatics for DNA Sequence Analysis, Humana press.
8. Lesk, A.M. Introduction to Bioinformatics. Oxford University Press.
9. Letovsky, S.I. Bioinformatics. Kluwer Academic Publishers.
10. Baldi, P. and Brunak, S. Bioinformatics. The MIT Press.

BIOLOGICAL EVALUATION OF DRUG THERAPY
(MPB 204T)

Scope

This paper has been designed to provide the knowledge to the biotechnology students to understand the importance of biological and evaluation of drug therapy of biological medicines.

Objective

At the completion of this subject it is expected that students will be able to,

- Understand about the general concept of standardization of biological.
- Understand the importance of transgenic animals and knockout animals.
- Understand the biological medicines in development of various diseases.
- Learn the biological evaluation of drugs in vitro and in vivo

THEORY 60 Hrs

1. Biological Standardization 12 Hrs

General principles, Scope and limitation of bio-assay, bioassay of some official drugs.

Preclinical drug evaluation

Preclinical drug evaluation of its biological activity, potency and toxicity-Toxicity test in animals including acute, sub-acute and chronic toxicity, ED50 and LD50 determination, special toxicity test like teratogenecity and mutagenecity.

Guidelines for toxicity studies

Various guidelines for toxicity studies. Animal experiments assessing safety of packaging materials.

2 Pyrogens 12 Hrs

Pyrogens: Sources, Chemistry and properties of bacterial pyrogens and endotoxins, Official pyrogen tests.

Microbiological assay

Assay of antibiotics and vitamins.

Biological evaluation of drugs

Screening and evaluation (including principles of screening, development of models for diseases: In vivo models / In vitro models / cell line study).

3 Biologic Medicines in Development for various diseases - By Therapeutic Category — 12 Hrs

- Genetic Disorders
- Eye related Disorders
- Digestive Disorders
- Diabetes/Related Conditions
- Cardiovascular Disease
- Cancer/Related Conditions
- Blood Disorders
- Autoimmune Disorders
- Infectious Diseases
- Neurologic Disorders
- Skin Diseases
- Organe Transplantation

Biologic Medicines in Development for various diseases – by Product Category

- Antisense
- Vaccines
- Recombinant Hormones/Proteins
- Monoclonal Antibodies (mAb)
- Interferons
- Growth Factors
- Gene Therapy
- RNA Interference

4 Regulatory aspects : drugs, biologics and medical devices — 12 Hrs

An introduction to the regulations and documents necessary for approval of a medical product.

Regulatory consideration

Regulatory consideration for pre-clinical testing and clinical testing of drugs, biologics and medical devices.

New Drug Applications for Global Pharmaceutical Product Approvals

5 Bioavailability — 12 Hrs

Objectives and consideration in bio-availability studies of Biopharmaceuticals, Concept of equivalents, Measurements of bio-availability.

Determination of the rate of absorption, Bioequivalence and its importance, Regulatory aspects of bio-availability and bioequivalence studies for conventional dosage forms and controlled drug delivery systems of Biopharmaceuticals.

Pharmacokinetics

Pharmacokinetics:- Basic consideration, Pharmacokinetic models, Application of Pharmacokinetics in new drug development of Biopharmaceuticals and designing of dosage forms and Novel drug delivery systems of Biopharmaceuticals.

REFERENCES

1. Perkins F.T., Hennessen W. Standardization and Control of Biologicals Produced by Recombinant DNA Technology, International Association of Biological Standardization
2. J.H. Burn., Biological Standardization, Oxford University Press
3. Drug Discovery and Evaluation in Pharmacology assay: Vogel
4. Chow, Shein, Ching, Design and analysis of animal studies in pharmaceutical development,
5. Nodine and Siegler, Animal and Clinical pharmacologic Techniques in Drug Evaluation.
6. Screening methods in pharmacology (vol I & II), R.A. Turner.

PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL - II
(MPB 205P)

1. Protein identification
2. Protein characterization
3. Protein biochemistry
4. Recombinant DNA Technology
5. Protein expression
6. Protein formulations
7. Database searching
8. Sequence analysis methods
9. Protein structure prediction
10. Gene annotation methods
11. Phylogenetic analysis
12. Protein, DNA binding studies
13. Preparation of DNA for PCR applications – Isolation, Purity and Quantification
14. Introduction to PCR – working of PCR, Programming.
15. Introduction to RT-PCR – working, programming.
16. Primer design using softwares.
17. Gene DNA amplification by random / specific primers.
18. Southern Hybridization
19. Western Blotting
20. Gene transformation

PHARMACYPRACTICE(MPP)

CLINICAL PHARMACY PRACTICE (MPP 101T)

Scope

This course is designed to impart the basic knowledge and skills that are required to practice pharmacy including the provision of pharmaceutical care services to both healthcare professionals and patients in clinical settings.

Objectives

Upon completion of this course it is expected that students shall be able to :

- Understand the elements of pharmaceutical care and provide comprehensive patient care services
- Interpret the laboratory results to aid the clinical diagnosis of various disorders
- Provide integrated, critically analyzed medicine and poison information to enable healthcare professionals in the efficient patient management

THEORY 60 Hrs

1. Introduction to Clinical Pharmacy: Definition, evolution and scope of clinical pharmacy, International and national scenario of clinical pharmacy practice, Pharmaceutical care — 12 Hrs

   Clinical Pharmacy Services: Ward round participation, Drug therapy review (Drug therapy monitoring including medication order review, chart endorsement, clinical review and pharmacist interventions)

2 Clinical Pharmacy Services: Patient medication history interview, Basic concept of medicine and poison information services, Basic concept of pharmacovigilance, Hemovigilance, Materiovigilance and AEFI, Patient medication counselling, Drug utilisation evaluation, Documentation of clinical pharmacy services, Quality assurance of clinical pharmacy services. — 12 Hrs

3 Patient Data Analysis: — 12 Hrs

Patient Data & Practice Skills: Patient's case history - its structure and significances in drug therapy management, Common medical abbreviations and terminologies used in clinical practice, Communication skills: verbal and non-verbal communications, its applications in patient care services.

	Lab Data Interpretation: Hematological tests, Renal function tests, Liver function tests	
4	Lab Data Interpretation: Tests associated with cardiac disorders, Pulmonary function tests, Thyroid function tests, Fluid and electrolyte balance, Microbiological culture sensitivity tests	12 Hrs
5	Medicines & Poison Information Services Medicine Information Service: Definition and need for medicine information service, Medicine information resources, Systematic approach in answering medicine information queries, Preparation of verbal and written response, Establishing a drug information centre. Poison Information Service: Definition, need, organization and functions of poison information centre.	12 Hrs

REFERENCES

1. A Textbook of Clinical Pharmacy Practice – Essential concepts and skills – Parthasarathi G, Karin Nyfort-Hansen and Milap Nahata
2. Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia
3. Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc
4. Relevant review articles from recent medical and pharmaceutical literature.

PHARMACOTHERAPEUTICS-I
(MPP 102T)

Scope

This course aims to enable the students to understand the different treatment approaches in managing various disease conditions. Also, it imparts knowledge and skills in optimizing drug therapy of a patient by individualizing the treatment plan through evidence-based medicines.

Objectives

Upon completion of this course it is expected that students shall be able to:

- Describe and explain the rationale for drug therapy
- Summarize the therapeutic approach for management of various disease conditions including reference to the latest available evidence
- Discuss the clinical controversies in drug therapy and evidence based medicine
- Prepare individualized therapeutic plans based on diagnosis
- Identify the patient specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time- course of clinical and laboratory indices of therapeutic response and adverse effect/s)

THEORY 60 Hrs

Etiopathogenesis and pharmacotherapy of diseases associated with following systems

1.	Cardiovascular system: Hypertension, Congestive cardiac failure, Acute coronary syndrome, Arrhythmias, Hyperlipidemias.	12 Hrs
2	Respiratory system: Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases Endocrine system: Diabetes, Thyroid diseases	12 Hrs
3	Gastrointestinal system: Peptic ulcer diseases, Reflux esophagitis, Inflammatory bowel diseases, Jaundice & hepatitis	12 Hrs
4	Gastrointestinal system: Cirrhosis, Diarrhea and Constipation, Drug-induced liver disease	12 Hrs
	Hematological diseases: Anemia, Deep vein thrombosis, Drug induced hematological disorders	

5	Bone and joint disorders: Rheumatoid arthritis, Osteoarthritis, Gout, Osteoporosis	12 Hrs
	Dermatological Diseases: Psoriasis, Eczema and scabies, impetigo, drug induced skin disorders	
	Ophthalmology: Conjunctivitis, Glaucoma	

REFERENCES

1. Roger and Walker. Clinical Pharmacy and Therapeutics - Churchill Livingstone publication
2. Joseph T. Dipiro et al. Pharmacotherapy: A Pathophysiologic Approach- Appleton & Lange
3. Robins SL. Pathologic basis of disease -W.B. Saunders publication
4. Eric T. Herfindal. Clinical Pharmacy and Therapeutics- Williams and Wilkins Publication
5. Lloyd Young and Koda-Kimble MA Applied Therapeutics: The clinical Use of Drugs- Lippincott Williams and Wilkins
6. Chisholm- Burns Wells Schwinghammer Malone and Joseph P Dipiro. Pharmacotherapy Principles and practice-– McGraw Hill Publication
7. Carol Mattson Porth. Principles of Pathophysiology- Lippincott Williams and Wilkins
8. Harrison's. Principles of Internal Medicine - McGraw Hill
9. Relevant review articles from recent medical and pharmaceutical literature

HOSPITAL & COMMUNITY PHARMACY
(MPP 103T)

Scope

This course is designed to impart basic knowledge and skills that are required to practice pharmacy in both hospital and community settings.

Objectives

Upon completion of this course it is expected that students shall be able to:

- Understand the organizational structure of hospital pharmacy
- Understand drug policy and drug committees
- Know about procurement & drug distribution practices
- Know the admixtures of radiopharmaceuticals
- Understand the community pharmacy management
- Know about value added services in community pharmacies

THEORY 60 Hrs

1.	Introduction to Hospitals – Definition, classification, organizational structure Hospital Pharmacy: Definition, Relationship of hospital pharmacy department with other departments, Organizational structure, legal requirements, work load statistics, Infrastructural requirements, Hospital Pharmacy Budget and Hospital Pharmacy management Hospital Drug Policy: Pharmacy & Therapeutics Committee, Infection Control committee, Research & Ethics Committee, Management of Medicines as per NABH	12 Hrs
2	Hospital Formulary Guidelines and its development, Developing Therapeutic guidelines, Drug procurement process, and methods of Inventory control, Methods of Drug distribution, Intravenous admixtures, Hospital Waste Management	12 Hrs
3	Education and training: Training of technical staff, training and continuing education for pharmacists, Pharmacy students, Medical staff and students, Nursing staff and students, Formal and informal meetings and lectures, Drug and therapeutics newsletter. Community Pharmacy Practice: Definition, roles & responsibilities of community pharmacists, and their relationship with other health care providers.	12 Hrs

	Community Pharmacy management: Legal requirements to start community pharmacy, site selection, lay out & design, drug display, super drug store model, accounts and audits, Good dispensing practices, Different softwares & databases used in community pharmacies. Entrepreneurship in community pharmacy.	
4	Prescription – Legal requirements & interpretation, prescription related problems Responding to symptoms of minor ailments: Head ache, pyrexia, menstrual pains, food and drug allergy, OTC medication: Rational use of over the counter medications Medication counseling and use of patient information leaflets Medication adherence – Definition, factors influencing adherence behavior, strategies to improve medication adherence Patient referrals to the doctors ADR monitoring in community pharmacies	12 Hrs
5	Health Promotion – Definition and health promotion activities, family planning, Health screening services, first aid, prevention of communicable and non-communicable diseases, smoking cessation, Child & mother care National Health Programs- Role of Community Pharmacist in Malaria and TB control programs Home Medicines review program – Definition, objectives, Guidelines, method and outcomes Research in community pharmacy Practice	12 Hrs

REFERENCES

1. Hospital Pharmacy - Hassan WE. Lea and Febiger publication.
2. Textbook of hospital pharmacy - Allwood MC and Blackwell.
3. Avery's Drug Treatment, Adis International Limited.
4. Community Pharmacy Practice – Ramesh Adepu, BSP Publishers, Hyderabad
5. Remington Pharmaceutical Sciences.
6. Relevant review articles from recent medical and pharmaceutical literature

CLINICAL RESEARCH
(MPP 104T)

Scope

This course aims to provide the students an opportunity to learn drug development process especially the phases of clinical trials and also the ethical issues involved in the conduct of clinical research. Also, it aims to imparts knowledge and develop skills on conceptualizing, designing, conducting and managing clinical trials.

Objectives

Upon completion of this course it is expected that students shall be able to:

- Know the new drug development process.
- Understand the regulatory and ethical requirements.
- Appreciate and conduct the clinical trials activities
- Know safety monitoring and reporting in clinical trials
- Manage the trial coordination process

THEORY 60 Hrs

1. Drug development process: Introduction, various approaches to drug discovery, Investigational new drug application submission Ethics in Biomedical Research: Ethical Issues in Biomedical Research – Principles of ethics in biomedical research, Ethical committee [institutional review board] - its constitution and functions, Challenges in implementation of ethical guidelines, ICH GCP guidelines and ICMR guidelines in conduct of Clinical trials, Drug Safety Reporting. 12 Hrs

2 Types and Designs used in Clinical Research: Planning and execution of clinical trials, Various Phases of clinical trials, Bioavailability and Bioequivalence studies, Randomization techniques (Simple randomization, restricted randomization, blocking method and stratification), Types of research designs based on Controlling Method (Experimental, Quasi experimental, and Observational methods) Time Sequences (Prospective and Retrospective), Sampling methods (Cohort study, case Control study and cross sectional study), Health outcome measures (Clinical & Physiological, Humanistic and economic) 12 Hrs

Clinical Trial Study team: Roles and responsibilities of: Investigator, Study Coordinator, Sponsor, Monitor, Contract Research Organization.

3	Clinical trial Documents: Guidelines to the preparation of following documents: Protocols, Investigator's Brochure, Informed Consent Form, Case report forms, Contracts and agreements, Dairy Cards Clinical Trial Start up activities: Site Feasibility Studies, Site/Investigator selection, Pre-study visit, Investigator meeting, Clinical trial agreement execution, Ethics committee document preparation and submission	12 Hrs
4	Investigational Product: Procurement and Storage of investigation product Filing procedures: Essential documents for clinical trial, Trial Master File preparation and maintenance, Investigator Site File, Pharmacy File, Site initiation visit, Conduct, Report and Follow up Clinical Trial Monitoring and Close out: Preparation and conduct of monitoring visit: Review of source documents, CRF, ICF, IP storage, accountability and reconciliation, Study Procedure, EC communications, Safety reporting, Monitoring visit reporting and follow-up Close-Out visit: Study related documents collection, Archival requirement, Investigational Product reconciliation and destruction, Close-Out visit report.	12 Hrs
5	Quality Assurance and Quality Control in Clinical Trials: Types of audits, Audit criteria, Audit process, Responsibilities of stakeholders in audit process, Audit follow-up and documentation, Audit resolution and Preparing for FDA inspections, Fraud and misconduct management Data Management Infrastructure and System Requirement for Data Management: Electronic data capture systems, Selection and implementation of new systems, System validation and test procedures, Coding dictionaries, Data migration and archival Clinical Trial Data Management: Standard Operating Procedures, Data management plan, CRF & Data base design considerations, Study set-up, Data entry, CRF tracking and corrections, Data cleaning, Managing laboratory and ADR data, Data transfer and database lock, Quality Control and Quality Assurance in CDM, Data mining and warehousing.	12 Hrs

REFERENCES

1. Principles and practice of pharmaceutical medicine, Second edition. Authors:Lionel. D. Edward, Aadrew.J.Flether Anthony W Fos , Peter D Sloaier Publisher:Wiley;
2. Handbook of clinical research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone
3. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
4. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health.
5. International Conference on Harmonisation of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
6. Ethical Guidelines for Biomedical Research on Human Subjects. Indian Council of Medical Research, New Delhi.
7. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, John Wiley and Sons.
8. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
9. Goodman & Gilman: JG Hardman, LE Limbard, McGraw Hill Publications.
10. Relevant review articles from recent medical and pharmaceutical literature.

PHARMACY PRACTICE PRACTICAL – I
(MPP 105P)

Pharmacy Practice practical component includes experiments covering important topics of the courses Clinical Pharmacy Practice, Pharmacotherapeutics-I, Hospital & Community Pharmacy and Clinical Research.

List of Experiments (24)

1. Treatment Chart Review (one)
2. Medication History Interview (one)
3. Patient Medication Counseling (two)
4. Drug Information Query (two)
5. Poison Information Query (one)
6. Lab Data Interpretation (two)
7. Presentation of clinical cases of various disease conditions adopting Pharmaceutical Care Plan Model (eight)
8. ABC Analysis of a given list of medications (one)
9. Preparation of content of a medicine, with proper justification, for the inclusion in the hospital formulary (one)
10. Formulation and dispensing of a given IV admixtures (one)
11. Preparation of a patient information leaflet (two)
12. Preparation of Study Protocol (one)
13. Preparation of Informed Consent Form (one)

PRINCIPLES OF QUALITY USE OF MEDICINES
(MPP 201T)

Scope:

This course is designed to impart basic knowledge and skills that are required to practice quality use of medicines (QUM) in different healthcare settings and also to promote quality use of medicines, in clinical practice, through evidence-based medicine approach.

Objectives:

Upon completion of this course it is expected that students shall be able to:

- Understand the principles of quality use of medicines
- Know the benefits and risks associated with use of medicines
- Understand regulatory aspects of quality use of medicines
- Identify and resolve medication related problems
- Promote quality use of medicines
- Practice evidence-based medicines

THEORY 60 Hrs

1.	Introduction to Quality use of medicines (QUM): Definition and Principles of QUM, Key partners and responsibilities of the partners, Building blocks in QMC, Evaluation process in QMC, Communication in QUM, Cost effective prescribing.	12 Hrs
2	Concepts in QUM Evidence based medicine: Definition, concept of evidence based medicine, Approach and practice of evidence based medicine in clinical settings Essential drugs: Definition, need, concept of essential drug, National essential drug policy and list Rational drug use: Definition, concept and need for rational drug use, Rational drug prescribing, Role of pharmacist in rational drug use.	12 Hrs
3	QUM in various settings: Hospital settings, Ambulatory care/Residential care, Role of health care professionals in promoting the QUM, Strategies to promote the QUM, Impact of QUM on E-health, integrative medicine and multidisciplinary care. QUM in special population: Pediatric prescribing, Geriatric prescribing, Prescribing in pregnancy and lactation, Prescribing in immune compromised and organ failure patients.	12 Hrs

4	Regulatory aspects of QUM in India: Regulation including scheduling, Regulation of complementary medicines, Regulation of OTC medicines, Professional responsibility of pharmacist, Role of industry in QUM in medicine development.	12 Hrs
5	Medication errors: Definition, categorization and causes of medication errors, Detection and prevention of medication errors, Role of pharmacist in monitoring and management of medication errors Pharmacovigilance: Definition, aims and need for pharmacovigilance, Types, predisposing factors and mechanism of adverse drug reactions (ADRs), Detection, reporting and monitoring of ADRs, Causality assessment of ADRs, Management of ADRs, Role of pharmacist in pharmacovigilance.	12 Hrs

REFERENCES:

1. A Textbook of Clinical Pharmacy Practice – Essential concepts and skills – Parthasarathi G, Karin Nyfort-Hansen and Milap Nahata
2. Andrews EB, Moore N. Mann's Pharmacovigilance
3. Dipiro JT, Talbert RL, Yee GC. Pharmacotherapy: A Pathophysiologic Approach
4. Straus SE, Richardson WS, Glasziou P, Haynes RB. Evidence-Based Medicine: How to practice and teach it
5. Cohen MR. Medication Errors
6. Online:
   - http://medicinesaustralia.com.au/files/2012/05/MA_QUM_External_Reduced.pdf
   - http://curriculum.racgp.org.au/statements/quality-use-of-medicines/
   - http://www.rug.nl/research/portal/files/14051541/Chapter_2.pdf
7. Relevant review articles from recent medical and pharmaceutical literature.

PHARMACOTHERAPEUTICS II
(MPP 202T)

Scope

This course aims to enable the students to understand the different treatment approaches in managing various disease conditions. Also, it imparts knowledge and skills in optimizing drug therapy of a patient by individualizing the treatment plan through evidence-based medicines.

Objectives

Upon completion of this course it is expected that students shall be able to:

- Describe and explain the rationale for drug therapy
- Summarize the therapeutic approach for management of various disease conditions including reference to the latest available evidence
- Discuss the clinical controversies in drug therapy and evidence based medicine
- Prepare individualized therapeutic plans based on diagnosis
- Identify the patient specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time- course of clinical and laboratory indices of therapeutic response and adverse effect/s)

THEORY		60 Hrs
1.	Nervous system: Epilepsy, Parkinson's disease, Stroke, Headache, Alzheimer's disease, Neuralgias and Pain pathways and Pain management.	12 Hrs
2	Psychiatric disorders: Schizophrenia, Depression, Anxiety disorders, Sleep disorders, Drug induced psychiatric disorders Renal system: Acute renal failure, Chronic renal failure, Renal dialysis, Drug induced renal disease	12 Hrs
3	Infectious diseases: General guidelines for the rational use of antibiotics and surgical prophylaxis, Urinary tract infections, Respiratory tract infections, Gastroenteritis, Tuberculosis, Malaria, Bacterial endocarditis, Septicemia.	12 Hrs
4	Infectious diseases: Meningitis, HIV and opportunistic infections, Rheumatic fever, Dengue fever, H1N1, Helmenthiasis, Fungal infections Gynecological disorders: Dysmenorrhea, Hormone replacement therapy.	12 Hrs

5	Oncology: General principles of cancer chemotherapy, pharmacotherapy of breast cancer, lung cancer, head & neck cancer, hematological malignancies, Management of nausea and vomiting, Palliative care	12 Hrs

REFERENCES

1. Roger and Walker. Clinical Pharmacy and Therapeutics - Churchill Livingstone publication.
2. Joseph T. Dipiro et al. Pharmacotherapy: A Pathophysiologic Approach- Appleton & Lange
3. Robins SL. Pathologic basis of disease -W.B. Saunders publication
4. Eric T. Herfindal. Clinical Pharmacy and Therapeutics- Williams and Wilkins Publication
5. Lloyd Young and Koda-Kimble MA Applied Therapeutics: The clinical Use of Drugs- Lippincott Williams and Wilkins
6. Chisholm- Burns Wells Schwinghammer Malone and Joseph P Dipiro. Pharmacotherapy Principles and practice-– McGraw Hill Publication
7. Carol Mattson Porth. Principles of Pathophysiology- Lippincott Williams and Wilkins
8. Harrison's. Principles of Internal Medicine - McGraw Hill
9. Relevant review articles from recent medical and pharmaceutical literature

CLINICAL PHARMACOKINETICS AND THERAPEUTIC DRUG MONITORING
(MPP 203T)

Scope

This course is designed to enable students to understand the basics principles and applications of pharmacokinetics in designing the individualized dosage regimen, to interpret the plasma drug concentration profile in altered pharmacokinetics, drug interactions and in therapeutic drug monitoring processes to optimize the drug dosage regimen. Also, it enables students to understand the basic concepts of pharmacogenetics, pharmacometrics for modeling and simulation of pharmacokinetic data.

Objectives

Upon completion of this course it is expected that students shall be able to:

- Design the drug dosage regimen for individual patients
- Interpret and correlate the plasma drug concentrations with patients' therapeutic outcomes
- Recommend dosage adjustment for patients with renal/ hepatic impairment
- Recommend dosage adjustment for paediatrics and geriatrics
- Manage pharmacokinetic drug interactions
- Apply pharmacokinetic parameters in clinical settings
- Interpret the impact of genetic polymorphisms of individuals on pharmacokinetics and or pharmacodynamics of drugs
- Do pharmacokinetic modeling for the given data using the principles of pharmacometrics

THEORY 60 Hrs

1. Introduction to Clinical pharmacokinetics: Compartmental and Non compartmental models, Renal and non-renal clearance, Organ extraction and models of hepatic clearance, Estimation and determinants of bioavailability, Multiple dosing, Calculation of loading and maintenance doses
   Designing of dosage regimens: Determination of dose and dosing intervals, Conversion from intravenous to oral dosing, Nomograms and Tabulations in designing dosage regimen. 12 Hrs

2	Pharmacokinetics of Drug Interaction: Pharmacokinetic drug interactions, Inhibition and Induction of Drug metabolism, Inhibition of Biliary Excretion Pharmacogenetics: Genetic polymorphism in Drug metabolism: Cytochrome P-450 Isoenzymes, Genetic Polymorphism in Drug Transport and Drug Targets, Pharmacogenetics and Pharmacokinetic / Pharmacodynamic considerations Introduction to Pharmacometrics: Introduction to Bayesian Theory, Adaptive method or Dosing with feedback, Analysis of Population pharmacokinetic Data.	12 Hrs
3	Non Linier Mixed Effects Modelling: The Structural or Base Model, Modeling Random Effects, Modeling Covariate Relationships, Mixture Model, Estimation Methods, Model Building Techniques, Covariate Screening Methods, Testing the model assumptions, Precision of the parameter estimates and confidence intervals, Model misspecification and violation of the model assumptions, Model Validation, Simulation of dosing regimens and dosing recommendations, Pharmacometrics software.	12 Hrs
4	Altered Pharmacokinetics: Drug dosing in the elderly, Drug dosing in the paediatrics, Drug dosing in the obese patients, Drug dosing in the pregnancy and lactation, Drug dosing in the renal failure and extracorporeal removal of drugs, Drug dosing in the in hepatic failure.	12 Hrs
5	Therapeutic Drug monitoring: Introduction, Individualization of drug dosage regimen (Variability – Genetic, age, weight, disease and Interacting drugs), Indications for TDM, Protocol for TDM, Pharmacokinetic/Pharmacodynamic Correlation in drug therapy, TDM of drugs used in the following conditions: Cardiovascular disease: Digoxin, Lidocaine, Amiodarone; Seizure disorders: Phenytoin, Carbamazepine, Sodium Valproate; Psychiatric conditions: Lithium, Fluoxetine, Amitriptyline; Organ transplantations: Cyclosporine; Cytotoxic Agents: Methotrexate, 5-FU, Cisplatin; Antibiotics: Vancomycin, Gentamicin, Meropenem.	12 Hrs

REFERENCES

1. Leon Shargel, Susanna Wu-Pong, Andrew Yu. Applied Biopharmaceutics & Pharmacokinetics. New York: Mc Graw Hill.
2. Peter L. Bonate. Pharmacokinetic - Pharmacodynamic Modeling and Simulation. Springer Publications.
3. Michael E. Burton, Leslie M. Shaw, Jerome J. Schentag, William E.Evans. Applied Pharmacokinetics & Pharmacodynamics: Principles of Therapeutic Drug Monitoring. lippincott Williams & Wilkins.
4. Steven How-Yan Wong, Irving Sunshine. Handbook of Analytical Therapeutic Drug Monitoring and Toxicology. CRC Press, USA.
5. Soraya Dhillon, Andrzej Kostrzewski. Clinical pharmacokinetics. 1st edition. London: Pharmaceutical Press.
6. Joseph T.Dipiro, William J.Spruill, William E.Wade, Robert A.Blouin and Jane M.Pruemer .Concepts in Clinical Pharmacokinetics. American Society of Health-System Pharmacists, USA.
7. Malcolm Rowland, Thomas N. Tozer .Clinical Pharmacokinetics and pharmacodynamics: concepts and applications. lippincott Williams & Wilkins, USA.
8. Evans, Schentag, Jusko. Applied pharmacokinetics. American Society of Health system Pharmacists, USA.
9. Michael E. Winter. Basic Clinical Pharmacokinetics. lippincott Williams & Wilkins, USA.
10. Milo Gibaldi. Biopharmaceutics and Clinical Pharmacokinetics. Pharma Book Syndicate, USA.
11. Dhillon and Kostrzewski. Clinical pharmacokinetics. Pharmaceutical Press, London.
12. John E .Murphy. Clinical Pharmacokinetics. 5th edition. US: American Society of Health- System Pharmacist, USA.
13. Relevant review articles from recent medical and pharmaceutical literature

PHARMACOEPIDEMIOLOGY & PHARMACOECONOMICS
(MPP 204T)

Scope

This course enables students to understand various pharmacoepidemiological methods and their clinical applications. Also, it aims to impart knowledge on basic concepts, assumptions, terminology, and methods associated with Pharmacoeconomics and health related outcomes, and when should be appropriate Pharmacoeconomic model should be applied for a health care regimen.

Objectives

Upon completion of this course it is expected that students shall be able to:

- Understand the various epidemiological methods and their applications
- Understand the fundamental principles of Pharmacoeconomics.
- Identify and determine relevant cost and consequences associated with pharmacy products and services.
- Perform the key Pharmacoeconomics analysis methods
- Understand the Pharmacoeconomic decision analysis methods and its applications.
- Describe current Pharmacoeconomic methods and issues.
- Understand the applications of Pharmacoeconomics to various pharmacy settings.

THEORY 60 Hrs

1. Introduction to Pharmacoepidemiology: Definition, Scope, Need, Aims & Applications; Outcome measurement: Outcome measures, Drug use measures: Monetary units, Number of prescriptions, units of drug dispensed, defined daily doses, prescribed daily doses, Diagnosis and Therapy surveys, Prevalence, Incidence rate, Monetary units, number of prescriptions, unit of drugs dispensed, defined daily doses and prescribed daily doses, medications adherence measurements. Concept of risk: Measurement of risk, Attributable risk and relative risk, Time- risk relationship and odds ratio — 12 Hrs

2 Pharmacoepidemiological Methods: Qualitative models: Drug Utilization Review; Quantitative models: case reports, case series, Cross sectional studies, Cohort and case control studies, Calculation of Odds' ratio, Meta analysis models, Drug effects study in populations: Spontaneous reporting, Prescription event — 12 Hrs

monitoring, Post marketing surveillance, Record linkage systems, Applications of Pharmacoepidemiology

3	Introduction to Pharmacoeconomics: Definition, history of Pharmacoeconomics, Need of Pharmacoeconomic studies in Indian healthcare system. Cost categorization and resources for cost estimation: Direct costs. Indirect costs. Intangible costs. Outcomes and Measurements of Pharmacoeconomics: Types of outcomes: Clinical outcome, Economic outcomes, Humanistic outcomes; Quality Adjusted Life Years, Disability Adjusted Life Years Incremental Cost Effective Ratio, Average Cost Effective Ratio. Person Time, Willingness To Pay, Time Trade Off and Discounting.	12 Hrs
4	Pharmacoeconomic evaluations: Definition, Steps involved, Applications, Advantages and disadvantages of the following Pharmacoeconomic models: Cost Minimization Analysis (CMA), Cost Benefit Analysis (CBA), Cost Effective Analysis (CEA), Cost Utility Analysis (CUA), Cost of Illness (COI), Cost Consequences Analysis (COA).	12 Hrs
5	Definition, Steps involved, Applications, Advantages and disadvantages of the following: Health related quality of life (HRQOL): Definition, Need for measurement of HRQOL, Common HRQOL measures. Definition, Steps involved, Applications of the following: Decision Analysis and Decision tree, Sensitivity analysis, Markov Modeling, Software used in pharmacoeconomic analysis, Applications of Pharmacoeconomics.	12 Hrs

REFERENCES

1. Rascati K L. Essentials of Pharmacoeconomics, Woulters Kluwer Lippincott Williams & Wilkins, Philadelphia.
2. Thomas E Getzen. Health economics. Fundamentals and Flow of Funds. John Wiley & Sons, USA.
3. Andrew Briggs, Karl Claxton, Mark Sculpher. Decision Modelling for Health Economic Evaluation, Oxford University Press, London.
4. Michael Drummond, Mark Sculpher, George Torrence, Bernie O'Brien and Greg Stoddart. Methods for the Economic Evaluation of Health Care Programmes Oxford University Press, London.

5. George E Mackinnon III. Understanding health outcomes and pharmacoeconomics.
6. Graker, Dennis. Pharmacoeconomics and outcomes.
7. Walley, Pharmacoeconomics.
8. Pharmacoeconomic – ed. by Nowakowska – University of Medical Sciences, Poznan.
9. Relevant review articles from recent medical and pharmaceutical literature

PHARMACY PRACTICE PRACTICAL - II
(MPP 205P)

Pharmacy Practice practical component includes experiments covering important topics of the courses Principles of Quality Use of Medicines, Pharmacotherapeutics-II, Clinical Pharmacokinetics & Therapeutic Drug Monitoring and Pharmacoepidemiology and Pharmacoeconomics.

List of Experiments (24)

1. Causality assessment of adverse drug reactions (three)
2. Detection and management of medication errors (three)
3. Rational use of medicines in special population (three)
4. Presentation of clinical cases of various disease conditions adopting Pharmaceutical Care Plan Model (eight)
5. Calculation of Bioavailability and Bioequivalence from the given data (two)
6. Interpretation of Therapeutic Drug Monitoring reports of a given patient (three)
7. Calculation of various Pharmacoeconomic outcome analysis for the given data (two)

PHARMACOLOGY (MPL)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPL 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know about,

- Chemicals and Excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY 60 Hrs

1. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. 10 Hrs

   IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.

   Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence (Characterestics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

   Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy. 10 Hrs

3	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	10 Hrs
4	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: j) Thin Layer chromatography k) High Performance Thin Layer Chromatography l) Ion exchange chromatography m) Column chromatography n) Gas chromatography o) High Performance Liquid chromatography p) Ultra High Performance Liquid chromatography q) Affinity chromatography r) Gel Chromatography	10 Hrs
5	Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	10 Hrs
6	Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.	10 Hrs

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

ADVANCED PHARMACOLOGY - I
(MPL 102T)

Scope

The subject is designed to strengthen the basic knowledge in the field of pharmacology and to impart recent advances in the drugs used for the treatment of various diseases. In addition, this subject helps the students to understand the concepts of drug action and mechanisms involved

Objectives

Upon completion of the course the student shall be able to :

- Discuss the pathophysiology and pharmacotherapy of certain diseases
- Explain the mechanism of drug actions at cellular and molecular level
- Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

THEORY 60 Hrs

1. General Pharmacology 12 Hrs

a. Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Concepts of linear and non-linear compartment models. Significance of Protein binding.

b. Pharmacodynamics: Mechanism of drug action and the relationship between drug concentration and effect. Receptors, structural and functional families of receptors, quantitation of drug receptors interaction and elicited effects.

2 Neurotransmission 12 Hrs

a. General aspects and steps involved in neurotransmission.

b. Neurohumoral transmission in autonomic nervous system (Detailed study about neurotransmitters- Adrenaline and Acetyl choline).

c. Neurohumoral transmission in central nervous system (Detailed study about neurotransmitters- histamine, serotonin, dopamine, GABA, glutamate and glycine].

d. Non adrenergic non cholinergic transmission (NANC). Co-transmission

Systemic Pharmacology

A detailed study on pathophysiology of diseases, mechanism of action, pharmacology and toxicology of existing as well as novel drugs used in the following systems

Autonomic Pharmacology

Parasympathomimetics and lytics, sympathomimetics and lytics, agents affecting

neuromuscular junction

3	Central nervous system Pharmacology General and local anesthetics Sedatives and hypnotics, drugs used to treat anxiety. Depression, psychosis, mania, epilepsy, neurodegenerative diseases. Narcotic and non-narcotic analgesics.	12 Hrs
4	Cardiovascular Pharmacology Diuretics, antihypertensives, antiischemics, anti- arrhythmics, drugs for heart failure and hyperlipidemia. Hematinics, coagulants , anticoagulants, fibrinolytics and anti-platelet drugs	12 Hrs
5	Autocoid Pharmacology The physiological and pathological role of Histamine, Serotonin, Kinins Prostaglandins Opioid autocoids. Pharmacology of antihistamines, 5HT antagonists.	12 Hrs

REFEERENCES

1. The Pharmacological Basis of Therapeutics, Goodman and Gillman's
2. Principles of Pharmacology. The Pathophysiologic basis of drug Therapy by David E Golan, Armen H, Tashjian Jr, Ehrin J,Armstrong, April W, Armstrong, Wolters, Kluwer-Lippincott Williams & Wilkins Publishers.
3. Basic and Clinical Pharmacology by B.G Katzung
4. Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.
5. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
6. Graham Smith. Oxford textbook of Clinical Pharmacology.
7. Avery Drug Treatment
8. Dipiro Pharmacology, Pathophysiological approach.
9. Green Pathophysiology for Pharmacists.

10. Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)
11. A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company
12. KD.Tripathi. Essentials of Medical Pharmacology.
13. Modern Pharmacology with Clinical Applications, Craig Charles R. & Stitzel Robert E., Lippincott Publishers.
14. Clinical Pharmacokinetics & Pharmacodynamics : Concepts and Applications - Malcolm Rowland and Thomas N.Tozer, Wolters Kluwer, Lippincott Williams & Wilkins Publishers.
15. Applied biopharmaceutics and Pharmacokinetics, Pharmacodynamics and Drug metabolism for industrial scientists.
16. Modern Pharmacology, Craig CR. & Stitzel RE, Little Brown & Company.

PHARMACOLOGICAL AND TOXICOLOGICAL SCREENING METHODS - I
(MPL 103T)

Scope

This subject is designed to impart the knowledge on preclinical evaluation of drugs and recent experimental techniques in the drug discovery and development. The subject content helps the student to understand the maintenance of laboratory animals as per the guidelines, basic knowledge of various in-vitro and in-vivo preclinical evaluation processes

Objectives

Upon completion of the course the student shall be able to,

- Appraise the regulations and ethical requirement for the usage of experimental animals.
- Describe the various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental animals
- Describe the various newer screening methods involved in the drug discovery process
- Appreciate and correlate the preclinical data to humans

THEORY 60 Hrs

1. Laboratory Animals 12 Hrs

Common laboratory animals: Description, handling and applications of different species and strains of animals.

Transgenic animals: Production, maintenance and applications
Anaesthesia and euthanasia of experimental animals.
Maintenance and breeding of laboratory animals.
CPCSEA guidelines to conduct experiments on animals

Good laboratory practice.
Bioassay-Principle, scope and limitations and methods

2 Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. 12 Hrs

General principles of preclinical screening. CNS Pharmacology: behavioral and muscle co ordination, CNS stimulants and

depressants, anxiolytics, anti-psychotics, anti epileptics and nootropics. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimers and multiple sclerosis. Drugs acting on Autonomic Nervous System.

3	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Respiratory Pharmacology: anti-asthmatics, drugs for COPD and anti allergics. Reproductive Pharmacology: Aphrodisiacs and antifertility agents Analgesics, antiinflammatory and antipyretic agents. Gastrointestinal drugs: anti ulcer, anti -emetic, anti-diarrheal and laxatives.	12 Hrs
4	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Cardiovascular Pharmacology: antihypertensives, antiarrythmics, antianginal, antiatherosclerotic agents and diuretics. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents. Anti cancer agents. Hepatoprotective screening methods.	12 Hrs
5	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Iimmunomodulators, Immunosuppressants and immunostimulants General principles of immunoassay: theoretical basis and optimization of immunoassay, heterogeneous and homogenous immunoassay systems. Immunoassay methods evaluation; protocol outline, objectives and preparation. Immunoassay for digoxin and insulin Limitations of animal experimentation and alternate animal experiments. Extrapolation of in vitro data to preclinical and preclinical to humans	12 Hrs

REFERENCES

1. Biological standardization by J.H. Burn D.J. Finney and I.G. Goodwin
2. Screening methods in Pharmacology by Robert Turner. A
3. Evaluation of drugs activities by Laurence and Bachrach
4. Methods in Pharmacology by Arnold Schwartz.
5. Fundamentals of experimental Pharmacology by M.N.Ghosh
6. Pharmacological experiment on intact preparations by Churchill Livingstone
7. Drug discovery and Evaluation by Vogel H.G.
8. Experimental Pharmacology by R.K.Goyal.
9. Preclinical evaluation of new drugs by S.K. Guta
10. Handbook of Experimental Pharmacology, SK.Kulkarni
11. Practical Pharmacology and Clinical Pharmacy, SK.Kulkarni, 3rd Edition.
12. David R.Gross. Animal Models in Cardiovascular Research, 2nd Edition, Kluwer Academic Publishers, London, UK.
13. Screening Methods in Pharmacology, Robert A.Turner.
14. Rodents for Pharmacological Experiments, Dr.Tapan Kumar chatterjee.
15. Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi (Author), Ajay Prakash (Author)

CELLULAR AND MOLECULAR PHARMACOLOGY
(MPL 104T)

Scope:

The subject imparts a fundamental knowledge on the structure and functions of cellular components and help to understand the interaction of these components with drugs. This information will further help the student to apply the knowledge in drug discovery process.

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the receptor signal transduction processes.
- Explain the molecular pathways affected by drugs.
- Appreciate the applicability of molecular pharmacology and biomarkers in drug discovery process.
- Demonstrate molecular biology techniques as applicable for pharmacology

THEORY		60 Hrs
1.	Cell biology Structure and functions of cell and its organelles Genome organization. Gene expression and its regulation, importance of siRNA and micro RNA, gene mapping and gene sequencing Cell cycles and its regulation. Cell death- events, regulators, intrinsic and extrinsic pathways of apoptosis. Necrosis and autophagy.	12 Hrs
2	Cell signaling Intercellular and intracellular signaling pathways. Classification of receptor family and molecular structure ligand gated ion channels; G-protein coupled receptors, tyrosine kinase receptors and nuclear receptors. Secondary messengers: cyclic AMP, cyclic GMP, calcium ion, inositol 1,4,5-trisphosphate, (IP3), NO, and diacylglycerol. Detailed study of following intracellular signaling pathways: cyclic AMP signaling pathway, mitogen-activated protein kinase (MAPK) signaling, Janus kinase (JAK)/signal transducer and activator of transcription (STAT) signaling pathway.	12 Hrs

3	Principles and applications of genomic and proteomic tools DNA electrophoresis, PCR (reverse transcription and real time), Gene sequencing, micro array technique, SDS page, ELISA and western blotting, Recombinant DNA technology and gene therapy Basic principles of recombinant DNA technology-Restriction enzymes, various types of vectors. Applications of recombinant DNA technology. Gene therapy- Various types of gene transfer techniques, clinical applications and recent advances in gene therapy.	12 Hrs
4	Pharmacogenomics Gene mapping and cloning of disease gene. Genetic variation and its role in health/ pharmacology Polymorphisms affecting drug metabolism Genetic variation in drug transporters Genetic variation in G protein coupled receptors Applications of proteomics science: Genomics, proteomics, metabolomics, functionomics, nutrigenomics Immunotherapeutics Types of immunotherapeutics, humanisation antibody therapy, Immunotherapeutics in clinical practice	12 Hrs
5	a. Cell culture techniques Basic equipments used in cell culture lab. Cell culture media, various types of cell culture, general procedure for cell cultures; isolation of cells, subculture, cryopreservation, characterization of cells and their application. Principles and applications of cell viability assays, glucose uptake assay, Calcium influx assays Principles and applications of flow cytometry b. Biosimilars	12 Hrs

REFERENCES:

1. The Cell, A Molecular Approach. Geoffrey M Cooper.
2. Pharmacogenomics: The Search for Individualized Therapies. Edited by J. Licinio and M -L. Wong
3. Handbook of Cell Signaling (Second Edition) Edited by Ralph A. et.al
4. Molecular Pharmacology: From DNA to Drug Discovery. John Dickenson et.al
5. Basic Cell Culture protocols by Cheril D.Helgason and Cindy L.Miller
6. Basic Cell Culture (Practical Approach) by J. M. Davis (Editor)
7. Animal Cell Culture: A Practical Approach by John R. Masters (Editor)
8. Current porotocols in molecular biology vol I to VI edited by Frederick M.Ausuvel et la.

PHARMACOLOGICAL PRACTICAL - I
(MPL 105P)

1. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry

Handling of laboratory animals.

1. Various routes of drug administration.
2. Techniques of blood sampling, anesthesia and euthanasia of experimental animals.
3. Functional observation battery tests (modified Irwin test)
4. Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity.
5. Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity.
6. Evaluation of diuretic activity.
7. Evaluation of antiulcer activity by pylorus ligation method.
8. Oral glucose tolerance test.
9. Isolation and identification of DNA from various sources (Bacteria, Cauliflower, onion, Goat liver).
10. Isolation of RNA from yeast
11. Estimation of proteins by Braford/Lowry's in biological samples.
12. Estimation of RNA/DNA by UV Spectroscopy
13. Gene amplification by PCR.
14. Protein quantification Western Blotting.
15. Enzyme based in-vitro assays (MPO, AChEs, α amylase, α glucosidase).
16. Cell viability assays (MTT/Trypan blue/SRB).
17. DNA fragmentation assay by agarose gel electrophoresis.
18. DNA damage study by Comet assay.
19. Apoptosis determination by fluorescent imaging studies.
20. Pharmacokinetic studies and data analysis of drugs given by different routes of administration using softwares
21. Enzyme inhibition and induction activity
22. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (UV)
23. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (HPLC)

REFERENCES

1. CPCSEA, OECD, ICH, USFDA, Schedule Y, EPA guidelines,
2. Fundamentals of experimental Pharmacology by M.N.Ghosh
3. Handbook of Experimental Pharmacology by S.K. Kulkarni.
4. Drug discovery and Evaluation by Vogel H.G.
5. Spectrometric Identification of Organic compounds - Robert M Silverstein,
6. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman,
7. Vogel's Text book of quantitative chemical analysis - Jeffery, Basset, Mendham, Denney,
8. Basic Cell Culture protocols by Cheril D. Helgason and Cindy L.Mille
9. Basic Cell Culture (Practical Approach) by J. M. Davis (Editor)
10. Animal Cell Culture: A Practical Approach by John R. Masters (Editor)
11. Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi(Author), Ajay Prakash (Author) Jaypee brothers' medical publishers Pvt. Ltd

ADVANCED PHARMACOLOGY - II
(MPL 201T)

Scope

The subject is designed to strengthen the basic knowledge in the field of pharmacology and to impart recent advances in the drugs used for the treatment of various diseases. In addition, the subject helps the student to understand the concepts of drug action and mechanism involved

Objectives

Upon completion of the course the student shall be able to:

- Explain the mechanism of drug actions at cellular and molecular level
- Discuss the Pathophysiology and pharmacotherapy of certain diseases
- Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

	THEORY	60 Hrs
1.	Endocrine Pharmacology Molecular and cellular mechanism of action of hormones such as growth hormone, prolactin, thyroid, insulin and sex hormones Anti-thyroid drugs, Oral hypoglycemic agents, Oral contraceptives, Corticosteroids. Drugs affecting calcium regulation	12 Hrs
2	Chemotherapy Cellular and molecular mechanism of actions and resistance of antimicrobial agents such as ß-lactams, aminoglycosides, quinolones, Macrolide antibiotics. Antifungal, antiviral, and anti-TB drugs.	12 Hrs
3	Chemotherapy Drugs used in Protozoal Infections Drugs used in the treatment of Helminthiasis Chemotherapy of cancer Immunopharmacology Cellular and biochemical mediators of inflammation and immune response. Allergic or hypersensitivity reactions. Pharmacotherapy of asthma and COPD. Immunosuppressants and Immunostimulants	12 Hrs

4	GIT Pharmacology Antiulcer drugs, Prokinetics, antiemetics, anti-diarrheals and drugs for constipation and irritable bowel syndrome. Chronopharmacology Biological and circadian rhythms, applications of chronotherapy in various diseases like cardiovascular disease, diabetes, asthma and peptic ulcer	12 Hrs
5	Free radicals Pharmacology Generation of free radicals, role of free radicals in etiopathology of various diseases such as diabetes, neurodegenerative diseases and cancer. Protective activity of certain important antioxidant Recent Advances in Treatment: Alzheimer's disease, Parkinson's disease, Cancer, Diabetes mellitus	12 Hrs

REFERENCES

1. The Pharmacological basis of therapeutics- Goodman and Gill man's
2. Principles of Pharmacology. The Pathophysiologic basis of drug therapy by David E Golan et al.
3. Basic and Clinical Pharmacology by B.G -Katzung
4. Pharmacology by H.P. Rang and M.M. Dale.
5. Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.
6. Text book of Therapeutics, drug and disease management by E T. Herfindal and Gourley.
7. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
8. Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists
9. Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)
10. A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company.
11. KD.Tripathi. Essentials of Medical Pharmacology
12. Principles of Pharmacology. The Pathophysiologic basis of drug Therapy by David E Golan, Armen H, Tashjian Jr, Ehrin J,Armstrong, April W, Armstrong, Wolters, Kluwer-Lippincott Williams & Wilkins Publishers

PHARMACOLOGICAL AND TOXICOLOGICAL SCREENING METHODS-II
(MPL 202T)

Scope:

This subject imparts knowledge on the preclinical safety and toxicological evaluation of drug & new chemical entity. This knowledge will make the student competent in regulatory toxicological evaluation.

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the various types of toxicity studies.
- Appreciate the importance of ethical and regulatory requirements for toxicity studies.
- Demonstrate the practical skills required to conduct the preclinical toxicity studies.

THEORY 60 Hrs

1.	Basic definition and types of toxicology (general, mechanistic, regulatory and descriptive) Regulatory guidelines for conducting toxicity studies OECD, ICH, EPA and Schedule Y OECD principles of Good laboratory practice (GLP) History, concept and its importance in drug development	12 Hrs
2	Acute, sub-acute and chronic- oral, dermal and inhalational studies as per OECD guidelines. Acute eye irritation, skin sensitization, dermal irritation & dermal toxicity studies. Test item characterization- importance and methods in regulatory toxicology studies	12 Hrs
3	Reproductive toxicology studies, Male reproductive toxicity studies, female reproductive studies (segment I and segment III), teratogenecity studies (segment II) Genotoxicity studies (Ames Test, in vitro and in vivo Micronucleus and Chromosomal aberrations studies) In vivo carcinogenicity studies	12 Hrs
4	IND enabling studies (IND studies)- Definition of IND, importance of IND, industry perspective, list of studies needed for IND submission.	12 Hrs

Safety pharmacology studies- origin, concepts and importance of safety pharmacology.
Tier1- CVS, CNS and respiratory safety pharmacology, HERG assay. Tier2- GI, renal and other studies

5 Toxicokinetics- Toxicokinetic evaluation in preclinical studies, saturation kinetics Importance and applications of toxicokinetic studies. 12 Hrs
Alternative methods to animal toxicity testing.

REFERENCES

1. Hand book on GLP, Quality practices for regulated non-clinical research and development (http://www.who.int/tdr/publications/documents/glp-handbook.pdf).
2. Schedule Y Guideline: drugs and cosmetics (second amendment) rules, 2005, ministry of health and family welfare (department of health) New Delhi
3. Drugs from discovery to approval by Rick NG.
4. Animal Models in Toxicology, 3rd Edition, Lower and Bryan
5. OECD test guidelines.
6. Principles of toxicology by Karen E. Stine, Thomas M. Brown.
7. Guidance for Industry M3(R2) Nonclinical Safety Studies for the Conduct of Human Clinical Trials and Marketing Authorization for Pharmaceuticals (http://www.fda.gov/downloads/drugs/guidancecomplianceregulatoryinformation/guidances/ucm073246.pdf)

PRINCIPLES OF DRUG DISCOVERY
(MPL 203T)

Scope:

The subject imparts basic knowledge of drug discovery process. This information will make the student competent in drug discovery process

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the various stages of drug discovery.
- Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery
- Explain various targets for drug discovery.
- Explain various lead seeking method and lead optimization
- Appreciate the importance of the role of computer aided drug design in drug discovery

THEORY		60 Hrs
1.	An overview of modern drug discovery process: Target identification, target validation, lead identification and lead Optimization. Economics of drug discovery. Target Discovery and validation-Role of Genomics, Proteomics and Bioinformatics. Role of Nucleic acid microarrays, Protein microarrays, Antisense technologies, siRNAs, antisense oligonucleotides, Zinc finger proteins. Role of transgenic animals in target validation.	12 Hrs
2	Lead Identification- combinatorial chemistry & high throughput screening, in silico lead discovery techniques, Assay development for hit identification. Protein structure Levels of protein structure, Domains, motifs, and folds in protein structure. Computational prediction of protein structure: Threading and homology modeling methods. Application of NMR and X-ray crystallography in protein structure prediction	12 Hrs
3	Rational Drug Design Traditional vs rational drug design, Methods followed in traditional drug design, High throughput screening, Concepts of Rational Drug Design, Rational Drug Design Methods: Structure and Pharmacophore based approaches	12 Hrs

	Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening,	
4	Molecular docking: Rigid docking, flexible docking, manual docking; Docking based screening. De novo drug design. Quantitative analysis of Structure Activity Relationship History and development of QSAR, SAR versus QSAR, Physicochemical parameters, Hansch analysis, Fee Wilson analysis and relationship between them.	12 Hrs
5	QSAR Statistical methods – regression analysis, partial least square analysis (PLS) and other multivariate statistical methods. 3D-QSAR approaches like COMFA and COMSIA Prodrug design-Basic concept, Prodrugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design	12 Hrs

REFERENCES

1. MouldySioud. Target Discovery and Validation Reviews and Protocols: Volume 2 Emerging Molecular Targetsand Treatment Options. 2007 Humana Press Inc.
2. Darryl León. Scott MarkelIn. Silico Technologies in Drug Target Identification and Validation. 2006 by Taylor and Francis Group, LLC.
3. Johanna K. DiStefano. Disease Gene Identification. Methods and Protocols. Springer New York Dordrecht Heidelberg London.
4. Hugo Kubiny. QSAR: Hansch Analysis and Related Approaches. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH
5. Klaus Gubernator, Hans-Joachim Böhm. Structure-Based Ligand Design. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH
6. Abby L . Parrill. M . Rami Reddy. Rational Drug Design. Novel Methodology and Practical Applications. ACS Symposium Series; American Chemical Society: Washington, DC, 1999.
7. J. Rick Turner. New drug development design, methodology and, analysis. John Wiley & Sons, Inc., New Jersey.

CLINICAL RESEARCH AND PHARMACOVIGILANCE
(MPL 204T)

Scope:

This subject will provide a value addition and current requirement for the students in clinical research and pharmacovigilance. It will teach the students on conceptualizing, designing, conducting, managing and reporting of clinical trials. This subject also focuses on global scenario of Pharmacovigilance in different methods that can be used to generate safety data. It will teach the students in developing drug safety data in Pre-clinical, Clinical phases of Drug development and post market surveillance.

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the regulatory requirements for conducting clinical trial
- Demonstrate the types of clinical trial designs
- Explain the responsibilities of key players involved in clinical trials
- Execute safety monitoring, reporting and close-out activities
- Explain the principles of Pharmacovigilance
- Detect new adverse drug reactions and their assessment
- Perform the adverse drug reaction reporting systems and communication in Pharmacovigilance

THEORY — 60 Hrs

1. Regulatory Perspectives of Clinical Trials: — 12 Hrs
   Origin and Principles of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines
   Ethical Committee: Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant- Schedule Y, ICMR
   Informed Consent Process: Structure and content of an Informed Consent Process Ethical principles governing informed consent process
2. Clinical Trials: Types and Design — 12 Hrs
   Experimental Study- RCT and Non RCT,
   Observation Study: Cohort, Case Control, Cross sectional
   Clinical Trial Study Team
   Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management

3	Clinical Trial Documentation- Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report Clinical Trial Monitoring- Safety Monitoring in CT Adverse Drug Reactions: Definition and types. Detection and reporting methods. Severity and seriousness assessment.Predictability and preventability assessment, Management of adverse drug reactions; Terminologies of ADR.	12 Hrs
4	Basic aspects, terminologies and establishment of pharmacovigilance History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring programme, WHO and Regulatory terminologies of ADR, evaluation of medication safety, Establishing pharmacovigilance centres in Hospitals, Industry and National programmes related to pharmacovigilance. Roles and responsibilities in Pharmacovigilance	12 Hrs
5	Methods, ADR reporting and tools used in Pharmacovigilance International classification of diseases, International Non-proprietary names for drugs, Passive and Active surveillance, Comparative observational studies, Targeted clinical investigations and Vaccine safety surveillance. Spontaneous reporting system and Reporting to regulatory authorities, Guidelines for ADRs reporting. Argus, Aris G Pharmacovigilance, VigiFlow, Statistical methods for evaluating medication safety data.	12 Hrs
6	Pharmacoepidemiology, pharmacoeconomics, safety pharmacology	12 Hrs

REFERENCES

1. Central Drugs Standard Control Organization- Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health;2001.
2. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.

3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
4. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
5. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
6. Handbook of clinical Research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone.
7. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.

PHARMACOLOGICAL PRACTICAL - II
(MPL 205P)

1. To record the DRC of agonist using suitable isolated tissues preparation.
2. To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation.
3. To determine to the strength of unknown sample by matching bioassay by using suitable tissue preparation.
4. To determine to the strength of unknown sample by interpolation bioassay by using suitable tissue preparation
5. To determine to the strength of unknown sample by bracketing bioassay by using suitable tissue preparation
6. To determine to the strength of unknown sample by multiple point bioassay by using suitable tissue preparation.
7. Estimation of PA_2 values of various antagonists using suitable isolated tissue preparations.
8. To study the effects of various drugs on isolated heart preparations
9. Recording of rat BP, heart rate and ECG.
10. Recording of rat ECG
11. Drug absorption studies by averted rat ileum preparation.
12. Acute oral toxicity studies as per OECD guidelines.
13. Acute dermal toxicity studies as per OECD guidelines.
14. Repeated dose toxicity studies- Serum biochemical, haematological, urine analysis, functional observation tests and histological studies.
15. Drug mutagenicity study using mice bone-marrow chromosomal aberration test.
16. Protocol design for clinical trial.(3 Nos.)
17. Design of ADR monitoring protocol.
18. In-silico docking studies. (2 Nos.)
19. In-silico pharmacophore based screening.
20. In-silico QSAR studies.
21. ADR reporting

REFERENCES

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. Text book of in-vitro practical Pharmacology by Ian Kitchen
4. Bioassay Techniques for Drug Development by Atta-ur-Rahman, Iqbal choudhary and William Thomsen
5. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
6. Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists.

PHARMACOGNOSY (MPG)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPG 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know,

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY 60 Hrs

1. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy. 12 Hrs

   IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy

   Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

   Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2 NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy.1 12 Hrs

3 Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hrs

4 Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: 10 Hrs

a) Thin Layer chromatography
b) High Performance Thin Layer Chromatography
c) Ion exchange chromatography
d) Column chromatography
e) Gas chromatography
f) High Performance Liquid chromatography
g) Ultra High Performance Liquid chromatography
h) Affinity chromatography
i) Gel Chromatography

5 Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: 10 Hrs

a) Paper electrophoresis
b) Gel electrophoresis
c) Capillary electrophoresis
d) Zone electrophoresis
e) Moving boundary electrophoresis
f) Iso electric focusing

X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.

6 Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. 10 Hrs

Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and

cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.

ADVANCED PHARMACOGNOSY - I
(MPG 102T)

SCOPE

To learn and understand the advances in the field of cultivation and isolation of drugs of natural origin, various phytopharmaceuticals, nutraceuticals and their medicinal use and health benefits.

OBJECTIVES

Upon completion of the course, the student shall be able to know the,

- advances in the cultivation and production of drugs
- various phyto-pharmaceuticals and their source, its utilization and medicinal value.
- various nutraceuticals/herbs and their health benefits
- Drugs of marine origin
- Pharmacovigilance of drugs of natural origin

THEORY 60 Hrs

1. Plant drug cultivation: General introduction to the importance of Pharmacognosy in herbal drug industry, Indian Council of Agricultural Research, Current Good Agricultural Practices, Current Good Cultivation Practices, Current Good Collection Practices, Conservation of medicinal plants- Ex-situ and In-situ conservation of medicinal plants. 12 Hrs

2 Marine natural products: General methods of isolation and purification, Study of Marine toxins, Recent advances in research in marine drugs, Problems faced in research on marine drugs such as taxonomical identification, chemical screening and their solution. 12 Hrs

3 Nutraceuticals: Current trends and future scope, Inorganic mineral supplements, Vitamin supplements, Digestive enzymes, Dietary fibres, Cereals and grains, Health drinks of natural origin, Antioxidants, Polyunsaturated fatty acids, Herbs as functional foods, Formulation and standardization of neutraceuticals, Regulatory aspects, FSSAI guidelines, Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits of following 12 Hrs

i) Spirulina ii) Soya bean iii) Ginseng iv) Garlic v) Broccoli vi) Green and Herbal Tea vii) Flax seeds viii) Black cohosh ix) Turmeric.

4 Phytopharmaceuticals: Occurrence, isolation and characteristic features (Chemical nature, uses in pharmacy, medicinal and health benefits) of following. 12 Hrs

a) Carotenoids – i) α and β - Carotene ii) Xanthophyll (Lutein)
b) Limonoids – i) d-Limonene ii) α – Terpineol
c) Saponins – i) Shatavarins
d) Flavonoids – i) Resveratrol ii) Rutin iii) Hesperidin iv) Naringin v) Quercetin
e) Phenolic acids- Ellagic acid
f) Vitamins
g) Tocotrienols and Tocopherols
h) Andrographolide, Glycolipids, Gugulipids, Withanolides, Vascine, Taxol
i) Miscellaneous

5 Pharmacovigilance of drugs of natural origin: WHO and AYUSH guidelines for safety monitoring of natural medicine, Spontaneous reporting schemes for biodrug adverse reactions, bio drug-drug and bio drug-food interactions with suitable examples. 12 Hrs

REFERENCES (Latest Editions of)

1. Pharmacognosy - G. E. Trease and W.C. Evans. Saunders Edinburgh, New York.
2. Pharmacognosy-Tyler, Brady, Robbers
3. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I&II
4. Text Book of Pharmacognosy by T.E. Wallis
5. Marine Natural Products-Vol.I to IV.
6. Natural products: A lab guide by Raphael Ikan , Academic Press 1991.
7. Glimpses of Indian Ethano Pharmacology, P. Pushpangadam. Ulf Nyman. V.George Tropical Botanic Garden & Research Institute, 1995.
8. Medicinal natural products (a biosynthetic approach), Paul M. Dewick, John Wiley & Sons Ltd., England, 1998.
9. Chemistry of Marine Natural Products- Paul J. Schewer 1973.
10. Herbal Drug Industry by RD. Choudhary, Eastern Publisher, New Delhi, 1996.
11. Cultivation of Medicinal Plants by C.K. Atal & B.M. Kapoor.
12. Cultivation and Utilization of Aromatic Plants, C.K. Atal & B.M. Kapoor
13. Cultivation of medicinal and aromatic crops, AA Farooqui and B.S. Sreeramu. University Press, 2001.

14. Natural Products from Plants, 1st edition, by Peter B. Kaufman, CRC Press, New York, 1998
15. Recent Advances in Phytochemistry- Vol. 1&4: Scikel Runeckles- Appleton Century crofts.
16. Text book of Pharmacognosy, C.K.Kokate, Purohit, Ghokhale, Nirali Prakasshan, 1996.
17. Pharmacognosy and Pharmacobiotechnology, Ashutoshkar, New Age Publications, New Delhi.

PHYTOCHEMISTRY
(MPG 103T)

SCOPE

Students shall be equipped with the knowledge of natural product drug discovery and will be able to isolate, identify and extract and the phyto-constituents

OBJECTIVES

Upon completion of the course, the student shall be able to know the,

- different classes of phytoconstituents, their biosynthetic pathways, their properties, extraction and general process of natural product drug discovery
- phytochemical fingerprinting and structure elucidation of phytoconstituents.

THEORY 60 Hrs

1. Biosynthetic pathways and Radio tracing techniques: Constituents & their Biosynthesis, Isolation, Characterization and purification with a special reference to their importance in herbal industries of following phyto-pharmaceuticals containing drugs: 12 Hrs
   a) Alkaloids: Ephedrine, Quinine, Strychynine, Piperine, Berberine, Taxol, Vinca alkoloids.
   b) Glycosides: Digitoxin, Glycyrrhizin, Sennosides, Bacosides, Quercitin.
   c) Steroids: Hecogenin, guggulosterone and withanolides
   d) Coumarin: Umbelliferone.
   e) Terpenoids: Cucurbitacins

2 Drug discovery and development: History of herbs as source of drugs and drug discovery, the lead structure selection process, structure development, product discovery process and drug registration, Selection and optimization of lead compounds with suitable examples from the following source : artemesin, andrographolides. Clinical studies emphasising on phases of clinical trials, protocol design for lead molecules. 12 Hrs

3 Extraction and Phytochemical studies: Recent advances in extractions with emphasis on selection of method and choice of solvent for extraction, successive and exhaustive extraction and other methods of extraction commonly used like microwave 12 Hrs

assisted extraction, Methods of fractionation. Separation of phytoconstituents by latest CCCET, SCFE techniques including preparative HPLC and Flash column chromatography.

4	Phytochemical finger printing: HPTLC and LCMS/GCMS applications in the characterization of herbal extracts. Structure elucidation of phytoconstituents.	12 Hrs
5	Structure elucidation of the following compounds by spectroscopic techniques like UV, IR, MS, NMR (1H, 13C) a. Carvone, Citral, Menthol b. Luteolin, Kaempferol c. Nicotine, Caffeine iv) Glycyrrhizin.	12 Hrs

REFERENCES (Latest Editions of)

1. Organic chemistry by I.L. Finar Vol.II
2. Pharmacognosy by Trease and Evans, ELBS.
3. Pharmacognosy by Tylor and Brady.
4. Text book of Pharmacognosy by Wallis.
5. Clark's isolation and Identification of drugs by A.C. Mottal.
6. Plant Drug Analysis by Wagner & Bladt.
7. Wilson and Gisvolds text book of Organic Medicinnal and Pharmaceutical Chemistry by Deorge. R.F.
8. The Chemistry of Natural Products, Edited by R.H. Thomson, Springer International Edn. 1994.
9. Natural Products Chemistry Practical Manual by Anees A Siddiqui and SeemiSiddiqui
10. Organic Chemistry of Natural Products, Vol. 1&2. Gurdeep R Chatwal.
11. Chemistry of Natural Products- Vol. 1 onwards IWPAC.
12. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I&II
13. Medicinal Natural products – a biosynthetic approach, Dewick PM, John Wiley & Sons, Toronto, 1998.
14. Chemistry of Natural Products, Bhat SV, Nagasampagi BA, Meenakshi S, Narosa Publishing House, New Delhi.
15. Pharmacognosy & Phytochemistry of Medicinal Plants, 2nd edition, Bruneton J, Interceptt Ltd., New York, 1999.

INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY
(MPG 104T)

SCOPE

To understand the Industrial and commercial potential of drugs of natural origin, integrate traditional Indian systems of medicine with modern medicine and also to know regulatory and quality policy for the trade of herbals and drugs of natural origin.

OBJECTIVES

By the end of the course the student shall be able to know,

- the requirements for setting up the herbal/natural drug industry.
- the guidelines for quality of herbal/natural medicines and regulatory issues.
- the patenting/IPR of herbals/natural drugs and trade of raw and finished materials.

THEORY 60 Hrs

1. Herbal drug industry: Infrastructure of herbal drug industry involved in production of standardized extracts and various dosage forms. Current challenges in upgrading and modernization of herbal formulations. Entrepreneurship Development, Project selection, project report, technical knowledge, Capital venture, plant design, layout and construction. Pilot plant scale -up techniques, case studies of herbal extracts. Formulation and production management of herbals. 12 Hrs

2 Regulatory requirements for setting herbal drug industry: Global marketing management. Indian and international patent law as applicable herbal drugs and natural products. Export - Import (EXIM) policy, TRIPS. 12 Hrs

Quality assurance in herbal/natural drug products.
Concepts of TQM, GMP, GLP, ISO-9000.

3 Monographs of herbal drugs: General parameters of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic Pharmacopoeia, Siddha and Unani Pharmacopoeia, American herbal pharmacopoeia, British herbal pharmacopoeia, WHO guidelines in quality assessment of herbal drugs.

4	Testing of natural products and drugs: Herbal medicines - clinical laboratory testing. Stability testing of natural products, protocols.	12 Hrs
5	Patents: Indian and international patent laws, proposed amendments as applicable to herbal/natural products and process. Geographical indication, Copyright, Patentable subject maters, novelty, non obviousness, utility, enablement and best mode, procedure for Indian patent filing, patent processing, grant of patents, rights of patents, cases of patents, opposition and revocation of patents, patent search and literature, Controllers of patents.	12 Hrs

REFERENCES (Latest Editions of)

1. Herbal drug industry by R.D. Choudhary (1996), Eastern Publisher, New Delhi.
2. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine by Pulok K Mukharjee (2003), Ist Edition, Business horizons Robert Verpoorte, New Delhi.
3. Quality control of herbal drugs by Pulok K Mukarjee (2002), Business Horizons Pharmaceutical Publisher, New Delhi.
4. PDR for Herbal Medicines (2000), Medicinal Economic Company, New Jersey.
5. Indian Herbal Pharmacopoeia (2002), IDMA, Mumbai.
6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (1996), Nirali Prakashan, New Delhi.
7. Text book of Pharmacognosy and Phytochemistry by Vinod D. Rangarl (2002), Part I & II, Career Publication, Nasik, India.
8. Plant drug analysis by H.Wagner and S.Bladt, Springer, Berlin.
9. Standardization of Botanicals. Testing and extraction methods of medicinal herbs by V. Rajpal (2004), Vol.I, Eastern Publisher, New Delhi.
10. Phytochemical Dictionary. Handbook of Bioactive Compounds from Plants by J.B.Harborne, (1999), IInd Edition, Taylor and Francis Ltd, UK.
11. Herbal Medicine. Expanded Commission E Monographs by M.Blumenthal, (2004), IST Edition,
12. Drug Formulation Manual by D.P.S.Kohli and D.H.Shah (1998), Eastern Publisher, New Delhi.

PHARMACOGNOSY PRACTICAL - I
(MPG 105P)

1. Analysis of Pharmacopoeial compounds of natural origin and their formulations by UV Vis spectrophotometer
2. Analysis of recorded spectra of simple phytoconstituents
3. Experiments based on Gas Chromatography
4. Estimation of sodium/potassium by flame photometry
5. Development of fingerprint of selected medicinal plant extracts commonly used in herbal drug industry viz. Ashwagandha, Tulsi, Bael, Amla, Ginger, Aloe, Vidang, Senna, Lawsonia by TLC/HPTLC method.
6. Methods of extraction
7. Phytochemical screening
8. Demonstration of HPLC- estimation of glycerrhizin
9. Monograph analysis of clove oil
10. Monograph analysis of castor oil.
11. Identification of bioactive constituents from plant extracts
12. Formulation of different dosage forms and their standardisation.

MEDICINAL PLANT BIOTECHNOLOGY
(MPG 201T)

SCOPE

To explore the knowledge of Biotechnology and its application in the improvement of quality of medicinal plants

OBJECTIVES

Upon completion of the course, the student shall be able to,

- Know the process like genetic engineering in medicinal plants for higher yield of Phytopharmaceuticals.
- Use the biotechnological techniques for obtaining and improving the quality of natural products/medicinal plants

THEORY 60 Hrs

1. Introduction to Plant biotechnology: Historical perspectives, prospects for development of plant biotechnology as a source of medicinal agents. Applications in pharmacy and allied fields. Genetic and molecular biology as applied to pharmacognosy, study of DNA, RNA and protein replication, genetic code, regulation of gene expression, structure and complicity of genome, cell signaling, DNA recombinant technology. 12 Hrs

2 Different tissue culture techniques: Organogenesis and embryogenesis, synthetic seed and monoclonal variation, Protoplast fusion, Hairy root multiple shoot cultures and their applications. Micro propagation of medicinal and aromatic plants. Sterilization methods involved in tissue culture, gene transfer in plants and their applications. 15 Hrs

3 Immobilisation techniques & Secondary Metabolite Production: Immobilization techniques of plant cell and its application on secondary metabolite Production. Cloning of plant cell: Different methods of cloning and its applications. Advantages and disadvantages of plant cell cloning. Secondary metabolism in tissue cultures with emphasis on production of medicinal agents. Precursors and elicitors on production of secondary metabolites. 15 Hrs

4 Biotransformation and Transgenesis: Biotransformation, bioreactors for pilot and large scale cultures of plant cells and retention of biosynthetic potential in cell culture. Transgenic 13 Hrs

plants, methods used in gene identification, localization and sequencing of genes. Application of PCR in plant genome analysis.

5	Fermentation technology: Application of Fermentation technology, Production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest.	05 Hrs

REFERENCES (Latest Editions of)

1. Plant tissue culture, Bhagwani, vol 5, Elsevier Publishers.
2. Plant cell and Tissue Culture (Lab. Manual), JRMM. Yeoman.
3. Elements in biotechnology by PK. Gupta, Rastogi Publications, New Delhi.
4. An introduction to plant tissue culture by MK. Razdan, Science Publishers.
5. Experiments in plant tissue culture by John HD and Lorin WR., Cambridge University Press.
6. Pharmaceutical biotechnology by SP. Vyas and VK. Dixit, CBS Publishers.
7. Plant cell and tissue culture by Jeffrey W. Pollard and John M Walker, Humana press.
8. Plant tissue culture by Dixon, Oxford Press, Washington DC, 1985
9. Plant tissue culture by Street.
10. Pharmacognosy by G. E. Trease and WC. Evans, Elsevier.
11. Biotechnology by Purohit and Mathur, Agro-Bio, 3rd revised edition.
12. Biotechnological applications to tissue culture by Shargool, Peter D, Shargoal, CKC Press.
13. Pharmacognosy by Varo E. Tyler, Lynn R. Brady and James E. Robberrt, That Tjen, NGO.
14. Plant Biotechnology, Ciddi Veerasham.

ADVANCED PHARMACOGNOSY - II
(MPG 202T)

SCOPE

To know and understand the Adulteration and Deterioration that occurs in herbal/natural drugs and methods of detection of the same. Study of herbal remedies and their validations, including methods of screening

OBJECTIVES

Upon completion of the course, the student shall be able to know the,

- validation of herbal remedies
- methods of detection of adulteration and evaluation techniques for the herbal drugs
- methods of screening of herbals for various biological properties

THEORY 60 Hrs

1.	Herbal remedies – Toxicity and Regulations: Herbals vs Conventional drugs, Efficacy of Herbal medicine products, Validation of herbal therapies, Pharmacodynamic and Pharmacokinetic issues.	12 Hrs
2	Adulteration and Deterioration: Introduction, Types of Adulteration/ Substitution of Herbal drugs, Causes and Measures of Adulteration, Sampling Procedures, Determination of Foreign Matter, DNA Finger printing techniques in identification of drugs of natural origin, detection of heavy metals, pesticide residues, phytotoxin, microbial contamination in herbs and their formulations.	12 Hrs
3	Ethnobotany and Ethnopharmacology: Ethnobotany in herbal drug evaluation, Impact of Ethnobotany in traditional medicine, New development in herbals, Bio-prospecting tools for drug discovery, Role of Ethnopharmacology in drug evaluation, Reverse Pharmacology.	12 Hrs
4	Analytical Profiles of herbal drugs: Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelica officinalis, Psoralea corylifolia.	12 Hrs
5	Biological screening of herbal drugs: Introduction and Need for Phyto-Pharmacological Screening, New Strategies for evaluating	12 Hrs

Natural Products, In vitro evaluation techniques for Antioxidants, Antimicrobial and Anticancer drugs. In vivo evaluation techniques for Anti-inflammatory, Antiulcer, Anticancer, Wound healing, Antidiabetic, Hepatoprotective, Cardio protective, Diuretics and Antifertility, Toxicity studies as per OECD guidelines.

REFERENCES (Latest Editions of)

1. Glimpses of Indian Ethano Pharmacology by P. Pushpangadam. Ulf Nyman. V.George Tropical Botanic Garden & Research Institute.
2. Natural products: A lab guide by Raphael Ikan, Academic Press.
3. Pharmacognosy - G. E. Trease and W.C. Evans. WB. Saunders Edinburgh, New York.
4. Pharmacognosy-Tyler, Brady, Robbers, Lee & Fetiger.
5. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I & II, Springer Publishers.
6. Herbal Drug Industry by RD. Choudhary, Eastern Publishers, New Delhi.
7. Text book of Pharmacognosy by C.K.Kokate, Purohit, Ghokhale, Nirali Prakashan.
8. Text Book of Pharmacognosy by T.E. Wallis, J & A Churchill Ltd., London.
9. Quality control of herbal drugs by Pulok K Mukherjee, Business Horizons Pharmaceutical Publishers, New Delhi.
10. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
11. Text book of Pharmacognosy and Phytochemistry by Vinod D. RangarI, Part I & II, Career Publication, Nasik, India.
12. Plant drug analysis by H.Wagner and S.Bladt, 2nd edition, Springer, Berlin.
13. Standardization of Botanicals. Testing and extraction methods of medicinal herbs by V. Rajpal (2004), Vol.I, Eastern PublisherS, New Delhi.
14. Herbal Medicine. Expanded Commission E Monographs, M.Blumenthal.

INDIAN SYSTEMS OF MEDICINE
(MPG 203T)

SCOPE

To make the students understand thoroughly the principles, preparations of medicines of various Indian systems of medicine like Ayurveda, Siddha, Homeopathy and Unani. Also focusing on clinical research of traditional medicines, quality assurance and challenges in monitoring the safety of herbal medicines.

OBJECTIVES

After completion of the course, student is able to

- To understand the basic principles of various Indian systems of medicine
- To know the clinical research of traditional medicines, Current Good Manufacturing Practice of Indian systems of medicine and their formulations.

THEORY 60 Hrs

1.	Fundamental concepts of Ayurveda, Siddha, Unani and Homoeopathy systems of medicine Different dosage forms of the ISM. Ayurveda: Ayurvedic Pharmacopoeia, Analysis of formulations and bio crude drugs with references to: Identity, purity and quality. Siddha: Gunapadam (Siddha Pharmacology), raw drugs/Dhatu/Jeevam in Siddha system of medicine, Purification process (Suddhi).	12 Hrs
2	Naturopathy, Yoga and Aromatherapy practices a) Naturopathy - Introduction, basic principles and treatment modalities. b) Yoga - Introduction and Streams of Yoga. Asanas, Pranayama, Meditations and Relaxation techniques. c) Aromatherapy – Introduction, aroma oils for common problems, carrier oils.	12 Hrs
3	Formulation development of various systems of medicine Salient features of the techniques of preparation of some of the important class of Formulations as per Ayurveda, Siddha, Homeopathy and Unani Pharmacopoeia and texts. Standardization, Shelf life and Stability studies of ISM formulations.	12 Hrs

4	Schedule T – Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records. Quality assurance in ISM formulation industry - GAP, GMP and GLP. Preparation of documents for new drug application and export registration. Challenges in monitoring the safety of herbal medicines: Regulation, quality assurance and control, National/Regional Pharmacopoeias.	12 Hrs
5	TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU	12 Hrs

REFERENCES (Latest Editions of)

1. Ayurvedic Pharmacopoeia, The Controller of Publications, Civil Lines, Govt. of India, New Delhi.
2. Hand Book on Ayurvedic Medicines, H. Panda, National Institute of Industrial Research, New Delhi.
3. Ayurvedic System of Medicine, Kaviraj Nagendranath Sengupata, Sri Satguru Publications, New Delhi.
4. Ayurvedic Pharmacopoeia. Formulary of Ayurvedic Medicines, IMCOPS, Chennai.
5. Homeopathic Pharmacopoeia. Formulary of Homeopathic Medicines, IMCOPS, Chennai.
6. Homeopathic Pharmacy : An introduction & Hand book, Steven B. Kayne, Churchill Livingstone, New York.
7. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
8. British Herbal Pharmacopoeia, bRITISH Herbal Medicine Association, UK.
9. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine, Pulok K Mukharjee, Business Horizons, New Delhi.
10. Indian System of Medicine and Homeopathy in India, Planning and Evaluation Cell, Govt. of India, New Delhi.
11. Essential of Food and Nutrition, Swaminathan, Bappco, Bangalore.
12. Clinical Dietitics and Nutrition, F.P. Antia, Oxford University Press, Delhi.
13. Yoga - The Science of Holistic Living by V.K.Yoga, Vivekananda Yoga Prakashna Publishing, Bangalore.

HERBAL COSMETICS
(MPG 204T)

SCOPE

This subject deals with the study of preparation and standardization of herbal/natural cosmetics. This subject gives emphasis to various national and international standards prescribed regarding herbal cosmeceuticals.

OBJECTIVES

After completion of the course, student shall be able to,

- understand the basic principles of various herbal/natural cosmetic preparations
- current Good Manufacturing Practices of herbal/natural cosmetics as per the regulatory authorities

THEORY 60 Hrs

1.	Introduction: Herbal/natural cosmetics, Classification & Economic aspects. Regulatory Provisions relation to manufacture of cosmetics: - License, GMP, offences & Penalties, Import & Export of Herbal/natural cosmetics, Industries involved in the production of Herbal/natural cosmetics.	12 Hrs
2	Commonly used herbal cosmetics, raw materials, preservatives, surfactants, humectants, oils, colors, and some functional herbs, preformulation studies, compatibility studies, possible interactions between chemicals and herbs, design of herbal cosmetic formulation.	12 Hrs
3	Herbal Cosmetics : Physiology and chemistry of skin and pigmentation, hairs, scalp, lips and nail, Cleansing cream, Lotions, Face powders, Face packs, Lipsticks, Bath products, soaps and baby product, Preparation and standardisation of the following : Tonic, Bleaches, Dentifrices and Mouth washes & Tooth Pastes, Cosmetics for Nails.	12 Hrs
4	Cosmeceuticals of herbal and natural origin: Hair growth formulations, Shampoos, Conditioners, Colorants & hair oils, Fairness formulations, vanishing & foundation creams, anti-sun burn preparations, moisturizing creams, deodorants.	12 Hrs

5	Analysis of Cosmetics, Toxicity screening and test methods: Quality control and toxicity studies as per Drug and Cosmetics Act.	12 Hrs

REFERENCES (Latest Editions of)

1. Panda H. Herbal Cosmetics (Hand book), Asia Pacific Business Press Inc, New Delhi.
2. Thomson EG. Modern Cosmetics, Universal Publishing Corporation, Mumbai.
3. P.P.Sharma. Cosmetics - Formulation, Manufacturing & Quality Control, Vandana Publications, New Delhi.
4. Supriya K B. Handbook of Aromatic Plants, Pointer Publishers, Jaipur.
5. Skaria P. Aromatic Plants (Horticulture Science Series), New India Publishing Agency, New Delhi.
6. Kathi Keville and Mindy Green. Aromatheraphy (A Complete Guide to the Healing Art), Sri Satguru Publications, New Delhi.
7. Chattopadhyay PK. Herbal Cosmetics & Ayurvedic Medicines (EOU), National Institute of Industrial Research, Delhi.
8. Balsam MS & Edward Sagarin. Cosmetics Science and Technology, Wiley Interscience, New York.

HERBAL COSMETICS PRACTICALS
(MPG 205P)

1. Isolation of nucleic acid from cauliflower heads
2. Isolation of RNA from yeast
3. Quantitative estimation of DNA
4. Immobilization technique
5. Establishment of callus culture
6. Establishment of suspension culture
7. Estimation of aldehyde contents of volatile oils
8. Estimation of total phenolic content in herbal raw materials
9. Estimation of total alkaloid content in herbal raw materials
10. Estimation of total flavonoid content in herbal raw materials
11. Preparation and standardization of various simple dosage forms from Ayurvedic, Siddha, Homoeopathy and Unani formulary
12. Preparation of certain Aromatherapy formulations
13. Preparation of herbal cosmetic formulation such as lip balm, lipstick, facial cream, herbal hair and nail care products
14. Evaluation of herbal tablets and capsules
15. Preparation of sunscreen, UV protection cream, skin care formulations.
16. Formulation & standardization of herbal cough syrup.

Semester III

MRM 301T - Research Methodology & Biostatistics

UNIT – I

General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.

UNIT – II

Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests(students "t" test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxan rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.

UNIT – III

Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.

UNIT – IV

CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.

UNIT – V

Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.

PHARMACY COUNCIL OF INDIA
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Aiwan-E-Ghalib Marg, New Delhi-110 002.
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SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – PHILOSOPHY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

PHILOSOPHY
SYLLABUS FOR PH.D. ENTRANCE EXAMINATION
SECTION-I
Indian Philosophy

Vedic and Upanisadic world-views: Rta-the cosmic order, the divine and the human realms; the centrality of the institution of yajna (sacrifice), the concept of rna-duty/obligation; theories of creation.

Atman-Self (and not-self), jagrat, svapna, susupti and turiya, Brahman, sreyas and preyas

Karma, samsara, moksa

Carvaka: Pratyaksa as the only pramana, critique of anumana and sabda, rejection of non-material entities and of dharma and moksa

Jainism: Concept of reality- sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada and nayavada, theory of knowledge; bondage and liberation.

Buddhism : Four noble truths, astangamarga, nirvana, madhyam pratipad, pratutyasamutpada, ksanabhangavada, anatmavada.

Schools of Buddhism : Vaibhasika, Sautrantika Yogacara and Madhyamika

Nyaya: Prama and aprama pramanya and apramanya; pramana, pratyaksa, nirvikalpaka, savikalpaka, laukika and alaukika, anumana : anvayavyatireka, lingaparamarsa, vyapti; classification : vyaptigrahopayas, hetvabhasa, upamana; sabda : Sakti, laksana, akanksa, yogyata sannidhi and tatparya, concept of God, arguments for the exisence of God, adrsta nihsryeasa

Vaisesika: Concepts of padartha, dravya, guna, karma, samanya, samavaya, visesa, abhava, causation: Asatkaryavada, samavayi asamavayi nimitta karana, paramanuvada, adrsta, nihsryeasa

Samkhya : Satkaryavada, prakrti and its evolutes, arguments for the existence of prakrti, nature of purusa, arguments for the existence and plurality of purusa, relationship between purusa and prakrti, kaivalya atheism

Yoga : Patanjali's concept of citta and citta-vrtii, eight fold path of yoga, the role of God in yoga

10/2/25

Purva-mimamsa

Sruti and its importance atheism of purvamimamsa, classification of srutivakyas, vidhi, nisedha and arthavada, dharma, bhavana, sabdanityavada, jatisaktivada

Kumarila and Prabhakara schools of mimamsa and their major points of difference, triputi-samvit, jnatata, abhava and anupalabdhi, anvitabhidhanavada, abihitanvayavada

Vedanta

Advaita-Rejection of difference : Adhyasa, maya, three grades of satta, jiva, jivarnmukti, vivartavada

Visistadvaita: Saguna Brahman, refutation of maya aprthaksiddhi, parinamavada, jiva, bhakti and prapatti

Dvaita-Rejection of nirguna brahman and maya, bheda and saksi, bhakti

SECTION-II

WESTERN PHILOSOPHY

Plato- Theory of knowledge, knowledge (episteme) and opinion (doxa), theory of ideas, the method of dialectic, soul and God,

Aristotle- Classification of the sciences, the theoretical, the practical and the productive (theoria, praxis, techne), logic as an organon, critique of Plato's theory of Ideas, theory of causation, form and matter, potentiality and actuality, soul and God.

Medieval Philosophy

St. Augustine- Problem of evil

St. Anselm- Ontological argument

St. Thomas Aquinas- Faith and reason, essence and existence, the existence of God

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Rationalism

Descartes: Conception of method and the need for method in philosophy, clarity and distinctness as the criterion of truth, doubt and methodological scepticism, the cogito- intuition or inference? innate ideas, the real distinction between mind and matter, role of God., proofs for the existence of God, mind- body interactionalism

Spinoza: Substance, Attribute and Mode, the concept of God or Nature, the mind-body problem, pantheism, three orders of knowing.

Leibnitz: Monadology, truths of reason and truths of fact, innateness of all ideas, proofs for the existence of God, principles of non-contradiction, sufficient reason and identity of indiscernible, the doctrine of pre-established harmony, problem of freedom and philosophy.

Empiricism

Locke: Ideas and their classification, refutation of innate ideas, theory of knowledge, three grades of knowledge, theory of substance, distinction between primary and secondary qualities.

Berkeley: Rejection of the distinction between primary and secondary qualities, immaterialism, critique of abstract ideas, esse est percipi, the problem of solipsism; God and self.

Hume: Impressions and ideas, knowledge concerning relations of ideas and knowledge concerning matter of fact, induction and causality, the external world and the self, personal identity, rejection of metaphysics, scepticism, reason and the passions.

Critical Philosophy

Kant: The critical philosophy, classification of judgments, possibility of synthetic a priori judgments, the Copernican revolution, forms of sensibility, categories of understanding, the metaphysical and the transcendental deduction of the categories, phenomenon and noumenon, the ideas of

Reason-Soul, God and world as a whole, freedom and immortality, rejection of speculative metaphysics.

SECTION-II

INDIAN & WESTERN ETHICS

1- Rna and Rta

2- Purusarthas, svadharma

3- Varnadharma and Asramadharma

4- Niskamakarma and Svadharma and sthitaprajna

5- Pancasila, Triratnas, eight fold path

6- Psychological Hedonism, Utilitarianism

7- Kants Ethical theory

8- Problem of freedom of will

9- Good, right, justice

10- Duty and obligation

11- Cardinal virtues

12- Eudemonism

13- Freedom and responsibility

14- Crime and punishment

15- Ethical cognitivism and non-cognitivism

16- Ethical realism and intuitionism

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SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – PHYSICAL EDUCATION

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

SEMESTER I
THEORY COURSES
SOE/PE/C-501 RESEARCH PROCESS IN PHYSICAL EDUCATION

Course Outcome:

- The students will learn about the meaning, types and scope of Research in Physical Education.
- The students will understand about formulation of Hypothesis and further actions in Research.
- The students will explained about various types of Research Methods prevalent in Physical Education.
- The students will know about How to write Research Proposal and Research Report.

Course Specific Outcome:

The course will provide opportunities to the students to learn about nuances of Research and basic steps in location and formulation of a Research Problem. They will also get the idea of various types of Researches and their methodological implications.

UNIT I – Introduction

Meaning and Definition of Research – Need, Nature and Scope of research in Physical Education. Classification of Research, Location of Research Problem, Criteria for selection of a problem, Qualities of a good researcher.

UNIT II – Methods of Research

Descriptive Methods of Research; Survey Study, Case study, Introduction of Historical Research, Steps in Historical Research, Sources of Historical Research: Primary Data and Secondary Data, Historical Criticism: Internal Criticism and External Criticism.

UNIT III – Experimental Research

Experimental Research – Meaning, Nature and Importance, Meaning of Variable, Types of Variables. Experimental Design - Single Group Design, Reverse Group Design, Repeated Measure Design, Static Group Comparison Design, Equated Group Design, Factorial Design.

UNIT IV – Sampling

Meaning and Definition of Sample and Population.Types of Sampling; Probability Methods; Systematic Sampling, Cluster sampling, Stratified Sampling.Area Sampling – Multistage Sampling.Non- Probability Methods; Convenience Sample, Judgement Sampling, Quota Sampling.

UNIT V – Research Proposal and Report

Chapterization of Thesis / Dissertation, Front Materials, Body of Thesis – Back materials. Method of Writing Research proposal, Thesis / Dissertation; Method of writing abstract and full paper for presenting in a conference and to publish in journals ,Mechanics of writing Research Report, Footnote and Bibliography writing.

Reference:

Best J. W (1971) Research in Education, New Jersey; Prentice Hall, Inc

Clarke David. H & Clarke H, Harrison (1984) Research processes in Physical Education, New

Jersey; Prentice Hall Inc.
Jerry R Thomas & Jack K Nelson (2000) Research Methods in Physical Activities; Illinois; Human Kinetics;
Kamlesh, M. L. (1999) Research Methodology in Physical Education and Sports
Rothstain, A (1985) Research Design and Statistics for Physical Education, Englewood Cliffs: Prentice Hall, Inc
Subramanian, R, Thirumalai Kumar S & Arumugam C (2010) Research Methods in Health, Physical Education and Sports, New Delhi; Friends Publication

SOE/PE/C -502 PHYSIOLOGY OF EXERCISE

Course Outcome:

• The students will know about the meaning and significance of exercise physiology to Physical Education Teacher.
• The students will learn about the structural and functional unit of Skeletal Muscle and Sliding Filament Theory.
• The students will understand the process of energy liberation and its utilization in physical exercise in Human body.
• The students will be able to learn functioning of heart and important related terms like: Cardiac Output, Stroke Volume, Cardiac Hypertrophy etc.
• The students will learn about the impact of climatic conditions on Human body and its performance and effects of Ergogenic aids.

Course Specific Outcome:
The Course will enable the students to know about Human Physiology implications and impact of exercises/ training programs upon it.

UNIT I – Skeletal Muscles and Exercise
Macro & Micro Structure of the Skeletal Muscle, Chemical Composition. Sliding Filament theory of Muscular Contraction. Types of Muscle fibre.Muscle Tone, Chemistry of Muscular Contraction – Heat Production in the Muscle, Effect of exercises and training on the muscular system.

UNIT II – Cardiovascular System and Exercise
Heart Valves and Direction of the Blood Flow – Conduction System of the Heart – Blood Supply to the Heart – Cardiac Cycle – Stroke Volume – Cardiac Output – Heart Rate – Factors Affecting Heart Rate – Cardiac Hypertrophy – Effect of exercises and training on the Cardio vascular system.

UNIT III – Respiratory System and Exercise
Mechanics of Breathing – Respiratory Muscles, Minute Ventilation – Ventilation at Rest and During Exercise.Diffusion of Gases – Exchange of Gases in the Lungs –Exchange of Gases in the Tissues – Control of Ventilation – Ventilation and the Anaerobic Threshold.Oxygen Debt – Lung Volumes and Capacities – Effect of exercises and training on the respiratory system.

UNIT IV – Metabolism and Energy Transfer
Metabolism – ATP – PC or Phosphagen System – Anaerobic Metabolism – Aerobic Metabolism – Aerobic and Anaerobic Systems during Rest and Exercise. Short Duration High Intensity Exercises – High Intensity Exercise Lasting Several Minutes – Long Duration Exercises.

UNIT V – Climatic conditions and sports performance and ergogenic aids
Variation in Temperature and Humidity – Thermoregulation – Sports performance in hot climate, Cool Climate, high altitude. Influence of: Amphetamine, Anabolic steroids, Androstenedione, Beta Blocker, Choline, Creatine, Human growth hormone on sports performance. Narcotic, Stimulants: Amphetamines, Caffeine, Ephedrine, Sympathomimetic amines. Stimulants and sports performance.

Reference:

Amrit Kumar, R, Moses. (1995). Introduction to Exercise Physiology. Madras: PoompugarPathipagam.

BeotraAlka, (2000) Drug Education Handbook on Drug Abuse in Sports: Sports Authority of India Delhi.

Clarke, D.H. (1975). Exercise Physiology. New Jersey: Prentice Hall Inc., Englewood Cliffs.

David, L Costill. (2004). Physiology of Sports and Exercise.Human Kinetics.

Fox, E.L., and Mathews, D.K. (1981).The Physiological Basis of Physical Education and Athletics. Philadelphia: Sanders College Publishing.

Guyton, A.C. (1976). Textbook of Medical Physiology. Philadelphia: W.B. Sanders co. Richard, W. Bowers. (1989). Sports Physiology. WMC: Brown Publishers.

SOE/PE/C-503 EVALUATION IN PHYSICAL EDUCATION

Course Outcome:

• The students will learn about meaning and significance of Test, Measurement and Evaluation in Physical Education.
• The students will know about various technical aspects of Test like: Reliability, Validity, Objectivity and Norms.
• The students will be able to understand about the procedure of various motor fitness tests.
• The students will be able to know about Anthropometric and Aerobic-Anaerobic tests and their procedures.
• The students will know about the procedure and application of various skill tests related to popular sports.

Course Specific Outcome:
The students will learn about various types of tests like: Motor Fitness, Anthropometric and Skill tests prevalent in the field of Physical Education and their significance.

UNIT I – Introduction
Meaning and Definition of Test, Measurement and Evaluation.Need and Importance of Measurement and Evaluation. Criteria for Test Selection – Scientific Authenticity.Meaning, definition and establishing Validity, Reliability, Objectivity. Norms – Administrative Considerations.

UNIT II – Motor Fitness Tests
Meaning and Definition of Motor Fitness. Test for Motor Fitness; Indiana Motor Fitness Test (for elementary and high school boys, girls and College Men) Oregon Motor Fitness Test
(Separately for boys and girls) - JCR test. Motor Ability; Barrow Motor Ability Test – Newton Motor Ability Test – Muscular Fitness – Kraus Weber Minimum Muscular Fitness Test.

UNIT III – Physical Fitness Tests
Physical Fitness Test: AAHPERD Health Related Fitness Battery (revised in 1984), ACSM Health Related Physical Fitness Test, Roger's physical fitness Index. Cardio vascular test; Harvard step test, 12 minutes run / walk test, Multi-stage fitness test (Beep test)

UNIT IV – Anthropometric and Aerobic-Anaerobic Tests
Physiological Testing: Aerobic Capacity: The Bruce Treadmill Test Protocol, 1.5 Mile Run test for college age males and females. Anaerobic Capacity: Margaria-Kalamen test, Wingate Anaerobic Test, Anthropometric Measurements: Method of Measuring Height: Standing Height, Sitting Height. Method of measuring Circumference: Arm, Waist, Hip, Thigh. Method of Measuring Skin folds: Triceps, Sub scapular, Suprailiac.

UNIT V – Skill Tests
Specific Spots Skill Test: Badminton: Miller Wall Volley Test. Basketball: Johnson Basketball Test, Harrison Basketball Ability Test. Cricket: Sutcliff Cricket test. Hockey: Friendel Field Hockey Test, Harban's Hockey Test, Volleyball, Russel Lange Volleyball Test, Brady Volleyball Test. Football: Mor-Christian General Soccer Ability Skill Test Battery, Johnson Soccer Test, Mc-Donald Volley Soccer Test. Tennis: Dyer Tennis Test.

References:

Cureton T.K. (1947) Physical Fitness Appraisal and Guidance, St. Louis: The C. Mosby Company

Jenson, Clayne R and Cynt ha, C. Hirst (1980) Measurement in Physical Education and Athletics, New York, Macmillan Publishing Co. Inc

Kansal D.K. (1996), "Test and Measurement in Sports and Physical Education, New Delhi: DVS Publications

Krishnamurthy (2007) Evaluation in Physical Education and Sports, New Delhi; Ajay Verma Publication

Vivian H. Heyward (2005) Advance Fitness Assessment and Exercise Prescription, 3rd Edition, Dallas TX: The Cooper Institute for Aerobics Research

Wilmore JH and Costill DL. (2005) Physiology of Sport and Exercise: 3rd Edition. Champaigm IL: Human Kinetic

SOE/PE/E-501 Yogic Sciences

Course Outcome:

• The students will learn about Yoga, its parts, indications and contra indications of various Yogic practices.
• The students will know about the correct procedure of doing various Asanas and Pranayams.
• The students will be able to understand the techniques and benefits of various Kriyas.
• The students will know about various types of Mudras and their benefits.
• The students will be able to understand the significance of Yogic practice to the Sports.

Course Specific Outcome:
The students will be able to know about the Role and Significance of Yogic practice to various systems of Human body and Sports performance.

Unit I – Introduction
Meaning and Definition of Yoga.Astanga Yoga: Yama, Niyama, Aasna, Pranayama, Prathyahara, Dharana, Dhyana, Samadhi, Concept of Yogic Practices; Principles of Breathing– Awareness – Relaxation, Sequence – Counter pose – Time – Place – Clothes – Bathing – Emptying the bowels – Stomach – Diet – No Straining – Age – Contra- Indication – Inverted asana – Sunbathing.

Unit II – Aasanas and Pranayam
Loosening exercise: Techniques and benefits.Asanas: Types- Techniques and Benefits, Surya Namaskar: Methods and benefits. Pranayama: Types- Methods and benefits. Nadis: Meaning, methods and benefits, Chakras: Major Chakaras- Benefits of clearing and balancing Chakras.

Unit III – Kriyas
Shat Kriyas- Meaning, Techniques and Benefits of Neti – Dhati – Kapalapathi- Trataka – Nauli – Basti, Bandhas: Meaning, Techniques and Benefits of JalendraBandha, JihvaBandha, UddiyanaBandha, MulaBandha.

Unit IV – Mudras
Meaning, Techniques and Benefits of Hasta Mudras, Asamyuktahastam, Samyuktahastam , Mana Mudra, Kaya Mudra, Banda Mudra, Adhara Mudra. Meditation: Meaning, Techiques and Benefits of Meditation – Passive and active, Saguna Meditation and Nirguna Meditation.

Unit V – Yoga and Sports
Yoga Supplemental Exercise – Yoga Compensation Exercise – Yoga Regeneration Exercise-Power Yoga. Role of Yoga in Psychological Preparation of athelete: Mental Welbeing, Anxiety, Depression Concentration, Self Actualization. Effect of Yoga on Physiological System: Circulatory, Skeletal, Digestive, Nervous, Respiratory, Excretory Syste.

Reference:
Gore, (1990), Anatomy and Physiology of Yogac Practices.Lonavata: Kanchan
Iyengar, B.K.S. (2000), Light on Yoga. New Delhi: Harper Collins Publishers.
Karbelkar N.V.(1993) PatanjalYogasutraBhashya (Marathi Edition) Amravati: Hanuman VyayamPrasarakMandal

Kenghe.C.T. (1976). Yoga as Depth-Psychology and para-Psychology (Vol-I): Historical Background, Varanasi: BharataManishai.
Kuvalyananada Swami & S.L. Vinekar, (1963), Yogic Therapy – Basic Principles and Methods. New Delhi: Govt. of India, Central Health Education and Bureau.
Swami Kuvalayanda, (1998), Asanas. Lonavala: Kaivalyadhama.
Swami SatyananadaSarasvati. (1989), Asana Pranayama Mudra Bandha.Munger: Bihar School of Yoga.

SOE/PE/E/502 SPORTS TECHNOLOGY

Course Outcome:

• The students will be able to know about meaning and application of Technology to Sports world.
• The students will learn about various terms related to science and technology like: Nanotechnology.
• The students will understand about the use of various types of technology to playfields and equipment in Sports.
• The students will know about latest training gadgets and their impact on Sports performance.

Course Specific Outcome:

The students will be provided an opportunity to get acquaint with scientific terms and technologies being the part of Sports equipments, apparel and playfield and how it is improving the qualities of products of modern world and human performance.

Unit I – Sports Technology
Meaning, definition, purpose, advantages and applications, General Principles and purpose of instrumentation in sports, Workflow of instrumentation and business aspects, Technological impacts on sports.

Unit II – Science of Sports Materials
Adhesives- Nano glue, nanomoulding technology, Nano turf.Foot wear production, Factors and application in sports, constraints. Foams- Polyurethane, Polystyrene, Styrofoam, closed-cell and open-cell foams, Neoprene, Foam. Smart Materials – Shape Memory Alloy (SMA), Thermo chromic film, High-density modelling foam.

Unit III – Surfaces of Playfields
Modern surfaces for playfields, construction and installation of sports surfaces.Types of materials – synthetic, wood, polyurethane Artificial turf. Modern technology in the construction of indoor and outdoor facilities. Technology in manufacture of modern play equipments. Use of computer and software in Match Analysis and Coaching.

Unit IV – Modern equipment
Playing Equipments: Balls: Types, Materials and Advantages, Bat/Stick/ Racquets: Types, Materials and Advantages. Clothing and shoes: Types, Materials and Advantages. Measuring equipments: Throwing and Jumping Events. Protective equipments: Types, Materials and Advantages. Sports equipment with nano technology, Advantages.

Unit V – Training Gadgets
Basketball: Ball Feeder, Mechanism and Advantages. Cricket: Bowling Machine, Mechanism and Advantages, Tennis: Serving Machine, Mechanism and Advantages, Volleyball: Serving Machine Mechanism and Advantages. Lighting Facilities: Method of erecting Flood Light and measuring luminous. Video Coverage: Types, Size, Capacity, Place and Position of Camera in Live coverage of sporting events.

References:

Charles J.A. Crane, F.A.A. and Furness, J.A.G. (1987) "Selection of Engineering Materials" UK: Butterworth Heiremann.

Finn, R.A. and Trojan P.K. (1999) "Engineering Materials and their Applications" UK: Jaico Publisher.

John Mongilo, (2001) "Nano Technology 101 "New York: Green wood publishing.

Walia, J.S. Principles and Methods of Education (Paul Publishers, Jullandhar), 1999.

Kochar, S.K. Methods and Techniques of Teaching (New Delhi, Jullandhar, Sterling Publishers Pvt. Ltd.), 1982

SEMESTER II

SOE/PE/C-601 APPLIED STATICTICS IN PHYSICAL EDUCATION

Course Outcome:

• The students will know about meaning, application and significance of Statistics in Physical Education Teaching and Research.
• The students will understand about the use and types of data and various descriptive statistical techniques like: Measure of Central Tendencies and Measure of Variabilities.
• The students will be explained about Probability Distributions and various types of Graphs and their use in Physical Education.
• The students will learn about Inferential Statistics techniques like: 't' test, chi square test, ANOVA, ANCOVA.

Course Specific Outcome:
The students will enable to understand about use of Data, its statistical treatment and interpretation as per the need of the study in the field of Physical Education.

UNIT I – Introduction
Meaning and Definition of Statistics. Function, need and importance of Statistics. Types of Statistics. Meaning of the terms, Population, Sample, Data, types of data. Variables; Discrete, Continuous. Parametric and non-parametric statistics.

UNIT II – Data Classification, Tabulation and Measures of Central Tendency
Meaning, uses and construction of frequency table. Meaning, Purpose, Calculation and advantages of Measures of central tendency – Mean, median and mode.

UNIT III – Measures of Dispersions and Scales
Meaning, Purpose, Calculation and advances of Quartile, Deviation, Mean Deviation, Standard Deviation, Probable Error. Meaning, Purpose, Calculation and advantages of scoring scales; Sigma scale, Z Scale, Hull scale, T scale.

UNIT IV – Probability Distributions and Graphs
Normal Curve. Meaning of probability- Principles of normal curve – Properties of normal curve. Divergence form normality – Skewness and Kurtosis. Graphical Representation in Statistics; Line diagram, Bar diagram, Histogram, Frequency Polygon, Ogive Curve.

UNIT V – Inferential and Comparative Statistics
Tests of significance; Independent “t” test, Dependent “t” test – chi – square test, level of confidence and interpretation of data. Meaning of correlation – co-efficient of correlation – calculation of co-efficient of correlation by the product moment method and rank difference method. Concept of ANOVA and ANCOVA.

References:
Best J. W (1971) Research in Education, New Jersey; Prentice Hall, Inc

Clark D.H. (1999) Research Problem in Physical Education 2nd edition, Eaglewood Cliffs, Prentice Hall, Inc.

Jerry R Thomas & Jack K Nelson (2000) Research Methods in Physical Activities; Illinois; Human Kinetics;

Kamlesh, M. L. (1999) Research Methodology in Physical Education and Sports, New Delhi

Rothstain A (1985) Research Design and Statistics for Physical Education, Englewood Cliffs:Prentice Hall, Inc

Sivaramakrishnan. S. (2006) Statistics for Physical Education, Delhi; Friends Publication

SOE/PE/C-602 SPORTS BIOMECHANICS AND KINSESIOLOGY

Course Outcome:

• The students will be able to know about meaning and concept of Biomechanics and its importance in movement analysis.
• The student will understand about origin and insertion of important skeletal muscles and their movement pattern.
• The student will acquire knowledge about Motion-Cause and descriptions and factors affecting it.
• The student will get understanding of levers and projectile and their application in Physical Education and Sports.
• The student will enable to analyze various types of movements by adopting different method of analysis.

Course Specific Outcome:
The students will learn about the application of Kinesiological and Biomechanical knowledge and principles to sports setting and achieve the positive result out of it.

UNIT I – Introduction
Meaning, nature, role and scope of applied kinesiology and Sports Biomechanics. Meaning of Axis and Planes, Dynamics, Kinematics, Kinetics, Statics Centre of gravity -Line of gravity plane of the body and axis of motion, Vectors and Scalars.

UNIT II – Muscle Action
Origin, Insertion and action of muscles: Pectoralis major and minor, Deltoid, Biceps, Triceps (Anterior and Posterior), Trapezius, serratus, Sartorius, Rectus femoris, Abdominis, Quadriceps, Hamstring, Gastrocnemius.

UNIT III – Motion and Force
Meaning and definition of Motion. Types of Motion: Linear motion, angular motion, circular motion, uniform motion. Principals related to the law of Inertia, Law of acceleration, and law of counter force. Meaning and definition of force- Sources of force - Force components .Force applied at an angle - pressure -friction -Buoyancy, Spin - Centripetal force - Centrifugal force.

UNIT IV – Projectile and Lever
Freely falling bodies - Projectiles -Equation of projectiles stability Factors influencing equilibrium - Guiding principles for stability -static and dynamic stability. Meaning of work, power, energy, kinetic energy and potential energy. Leverage -classes of lever - practical application. Water resistance - Air resistance -Aerodynamics.

UNIT V – Movement Analysis
Analysis of Movement: Types of analysis: Kinesiological, Biomechanical. Cinematographic. Methods of analysis – Qualitative, Quantitative, Predictive

References:
Deshpande S.H. (2002). ManavKriyaVigyan – Kinesiology (Hindi Edition) Amravati

:HanumanVyayamPrasarakMandal.
Hoffman S.J. Introduction to Kinesiology (Human Kinesiology publication Inc. 2005
Thomas. (2001). Manual of structural Kinesiology, New York: McGraw Hill.
Uppal, A (2004), Kinesiology in Physical Education and Exercise Science, Delhi Friends publications.
Williams M (1982) Biomechanics of Human Motion, Philadelphia; Saunders Co.

SOE/PE/C-603 ATHLETIC CARE AND REHABILITATION

Course Outcome:

• The students will understand the meaning and use of corrective Physical Education.
• The student will be explained about Posture (Good and Bad), Posture Deformities, its adverse effects and remedial measures.
• The students will know about history and types of Massage, various massage strokes and their benefits.
• The students will be enabled to get knowledge of common sports injuries, its treatment and rehabilitation program.

Course specific Outcome:

The students will be provided the knowledge of corrective Physical Education and Rehabilitation program to make Sports person more productive and injury free career**.**

Unit I – Corrective Physical Education

Definition and objectives of corrective physical Education. Posture and body mechanics, Standards of Standing Posture.Value of good posture, Drawbacks and causes of bed posture.Posture test – Examination of the spine.

Unit II – Posture

Normal curve of the spine and its utility, Deviations in posture: Kyphosis, lordosis, flat back, Scoliosis, round shoulders, Knock Knee, Bow leg, Flat foot. Causes for deviations and treatment including exercises.

Unit III – Rehabilitation Exercises

Passive, Active, Assisted
Resisted exercise for Rehabilitation
Stretching, PNF techniques and principles.

Unit IV – Massage

Brief history of massage – Massage as an aid for relaxation – Points to be considered in giving massage – Physiological , Chemical, Psychological effects of massage – Indication / Contra indication of Massage – Classification of the manipulation used massage and their specific uses in the human body – Stroking manipulation: Effleurage – Pressure manipulation: Petrissage Kneading (Finger, Kneading, Circular) ironing Skin Rolling – Percussion manipulation: Tapotement, Hacking, Clapping, Beating, Pounding, Slapping, Cupping, Poking, Shaking Manipulation, Deep massage.

Unit V – Sports Injuries Care, Treatment and Support

Principles pertaining to the prevention of Sports injuries – care and treatment of exposed and unexposed injuries in sports – Principles of apply cold and heat, infrared rays – Ultrasonic, Therapy – Short wave diathermy therapy. Principles and techniques of Strapping and Bandages.

References:

Dohenty. J. Meno.Wetb, Moder D (2000) Track & Field, Englewood Cliffs, Prentice Hal Inc.

Lace, M. V. (1951) Massage and Medical Gymnastics, London: J & A Churchill Ltd.
McOoyand Young (1954) Tests and Measurement, New York: Appleton Century.
Naro, C. L. (1967) Manual of Massage and, Movement, London: Febra and Febra Ltd.
Rathbome, J.l. (1965) Corrective Physical education, London: W.B. Saunders & Co.
Stafford and Kelly, (1968) Preventive and Corrective Physical Education, New York.

SOE/PE/E-601 SPORTS JOURNALISM AND MASS MEDIA

Course Outcome:

• The students will understand about Meaning and Significance of Journalism in the Field of Sports.
• The students will be able to know about Role of Journalism in the field of Physical Education.
• The students will be explained about concept of Sports Bulletin and Sports Education.
• The students will know about Reporting of Sports Events, Publication of Sports Meet and organizing Press Meet.

Course specific Outcome:

The students will acquire knowledge about scope of Journalism in Sports world and Physical Education qualities and qualifications for Professional Sports Journalist.

UNIT I Introduction

Meaning and Definition of Journalism, Ethics of Journalism – Canons of journalism- Sports Ethics and Sportsmanship – Reporting Sports Events. National and International Sports News Agencies.

UNIT II Sports Bulletin

Concept of Sports Bulletin: Journalism and sports education – Structure of sports bulletin – Compiling a bulletin – Types of bulletin – Role of Journalism in the Field of Physical Education: Sports as an integral part of Physical Education – Sports organization and sports journalism – General news reporting and sports reporting.

UNIT III Mass Media

Mass Media in Journalism: Radio and T.V. Commentary – Running commentary on the radio – Sports expert's comments. Role of Advertisement in Journalism. Sports Photography: Equipment- Editing – Publishing.

UNIT IV Report Writing on Sports

Brief review of Olympic Games, Asian Games, Common Wealth Games World Cup, National Games and Indian Traditional Games. Preparing report of an Annual Sports Meet for Publication in Newspaper.Organization of Press Meet.

UNIT –V Journalism

Sports organization and Sports Journalism – General news reporting and sports reporting. Methods of editing a Sports report. Evaluation of Reported News.Interview with and elite Player and Coach.

Reference:

Ahiya B.N. (1988) Theory and Practice of Journalism: Set to Indian context Ed3. Delhi :Surjeet Publications
Ahiya B.N. Chobra S.S.A. (1990) Concise Course in Reporting. New Delhi: Surjeet Publication
Bhatt S.C. (1993) Broadcast Journalism Basic Principles. New Delhi. Haranand Publication
Dhananjay Joshi (2010) Value Education in Global Perspective. New Delhi: Lotus Press.
MohitChakrabarti (2008): Value Education: Changing Perspective, New Delhi: Kanishka Publication.

SOE/PE/E-602 SPORTS MANAGEMENT AND CURRICULUM DESIGN IN PHYSICAL EDUCATION

Course Outcome:

• The students will know about the concept of Sports Management, its principles and functions in Physical Education.

• The students will be able to learn about Program development colleges Sports program and community based Physical Education.

• The students will be explained about Curriculum, its principles, theories of Curriculum Development.

• The students will know about factors affecting Curriculum. Sources of Curriculum materials and latest avenues of information in the field of Physical Education.

Course specific Outcome:

The students will learn about the Management; Sports Management, Office Management, Personnel Management and Program Management, which will allow them to become a successful Professional in the field of Physical Education.

UNIT I – Introduction to Sports Management

Definition, Importance.Basic Principles and Procedures of Sports Management.Functions of Sports Management. Personal Management: Objectives of Personal Management, Personal Policies, Role of Personal Manager in an organization, Personnel recruitment and selection.

UNIT II – Program Management

Importance of Programme development and the role of management, Factors influencing programme development. Steps in programme development, Competitive Sports Programs, Benefits, Management Guidelines for School, Colleges Sports Programs, Management Problems in instruction programme, Community Based Physical Education and Sports program.

UNIT III – Equipments and Public Relation

Purchase and Care of Supplies of Equipment, Guidelines for selection of Equipments and Supplies, Purchase of equipments and supplies, Equipment Room, Equipment and supply Manager. Guidelines for checking, storing, issuing, care and maintenance of supplies and equipments. Public Relations in Sports: Planning the Public Relation Program – Principles of Public Relation – Public Relations in School and Communities – Public Relation and the Media.

UNIT IV – Curriculum

Meaning and Definition of Curriculum. Principles of Curriculum Construction: Students centred, Activity centred, Community centred, Forward looking principle, Principles of integration, Theories of curriculum development, Conservative (Preservation of Culture), Relevance, flexibility, quality, contextually and plurality. Approaches to Curriculum; Subject centred, Learner centred and Community centred, Curriculum Framework.

UNIT V – Curriculum Sources

Factors that affecting curriculum: Sources of Curriculum materials – text books – Journals – Dictionaries, Encyclopaedias, Magazines, Internet.Integration of Physical Education with other Sports Sciences – Curriculum research, Objectives of Curriculum research – Importance of Curriculum research.Evaluation of Curriculum, Methods of evaluation.

Reference:

Aggarwal, J.C (1990). Curriculum Reform in India – World overviews, Doaba World Education Series – 3 Delhi: Doaba House, Book seller and Publisher.

Carl, E, Willgoose. (1982. Curriculum in Physical Education, London: Prentice Hall. Chakraborthy & Samiran. (1998) .Sports Management. New Delhi: Sports Publication.

John, E, Nixon & Ann, E, Jewett. (1964). Physical Education Curriculum, New York: The Ronald Press Company.

McKernan, James (2007) Curriculum and Imagination: Process, Theory, Pedagogy and Action Research,. U.K. Routledge

NCERT (2000). National Curriculum Framework for School Education, New Delhi: NCERT.

NCERT (2005). National Curriculum Framework-2005, New Delhi: NCERT.

Williams, J.F. (2003). Principles of Physical Education. Meerut: College Book House.

SEMESTER III

SOE/PE/C-701 SCIENTIFIC PRINCIPLES OF SPORTS TRAINING

Course Outcome:

• The students will learn about Meaning and Principles of Sports Training.
• The students will know about various important terms of Sports Training like: Load, Adaptation, Supercompensation and Overload to make it more effective and meaningful.
• The students will be explained about various training methods for improving Motor abilities of Sportspersons.
• The students will acquire knowledge of Training plans and principles of Periodization for achieving Top form for an athlete.

Course specific Outcome:

The students will be able to get knowledge about scientific method of Sports Training and other relevant issue pertaining to it. They will be explained about various methods of Doping and its ill effects to Sportsperson's health.

UNIT I – Introduction

Sports training: Definition – Aim, Characteristics, Principles of Sports Training, Over Load: Definition, Causes of Over Load, Symptoms of Overload, Remedial Measures – Super Compensation – Altitude Training – Cross Training

UNIT II – Components of Physical Fitness

Strength: Methods to improve Strength: Weight Training, Isometric, Isotonic, Circuit Training, Speed: Methods to Develop Speed: Repetition Method, Downhill Run, Parachute Running, Wind Sprints, Endurance, Methods to Improve Endurance: Continuous Method, Interval Method, Repetition Method, Cross Country, Fartlek Training

UNIT III – Flexibility and Coordinative abilities

Flexibility: Methods to Improve the Flexibility- Stretch and Hold Method, Ballistic Method, Special Type Training: Plyometric Training. Training for Coordinative abilities: Methods to improve Coordinative abilities: Sensory Method, Variation in Movement Execution Method, Variation in External Condition Method, Combination of Movement Method, Types of Stretching Exercises.

UNIT IV – Training Plan

Training Plan: Macro Cycle, Meso-Cycle. Short Term Plan and Long Term Plans - Periodisation: Meaning, Single, Double and Multiple Periodisation, Preparatory Period, Competition Period and Transition Period.

UNIT V – Doping

Definition of Doping – Side effects of drugs – Dietary supplements – IOC list of doping classes and methods. Blood Doping – The use of erythropoietin in blood boosting – Blood doping control – The testing programmes – Problems in drug detection – Blood testing in doping control – Problems with the supply of medicines Subject to IOC regulations : over-the- counter drugs (OTC) – prescription only medicines (POMs) – Controlled drugs (CDs). Reporting test results – Education

References:

Bunn, J.N. (1998) Scientific Principles of Coaching, New Jersey Engle Wood Cliffs, Prentice Hall Inc.
Cart, E. Klafs&Daniel, D. Arnheim (1999) Modern Principles of Athletic Training St. Louis C. V. Mosphy Company
Daniel, D. Arnheim (1991) Principles of Athletic Traning, St. Luis, Mosby Year Book
David R. Mottram (1996) Drugs in Sport, School of Pharmacy, Liverpool: John Moore University
Hardayal Singh (1991) Science of Sports Training, New Delhi, DVS Publications
Jensen, C.R. & Fisher A.G. (2000) Scientific Basic of Athletic Conditioning, Philadelphia

SOE/PE/C-702 SPORTS MEDICINE

Course Outcome:

• The students will know about the meaning and importance of Sports Medicine for Physical Education field.
• The students will understand about various types of Therapeutic exercises, their procedures and advantages.
• The students will be explained about proper Rehabilitation program for Sportsperson.
• The students will acquire the knowledge about injuries common to lower and upper extremities of human body and its treatment.
• The students will learn about tapping and strapping of injured body part.

Course specific Outcome:

The students will know about the use of Sports Medicine for Injury free Sports participation and Rehabilitation program for recovery from any Sports Injury.

UNIT I – Introduction

Meaning, definition and importance of Sports Medicine, Definition and Principles of therapeutic exercises. Coordination exercise, Balance training exercise, Strengthening exercise, Mobilization exercise, Gait training, Gym ball exercise Injuries: acute, sub-acute, chronic. Advantages and Disadvantages of PRICE, PRINCE therapy, Aquatic therapy.

UNIT II – Basic Rehabilitation

Basic Rehabilitation: Strapping/Tapping: Definition, Principles Precautions Contraindications. Proprioceptive neuromuscular facilitation: Definition hold, relax, repeated contractions. Show reversal technique exercises. Isotonic, Isokinetic, isometric stretching. Definition.Types of stretching, Advantages, dangers of stretching, Manual muscle grading.

UNIT III – Spine Injuries and Exercise

Head, Neck and Spine injuries: Causes, Presentational of Spinal anomalies, Flexion, Compression, Hyperextension, Rotation injuries. Spinal range of motion. Free hand exercises, stretching and strengthening exercise for head neck, spine. Supporting and aiding techniques and equipment for Head, Neck and Spine injuries.

UNIT IV – Upper Extremity Injuries and Exercise

Upper Limb and Thorax Injuries: Shoulder: Sprain, Strain, Dislocation, and Strapping. Elbow: Sprain, Strain, Strapping. Wrist and Fingers: Sprain Strain, Strapping. Thorax, Rib fracture. Breathing exercises, Relaxation techniques, Free hand exercise, Stretching and strengthening exercise for shoulder, Elbow, Wrist and Hand. Supporting and aiding techniques and equipment for Upper Limb and Thorax Injuries.

UNIT V – Lower Extremity Injuries and Exercise

Lower Limb and Abdomen Injuries: Hip: Adductor strain, Dislocation, Strapping. Knee: Sprain, Strain, Strain, Strapping. Ankle: Sprain, Strain, Strapping. Abdomen: Abdominal wall, Contusion, Abdominal muscle strain. Free exercises – Stretching and strengthening exercise for Hip, knee, ankle and Foot. Supporting and aiding techniques and equipment for Lower limb and Abdomen injures.

References:

Christopher M. Norris. (1993). Sports Injures Diagnosis and Management for Physiotherapists. East Kilbride: Thomson Litho Ltd.

James, A. Gould & George J. Davies.(1985). Physical Physical Therapy. Toronto: C.V. Mosby Company.

Morris B. Million (1984) Sports Injuries and Athletic Problem. New Delhi: Surjeet Publication.

Pande.(1998). Sports Medicine. New Delhi: Khel Shitya Kendra

The Encyclopedia of Sports Medicine. (1998). The Olympic Book of Sports Medicine, Australia: Tittel Blackwell Scientific publications.

SOE/PE/C-703 HEALTH EDUCATION AND SPORTS NUTRITION

Course Outcome:

• The students will know about the concept, Dimensions and Spectrum of Health.
• The students will be able to understand about principles of Health Education and various School Health Services.
• The students will be explained about meaning and Significance of Hygiene for Healthy life.
• The students will know about Sports Nutrition and its impact on Human Performance.
• The students will be able to learn about Obesity and its hazards and weight management plans.

Course specific Outcome:

The students will know about Health Education and its application for better quality of Human life and performance through Nutritious and Balance Diet.

Unit - I Health Education

Concept, Dimensions, Spectrum and Determinants of Health
Definition of Health, Health Education, Health Instruction, Health Supervision, Aim, objective and Principles of Health Education
Health Service and guidance instruction in personal hygiene

Unit - II Health Problems in India

Communicable and Non Communicable Diseases
Obesity, Malnutrition, Adulteration in food, Environmental sanitation, Explosive, Population,
Personal and Environmental Hygiene for schools
Objective of school health service, Role of health education in schools
Health Services - Care of skin, Nails, Eye health service, Nutritional service, Health appraisal, Health record, Healthful school environment, first- aid and emergency care etc.

Unit- III – Hygiene and Health

Meaning of Hygiene, Type of Hygiene, dental Hygiene, Effect of Alcohol on Health, Effect of Tobacco on Health, Life Style Management, Management of Hypertension, Management of Obesity, Management of Stress

Unit – IV- Introduction to Sports Nutrition

Meaning and Definition of Sports Nutrition, Role of nutrition in sports, Basic Nutrition guidelines, Nutrients: Ingestion to energy metabolism (Carbohydrate, Protein and Fat), Role of carbohydrates, Fat and protein during exercise.

Unit – V Nutrition and Weight Management

Concept of BMI (Body mass index), Obesity and its hazard, Dieting versus exercise for weight control Maintaining a Healthy Lifestyle, Weight management program for sporty child, Role of diet and exercise in weight management, Design diet plan and exercise schedule for weight gain and loss.

References:

Bucher, Charles A. "Administration of Health and Physical Education Programme". Delbert, Oberteuffer, et. al." The School Health Education".

Ghosh, B.N. "Treaties of Hygiene and Public Health".
Hanlon, John J. "Principles of Public Health Administration" 2003.
Moss "Health Education" (National Education Association of U.T.A.)Nemir A. 'The School Health Education" (Harber and Brothers, New York). Nutrition Encyclopedia, edited by Delores C.S. James, The Gale Group, Inc.

SOE/PE/E-701 SPORTS ENGINEERING

Course Outcome:

• The students will be able to know about meaning of Sports Engineering and its applications.
• The students will be explained about mechanics of engineering materials.
• The students will learn about Dynamics and its use in Sports.
• The students will acquire knowledge of science related to Sports Infrastructure.
• The students will learn about maintenance of various Infrastructural facilities in Sports and Physical Education.

Course specific Outcome:

The student will be enabled to get knowledge of various scientific terms and principles involved in Engineering for construction and maintenance of Sports facilities.

Unit - I Introduction to sports engineering and Technology

Meaning of sports engineering, human motion detection and recording, human performance, assessment, equipment and facility designing and sports related instrumentation and measurement.

Unit - II Mechanics of engineering materials

Concept of internal force, axial force, shear force, bending movement, torsion, energy method to find displacement of structure, strain energy. Biomechanics of daily and common activities –Gait, Posture, Body levers, ergonomics, Mechanical principles in movements such as lifting, walking, running, throwing, jumping, pulling, pushing etc

Unit- III Sports Dynamics

Introduction to Dynamics, Kinematics to particles – rectilinear and plane curvilinear motion coordinate system.
Kinetics of particles – Newton's laws of Motion, Work, Energy, Impulse and momentum.

Unit- IV Building and Maintenance:

Sports Infrastructure- Gymnasium, Pavilion, Swimming Pool, Indoor Stadium, Out-door Stadium, Play Park, Academic Block, Administrative Block, Research Block, Library, Sports Hostels, etc.
Requirements: Air ventilation, Day light, Lighting arrangement, Galleries, Store rooms, Office, Toilet Blocks (M/F), Drinking Water, Sewage and Waste Water disposal system, Changing Rooms (M/F), Sound System (echo-free), Internal arrangement according to need and nature of activity to be performed, Corridors and Gates for free movement of people, Emergency provisions of lighting, fire and exits, Eco-friendly outer surrounding. Maintenance staff, financial consideration.
Building process:- design phase (including brief documentation), construction phase functional (occupational) life, Re-evaluation, refurnish, demolish.
Maintenance policy, preventive maintenance, corrective maintenance, record and register for maintenance.

Unit – V Facility life cycle costing

Basics of theoretical analysis of cost
Total life cost concepts, maintenance costs, energy cost, capital cost and taxation

Reference:

Franz K. F. et. al., Editor, Routledge Handbook of Sports Technology and Engineering (Routledge, 2013).
Steve Hake, Editor, The Engineering of Sport (CRC Press, 1996)
Franz K. F. et. al., Editor The Impact of Technology on Sports II (CRC Press, 2007)
Helge N., Sports Aerodynamics (Springer Science & Business Media, 2009)
Youlin Hong, Editor Routledge Handbook of Ergonomics in Sport and Exercise (Routledge, 2013)
Eric C. et al., Editor Sports Facility Operations Management (Routledge, 2010)

SOE/PE/E-702 PHYSICAL FITNESS AND WELLNESS

Course Outcome:

• The students will be able to learn about the concept of Physical Fitness and its principles involved in human movement.
• The students will know about Food sources and choices and food values.
• The students will be explained about various cardio respiratory activities and their benefits.
• The students will be able to learn about various types of Flexibility exercises, Pilates and Yoga.

Course specific Outcome:

Program content will be enabled to know about meaning and concept of Physical Fitness and Wellness for Physical Education Teachers and Coaches.

Unit I – Introduction

Meaning and Definition" of Physical Fitness, Physical Fitness Concepts and Techniques, Principles of physical fitness, Physiological principles involved in human movement.Components of Physical Fitness.

Leisure time physical activity and identify opportunities in the community to participate in this activity. Current trends in fitness and conditioning, components of total health fitness and the relationship between physical activity and lifelong wellness.

Unit II – Nutrition

Nutrients; Nutrition labelling information, Food Choices, Food Guide Pyramid, Influences on food choices-social, economic, cultural, food sources, Comparison of food values. Weight Management-proper practices to maintain, lose and gain. Eating Disorders, Proper hydration, the effects of performance enhancement drugs

Unit III – Aerobic Exercise

Cardio respiratory Endurance Training; proper movement forms, i.e., correct stride, arm movements, body alignment; proper warm-up, cool down, and stretching, monitoring heart rates during activity. Assessment of cardio respiratory fitness and set goals to maintain or improve fitness levels. Cardio respiratory activities including i.e. power walking, pacer test, interval training, incline running, distance running, aerobics and circuits.

Unit IV – Anaerobic Exercise

Resistance Training for Muscular Strength and Endurance; principles of resistance training, Safety techniques (spotting, proper body alignment, lifting techniques, spatial, awareness. and proper breathing techniques). Weight training principles and concepts; basic resistance exercises (including free hand exercise, free weight exercise, weight machines, exercise bands and tubing. medicine balls, fit balls) Advanced techniques of weight training

Unit V – Flexibility Exercise

Flexibility Training, Relaxation Techniques and Core Training.Safety techniques (stretching protocol; breathing and relaxation techniques) types of flexibility exercises (i.e. dynamic, static), Develop basic competency in relaxation and breathing techniques. Pilates, Yoga.

Reference:

David K. Miller & T. Earl Allen, Fitness, A life time commitment, Surjeet Publication Delhi 1989.
Dificore Judy, the complete guide to the postnatal fitness, A & C Black Publishers Ltd. 35 Bedford row, London 1998.
Warner W.K. Oeger& Sharon A. Hoeger, Fitness and Wellness, Morton Publishing Company, 1990.
Elizabeth & Ken day, Sports fitness for women, B.T. Batsford Ltd, London, 1986.
Emily R. Foster, KarynHartiger& Katherine A. Smith, Fitness Fun, Human Kinetics Publishers 2002.
Lawrence, Debbie, Exercise to Music. A & C Black Publishers Ltd. 37, Sohe Square, London 1999.

SEMESTER IV

SOE/PE/C-801 INFORMATION AND COMMUNICATION TECHNOLOGY IN PHYSICAL EDUCATION

Course Outcome:

• The students will learn about the concept, elements, process and types of communication.
• The students will be able to understand the need and importance of ICT in Education and Physical Education.
• The students will be explained about MS Word, MS Excel, MS Power Point, its application in Physical Education.
• The students will acquire knowledge about E-learning and its significance in Physical Education.

Course specific Outcome:

The students will be able to get knowledge of various ICT tools like MS Word, MS Excel, MS Power Point, their application for more meaningful and productive teaching.

Unit I – Communication & Classroom Interaction

Concept, Elements, Process & Types of Communication, Communication Barriers & Facilitators of communication
Importance of ICT Need of ICT in Education
Scope of ICT: Teaching Learning Process, Publication Evaluation, Research and Administration, Challenges in Integrating ICT in Physical Education

Unit II – Fundamentals of Computers

Characteristics, Types & Applications of Computers Hardware of Computer: Input, Output & Storage Devices Software of Computer: Concept & Types
Computer Memory: Concept & Types Viruses & its Management
Concept, Types & Functions of Computer Networks Internet and its Applications Web Browsers & Search Engines Legal & Ethical Issues

Unit III – MS Office Applications

MS Word: Main Features & its Uses in Physical Education
MS Excel: Main Features & its Applications in Physical Education MS Access: Creating a Database, Creating a Table, Queries, Forms & Reports on Tables and its Uses in Physical Education
MS Power Point: Preparation of Slides with Multimedia Effects MS Publisher: Newsletter & Brochure

Unit IV – ICT Integration in Teaching Learning Process

Approaches to Integrating ICT in Teaching Learning Process
Project Based Learning (PBL)
Co-Operative Learning
Collaborative Learning
ICT and Constructivism: A Pedagogical Dimension

Unit V – E-Learning & Web Based Learning

E-Learning
Web Based Learning
Visual Classroom

References:

Douglas E. Comer, The Internet Book, Purdue University, West Lafayette in 2005.
Heidi Steel Low price Edition, Microsoft Office Word 2003- 2004.
Pradeep K. Sinha&Priti; Sinha, Foundations computing BPB Publications -2006. Rebecca Bridges Altman Peach pit Press, Power point for window, 1999.
Sanjay Saxena, Vikas Publication House, Pvt. Ltd. Microsoft Office for ever one, Second Edition-2006.

SOE/PE/C-802 SPORTS PSYCHOLOGY

Course Outcome:

• The students will be able to know about need and importance of Sports Psychology for Physical Education teachers and Coaches.
• The students will learn about Motor Learning and Perceptual Mechanism and its significance in Sports Activities.
• The students will understand meaning, theories, types and application of Motivation in Sports and Physical Education.
• The students will be explained about different Relaxation techniques and procedures for Stress reduction in Sports.
• The students will know about Sports as Socialization tool and role of various Social Institutes.

Course specific Outcome:

The students will learn about Practical application of psychological principles and techniques to making teaching learning more meaningful. They will also understand the significance of Sports as Socializing act in the human society.

UNIT I - Introduction

Meaning, Definition, History, Need and Importance of Sports Psychology. Present Status of Sports Psychology in India. Motor Learning: Basic Considerations in Motor Learning– Motor Perception – Factors Affecting Perception – Perceptual Mechanism. Personality: Meaning, Definition, Structure – Measuring Personality Traits. Effects of Personality on Sports Performance.

UNIT II - Motivation

Meaning and Definition, Types of Motivation: Intrinsic, Extrinsic. Achievement Motivation: Meaning, Measuring of Achievement Motivation. Anxiety: Meaning and Definition, Nature, Causes, Method of Measuring Anxiety. Competitive Anxiety and Sports Performance. Stress: Meaning and Definition, Causes. Stress and Sports Performance. Aggression: Meaning and Definition, Method of Measurement. Aggression and Sports Performance. Self-Concept: Meaning and Definition, Method of Measurement.

UNIT III – Goal Setting

Meaning and Definition, Process of Goal Setting in Physical Education and Sports. Relaxation: Meaning and Definition, types and methods of psychological relaxation. Psychological Tests: Types of Psychological Test: Instrument based tests: Pass-along test – Tachistoscope – Reaction timer – Finger dexterity board – Depth perception box – Kinesthesiometer board. Questionnaire: Sports Achievement Motivation, Sports Competition Anxiety.

UNIT IV – Sports Sociology

Meaning and Definition – Sports and Socialization of Individual Sports as Social Institution.National Integration through Sports. Fans and Spectators: Meaning and definition, Advantages and disadvantages on Sports Performance. Leadership: Meaning, Definition, types. Leadership and Sports Performance.

UNIT V – Group Cohesion

Group: Definition and Meaning, Group Size, Groups on Composition, Group Cohesion, Group Interaction, Group Dynamics. Current Problems in Sports and Future Directions – Sports Social Crisis Management – Women in Sports: Sports Women in our Society, Participation pattern among Women, Gender inequalities in Sports.

References:

Jain. (2002), Sports Sociology, Heal SahetyKendre Publishers.

Jay Coakley. (2001) Sports in Society – Issues and Controversies in International Education, Mc-Craw Seventh Edn.

John D Lauther (2000) Psychology of Coaching.NerJersy: Prenticce Hall Inc.

John D. Lauther (1998) Sports Psychology. Englewood, Prentice Hall Inc.

MiroslawVauks& Bryant Cratty (1999).Psychology and the Superior Athlete. London: The Macmillan Co.

Richard, J. Crisp. (2000). Essential Social Psychology.Sage Publications.

Robert N. Singer (2001). Motor Learning and Human Performance. New York: The Macmillan Co

SOE/PE/C-803 EDUCATION TECHNOLOGY IN PHYSICAL EDUCATION

Course Outcome:

• The students will learn about the Nature and Scope of Education Technology in Physical Education.
• The students will be able to understand about task analysis, content analysis, and context analysis and its relevance in Physical Education teaching.
• The students will be explained about various forms of Audio-Visual media and their utilization/ application in the field of Physical Education.
• The students will acquire knowledge about recent innovations in the area of Education Technology and its significance in Learning.

Course specific Outcome:

The students will be able to know about the scope and applications of various Education Technology tools for innovative learning in Physical Education curriculum.

Unit I – Nature and Scope

Educational technology-concept, Nature and Scope. Forms of educational technology: teaching technology, instructional technology, and behaviour technology; Transactional usage of educational technology: integrated, complementary, supplementary stand-alone (independent); programmed learning stage; media application stage and computer application stage.

Unit II – Systems Approach to Physical Education and Communication

Systems Approach to Education and its Components: Goal Setting, Task Analysis, Content Analysis, Context Analysis and Evaluation Strategies; Instructional Strategies and Media for Instruction. Effectiveness of Communication in instructional system; Communication - Modes, Barriers and Process of Communication.

Unit III- Instructional Design

Instructional Design: Concept, Views. Process and stages of Development of Instructional Design. Overview of Models of Instructional Design; Instructional Design for Competency Based Teaching: Models for Development of Self Learning Material.

Unit IV – Audio Visual Media in Physical Education

Audio-visual media - meaning, importance and various forms Audio/Radio: Broadcast and audio recordings - strengths and Limitations, criteria for selection of instructional units, script writing, pre-production, post-production process and practices, Audio Conferencing and Interactive Radio Conference. Video/Educational Television: Telecast and Video recordings Strengths and limitations, Use of Television and CCTV in instruction and Training, Video Conferencing, SITE experiment, countrywide classroom project and Satellite based instructions. Use of animation films for the development of children's imagination.

Unit V – New Horizons of Educational Technology

Recent innovations in the area of ET interactive video - Hypertext, video-texts, optical fiber technology - laser disk, computer conferencing.etc. Procedure and organization of Teleconferencing/Interactive video-experiences of institutions, schools and universities. Recent experiments in the third world countries and pointers for, India with reference to Physical education. Recent trends of Research in Educational Technology and its future with reference to education.

Reference:

Amita Bhardwaj, New Media of Educational Planning".Sarup of Sons, New Delhi-2003 Bhatia and Bhatia. The Principles and Methods of Teaching (New Delhi :Doaba House),1959.

K. Sampath, A. Pannirselvam and S. Santhanam. Introduction to Educational Technology (New Delhi: Sterling Publishers Pvt. Ltd.): 1981.

Kochar, S.K. Methods and Techniques of Teaching (New Delhi, Jalandhar, Sterling Publishers Pvt. Ltd.), 1982

Kozman, Cassidy and kJackson. Methods in Physical Education (W.B. Saunders Company,Philadelphia and London), 1952.

SOE/PE/E-801 DISSERTATION

Course Outcome:

• The students will learn to prepare the Research Proposal by application of selection of a Research Program.
• The students will understand about various steps used in conducting a Research study.
• The students will learn to conduct a study by following Research Methodology in the field of Physical Education.

Course specific Outcome:

The students will learn about research work to be done systematically by application of standard procedure laid down for it.

1. A candidate shall have dissertation for M.P.Ed. – IV Semester and must submit his/her Synopsis and get it approved by the Head of Department on the recommendation of D.R.C. (Departmental Research Committee).

2. A candidate selecting dissertation must submit his/her dissertation not less than one week before the beginning of the IVth Semester Examination.
3. The candidate has to face the Viva-Voce conducted by DRC.

SOE/PE/E-802 VALUE AND ENVIRONMENTAL EDUCATION

Course Outcome:

- The students will know about the meaning and concepts of Value Education and its significance in Modern Education System.
- The students will acquire knowledge about need and importance of Environmental Education.
- The students will be able to understand the issues of rural health problems, its causes and sanitation.
- The students will know about various natural resources and effect of pollution on it.

Course specific Outcome:

Course will allow the students to have understanding of Value and Environmental Education to modern day youth and preventive measure to curtail the hazards of various types of pollution.

UNIT I – Introduction to Value Education.

Values: Meaning, Definition, Concepts of Values. Value Education: Need, Importance and Objectives. Moral Values: Need and Theories of Values. Classification of Values: Basic Values of Religion, Classification of Values.

UNIT II – Value Systems

Meaning and Definition, Personal and Communal Values, Consistency, Internally consistent, internally inconsistent, Judging Value System, Commitment, Commitment to values.

Unit- III – Environmental Education

Definition, Scope, Need and Importance of environmental studies., Concept of environmental education, Historical background of environmental education, Celebration of various days in relation with environment, Plastic recycling & prohibition of plastic bag / cover, Role of school in environmental conservation and sustainable development, Pollution free eco-system.

Unit - IV Rural Sanitation and Urban Health

Rural Health Problems, Causes of Rural Health Problems, Points to be kept in Mind for improvement of Rural Sanitation, Urban Health Problems, Process of Urban Health, Services of Urban Area, Suggested Education Activity, Services on Urban Slum Area, Sanitation at Fairs & Festivals, Mass Education.

Unit - V Natural Resources and related environmental issues:

Water resources, food resources and Land resources, Definition, effects and control measures of: Air Pollution, Water Pollution, Soil Pollution, Noise Pollution, Thermal Pollution Management of environment and Govt. policies, Role of pollution control board.

Reference:

Miller T.G. Jr., Environmental Science (Wadsworth Publishing Co.) Odum, E.P. Fundamentals of Ecology (U.S.A.: W.B. Saunders Co.) 1971.
Rao, M.N. & Datta, A.K. Waste Water Treatment (Oxford & IBH Publication Co. Pvt. Ltd.) 1987.
Townsend C. and others, Essentials of Ecology (Black well Science).
Miller T.G. Jr., Environmental Science (Wadsworth Publishing Co.).

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – PHYSICS

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

SCHEME OF EXAMINATION

&

COURSES OF STUDY

IN

M.Sc. PHYSICS

SCHOOL OF SCIENCE

H N B GARHWAL UNIVERSITY

(*A Central University*)

SRINAGAR GARHWAL -246174

(UTTARAKHAND)

M.Sc. (Physics) Semester I

Paper Code	Paper	Credits	Total Credits
SOP/FOS/PHY/C001	Classical Mechanics	3	18
SOP/FOS/PHY/C002	Mathematical Physics	3	
SOP/FOS/PHY/C003	Electrodynamics & Astrophysics	3	
SOP/FOS/PHY/C004	Electronics	3	
SOP/FOS/PHY/C005	Laboratory Course I (Practical –I)	3	
SOP/FOS/PHH/C006	Laboratory Course II (Practical –II)	3	
M.Sc. (Physics) Semester II			
Paper Code	**Paper**	**Credits**	**Total Credits**
SOP/FOS/PHY/C007	Atomic &, Molecular Physics	3	18
SOP/FOS/PHY/C008	Solid State Physics	3	
SOP/FOS/PHY/C009	Statistical Physics	3	
SOP/FOS/PHY/C010	Quantum Mechanics	3	
SOP/FOS/PHY/C011	Laboratory Course I (Practical –I)	3	
SOP/FOS/PHY/C012	Laboratory Course II (Practical –II)	3	
M.Sc. (Physics) Semester III			
Paper Code	**Paper**	**Credits**	**Total Credits**
SOP/FOS/PHY/C013	Advanced Quantum Mechanics	3	18
SOP/FOS/PHY/C014	Nuclear Physics	3	
SOP/FOS/PHY/C015	Laboratory Course I (General)	3	
SOP/FOS/PHY/E001	Condensed Matter Physics A	3	
SOP/FOS/PHY/E002	Electronics A	3	
SOP/FOS/PHY/E003	Laser Physics A	3	
SOP/FOS/PHY/E004	High Energy Physics A	3	
SOP/FOS/PHY/E005	Astrophysics A	3	
SOP/FOS/PHY/E006	Laboratory Course II (Circuit Design)	3	
M.Sc. (Physics) Semester IV			
Paper Code	**Paper**	**Credits**	**Total Credits**
SOP/FOS/PHY/C016	Computational Physics	3	18
SOP/FOS/PHY/C017	Particle Physics	3	
SOP/FOS/PHY/C018	Lab Course	3	
SOP/FOS/PHY/E007	Condensed Matter Physics B	3	
SOP/FOS/PHY/E008	Electronics B	3	
SOP/FOS/PHY/E009	Laser Physics B	3	
SOP/FOS/PHY/E010	High Energy Physics B	3	
SOP/FOS/PHY/E011	Astrophysics B	3	
SOP/FOS/PHY/E012	Project	3	

M. Sc. Semester I

SOP/FOS/PHY/C001: CLASSICAL MECHANICS

Unit I

Lagrangian formulation and Variational Principle: Mechanics of particles and system of particles, conversion law , constraints , degree of freedom, generalized coordinates **,** D'Alembert's principle, Lagrange's equations of motion from D'Alembert's principle, application of Lagrange's equation of motion to a particle and system of particles, conservation theorem, Hamilton's variational principle, Euler- Lagrange's differential equation

Unit II

Hamilton's formalism: Need of Hamilton's procedure , Legendre's transformation and Hamilton's equation of motion, physical significance of H cyclic coordinates, Hamilton's equation in cylindrical and spherical coordinates and applications, applications of Hamilton's equation of motion to a particle and system of particles

Unit III

Principle of least action (no proof): Canonical or contrast transformation, their advantages and examples, condition for a transformation to be canonical, infinitesimal contact transformation (ICT)

Poisson brackets : Definition and properties, Invariance with respect to Cnonical transformation, equation of motion in Poission's Bracket form, Jacobian's form.

Unit IV

Mechanics of Rigid Bodies and Theory of Small Oscillations: Coordinates of rigid body motion, Euler's angle, angular momentum of a rigid body moments and products of inertia, principle axis transformation, Euler's equation of motion of a rigid body, stable and unstable equilibriums. Lagrange's equation of motion for small oscillators, normal coordinates and normal mode frequency of vibrations, free vibration of linear triatomic molecules

Reference Books :N C Rama and P S Joag: Classical Mechanics (Tata Mc Graw Hil, 1991)

1. H Goldstein: Classical Mechanics (Addition Wesley, 1980)
2. A Sommerfield: Mechanics (Academic Press, 1952)
3. I Peiceivel and D Richards: Introduction to Dynamics (Cambridge University Press)

SOP/FOS/PHY/C002: MATHEMATICAL PHYSICS

Unit I

Differential Equations: Special equations of Mathematical Physics, Legendre and Associated Legendre equations.Hermite equation, Laguerre equation, Bessel's equation, Beta and Gamma functions. Fourier and Laplace Transforms, Laplace equation and its solution, Poission, Diffusion and Wave equations, Vibrating membrane.

Unit II

Group Theory: Definition, Classification of groups, subgroup, cyclic group, isomorphism and homomorphism, classes, vector spaces, representation theory of finite groups, Reducible and Ir-reducible representations, Schur's Lemmas and orthogonality theorem, Characters of representaions .

Unit III

Complex Variable: Function of complex variable, Analytic functions, Cauchy's integral theorem and Cauchy's integral formula , Taylor and Laurent's expressions, theorem of residues, Contour intergration.

Unit IV

Matrix and Tensors: Inverse and Trace of Matrix, Unitary Matrices, Orthogonality, Eigen values-Eigen vectors and Diagonalistaion of matrices, Coordinate transformation, Covarient and contravarient Tensors, addition, multiplication and contration of tensors, Associated tensors.

Reference Books :

1. G Arfken: Mathematical Methods for Physicist (Academic Press)
2. Pipes and Harvil: Mathematical Methods for Engineers and Physicist
3. C Harper: Introduction to Mathematical Physics (Prentice Hall of India)
4. A W Joshi: Element of Group Theory for Physicists (Wiley Eastern)

SOP/FOS/PHY/C003 : ELECTRODYNAMICS AND ASTROPHYSICS

Unit I

Maxwell's equations and Electromagnetic waves: Maxwell's equations and their physical significance. Equation of continuity and relaxation time, Vector and scalar potentials, Lorentz and Coulomb gauge,electromagnetic energy and Poynting's theorem, electromagnetic wave equations in free space, their plane wave solutions . Concept of Retarded potentials, Lienard Wiechert potentials, Multipole expansion of EM fields, Electric dipole radiations, field due to oscillating electric dipole, magnetic dipole radiations, electric quadrupole radiation

Unit II

Radiations from moving charges: Fields produced by moving charges, radiations from an accelerated charged particle at low velocities, radiations from a charged particles with co-linear velocity and acceleration, Radiations from an accelerated charged particle at low velocities in circular orbits-Larmor formula,Radiations from an accelerated charged particle at relativistic velocities in circular orbitsrelativistic generalization of Larmor Formula.

Unit III

The Solar System: Aspects of the sky: Concept of Celestial Coordinates and spherical astronomy. Astronomical telescopes. The early years of solar system, the solar system today. Study of Planets:Classification of the Planets, Orbits, Laws of planetary motion, Physical features, surface features, Internal Structure, Atmosphere, Satellites and Rings. Minor Bodies in Solar System: Asteroids, Meteors and Meteorites**:** Discovery of minor planets (Asteroids), their orbits and physical nature. Origin of the minor planets. Meteors and Meteorites. Observation of meteor showers and sporadic meteors. Orbits of sporadic meteoroids and meteor showers. Meteorites, its types and composition. Meteorite craters. Comets- Discovery and designation. Periodic comets. Physical nature. Spectra. Brightness variation. Gas production rates, dust and ion tails. Nature of dust particles and origin of comets.

Unit IV

Stellar System: Sun As A Star: History of Sun, Sun's interior, the photosphere, the solar atmosphere (chromosphere & corona). Salient features of sunspots, sun's rotation & solar magnetic field, explanation for observed features of sunspots. Distances of stars from the trigonometric. secular. and moving cluster parallaxes. Stellar motions. Magnitude scale and magnitude systems. Atmospheric extinction. Absolute magitudes and distance modulus. color index. The Hertzberg- Russell Diagram:The colour, Brightness or luminosity, the population of star. Elementary idea of Binary & Variable Stars. Nuclear fission, Nuclear fusion, condition for nuclear reaction in stars.Types of galaxies, Structure and features of the Milky Way Galaxy.

Reference Books:

1. D.J. Griffiths: Introduction to Electrodyanamics (Prentices Hall, 2002)
2. J.R. Reitz, F.J. Milford & R.W. Christy: Foundation of E.M. Theory
3. J.D.Jackson: Classical Electrodynamics (Wiley Eastern)
4. S.P. Puri: Classical Electrodynamics (Tata McGraw Hill, 1990)
5. J.B. Marion: Classical Electromagnetic Radiation
6. Landau and Lifshitz: The Classical theory of Fields (*Pergman Press*)
7. Panofsky and Philips: Electricity and Magnetism
8. R.N. Singh: Electromagnetic waves and fields (*Tata McGraw Hill*)
9. Jordan and Balman: Electromagnetic Waves and Radiation system

10. Marc L. Kutner: Astronomy: A Physical Perspecttive (Cambridge University Press)
11. Shu, F.H.: The Physical Universe An Introduction to Astronomy
12. Robert H. Baker : Astronomy
13. L Motz. & A.Duveen: The Essentials of Astronomy (Colombia University Press)
14. Willian K. Hartmann: Moons & Planets
15. I Morison: Introduction to Astronomy and Cosmology
16. A.W.Joshi & N.Rana: Our solar system
17. Jayant Naralikar: The Structure of Universe
18. K.D. Abhyankar : Astrophysics (Stars & Galaxies)
19. K.S.Krishnaswamy: Physics of Comets
20. McCusky: Introduction to Celestial Mechanics

SOP/FOS/PHY/C004 : ELECTRONICS

Unit I

Power amplifiers : Types of power amplifiers-series fed class A amplifier-series fed transformer coupled class B: push pull circuits-harmonic distortion in amplifiers-class C and D amplifiers-design considerations.

Unit II

Feedback in amplifiers: Feedback principle-effect of feedback on stability-nonlinear distortion input and output impedance-bandwidth-different types of feedback. Criteria for oscillation-phase shift,Wein bridge, crystal oscillator-frequency stability, astable, mono stable and bistable multivibrators, Schmitt trigger-bootstrap-sweep circuits.

Unit III

Operational amplifiers: Differential amplifier-ideal and real op—amp-input and out put impedance-frequency response-applications : amplifiers, mathematical operations, active filters, waveform generators-analog computations-comparators-S and H circuit-voltage regulator.

Unit IV

Optoelectronics: Optical fibres: graded index step index fibres-refractive index profiles-propagation of optical beams in fibres-mode characteristics and cut off conditions-losses in fibrwes-signal distortion group delay-material and wave guide dispersion.

Optical sources: Light emitting diodes-LED structure-internal quantum efficiency-injection laser diode-comparison of LED and ILD.

Optical detectors: PN junction photo diodes-PN photo detectors-avalanche photo diode-performance comparison.

Reference Books:

1. Millman & Halkias : Integrated Electronics (McGraw Hill)
2. Bolested: Electronic devices and circuit theory
3. Ryder : Electronics-fundamentals and applications(PHI)
4. Keiser : Optical fibre communications (McGraw Hill)
5. Agarwal : Nonlinear fibre optics(AP)

SOP/FOS/PHY/C005 : Laboratory Course –I

SOP/FOS/PHY/C006 : Laboratory Course -I

List of experiments : At least 10 experiments are to be performed

1. Study of LCR circuit
2. Transistorized LCR bridge
3. Study of UJT
4. Study of MOSFET
5. Study of NPN and PNP transistor characteristics
6. Study of DIAC
7. Study of TRIAC
8. Study of FET
9. R.C.coupled amplifier
10. T.C. coupled amplifier
11. Study of feedback amplifier
12. Study of Hartley oscillator
13. Study of Colpit oscillator
14. Study of Wien bridgev oscillator
15. Design and study of different network theorems

Seminar: Two seminars for each student are compulsory

Laboratry Course: Internal assessment through a written test

M.Sc. Semester II

SOP/FOS/PHC007: ATOMIC AND MOLECULAR PHYSICS

Atomic Spectroscopy: Fine structure of Hydrogen lines, alkali atom Spectra, penetrating and non penetrating orbits, electron spin orbit interaction, L-S and J-J coupling schemes, Hunde's rule Spectra of two valence electron atoms, (Helium, Magnesium), selection rules for atomic transitions, multielectron spectra, Central field approximation Hartrees self consistent field theory, Thomas Fermi statistical model, Pauli's exclusion principle and determination of ground state.

Zeeman Effect, Paschen Back Effect, Hyper fine structure, Stark effect, width of spectral lines, lamb shift.

Molecular Spectroscopy: Rotational spectra of diatomic molecules, non rigid rotator, vibrational spectra enharmonic oscillator explanation of rotational vibrational spectra in infrared, molecular dissociation and calculation of dissociation energy, Raman effect and intensity alternation of the rotational bands, Applications of infrared and Raman spectroscopy.

Born Openheimer approximation, Molecular orbital theory, Heitler-Loudon treatment of Hydrogen molecule ion and Hydrogen molecule, Electronic spectra of molecules, Fortrait Parabola, Deslandres table, vibrational structure of electronic bands, Intensities of electronic transitions, Franek Condon principle, Condon parabola.

Reference Books:

1. Atomic Spectra- H.E white Cambridge University Press, Newyork, 1935)
2. Principle of Atomic Spectra - Shore and Menzel
3. Spectra of Diatomic Molecules - G. Herzberg
4. C.B.Banewell: fundamentals of Molecular Spectroscopy
5. Molecular Spectroscopy – Arul Das.

SOP/FOS/PHY/C008 : SOLID STATE PHYSICS

Unit-I:

Crystal Structure: Periodic arrays of atoms, Primitive lattice cell, fundamental types of lattices, index system for lattice planes, Simple crystal structure, Atomic radii, coordination number, Cesium chloride structure, Hexagonal Close Packed Structure, Diamond Structure, cubic Zinc Sulphide structure, point group

Unit-2

Reciprocal lattice: diffraction waves by crystals,Braggs law,Scattered wave amplitude, Laue equations, Brillouin zones,reciprocal lattice to SC lattice, B C C lattice, F C C lattice, structure factor of B C C structure, F C C lattice, Atomic form factor

Unit -3

Crystal Binding and Elastic Constants: Ionic Crystal, Covalent Crystal, Metals, Hydrogen bonds, analysis of elastic springs, elastic compliance and stiffness constants, Elastic waves in cubic crystals, Experimental determination of elastic constants,

Unit-4:

Lattice Vibrations: Vibrations of crystals with monoatomic basis, First Brillouin zone, Group Velocity, Long wavelength limit, Two atoms per primitive basis, quantization of elastic waves, Phonons, Phonon momentum, Inelastic scattering of photons by phonons.\

Reference Books:

1. Introduction of Solid State Physics_ C Kittel
2. Solid State Physics_ N W Ashcroft & N David Mermin
3. Solid State Physics- Ajay Kumar Saxena
4. A J Dekker: Solid State Physics
5. Azaroff: Introduction to solids
6. Aschroft and Mermin: Solid State Physics
7. Peterson: Introduction to Solid State Physics
8. Verma and Srivastava: Crystallography for Solid State Physics

SOP/FOS/PHY/C009: STATISTICAL PHYSICS

Unit I

Basic Postulates- Phase space, relation between eigen states and phase space volume, Liouville's theorem, ensembles, microcanonical, canonical and grand canonical ensembles, Maxwell's Boltzmnn's distribution and Gibb's formulation for canonical and grand canonical ensembles, partition function, their thermodynamic properties, laws of thermodynamics.

Unit II

Application of classical distribution to the ideal gases: Degrees of freedom, translational motion, Helmholtz free energy, Gibb's free energy, entropy and thermodynamic properties, Gibb's paradox, Sakur-tetrode equation.

Imperfect gases: Difference between ideal and real gas, imperfect gases, Vander Waal's equation, virial coefficients, condensation of gases, general properties of liquids, Fermi theory, liquid Helium, phase rule.

Unit III

Quantum Statistics: Drawbacks of M B distribution, Bose-Einstein's and Fermi-Dirac distribution, symmetric and antisymmetric particles, partition functions, non degenerate, weakly degenerate and strongly degenerate cases, B.E. condensation, application to He, pressure-energy relationship, electronic specific heat of solids and paramagnetism.

Unit IV

Black Body Radiation: Planck's distribution, pressure and energy relationship of photons, black body radiation, Rayleigh Jean's formula, Wein's law, Wein's displacement formula, absorption and emission of radiation, Stefan's law, high temperature measurements.

Reference Books:

1. Glasstone: Theoretical Chemistry
2. E.S. Raj Gopal: Statistical Mechanics and Properties of Matter
3. Mayer And Mayer: Statistical Mechanics
4. Landau and Lifshitz: Statistical Physics
5. Pointon: Introduction to Statistical Physics
6. Huang: Statistical Mechanics
7. Wanier: Statistical Physics

SOP/FOS/PHY/C0010: QUANTUM MECHANICS

Section A

Introduction:
A brief review of foundations of quantum mechanics, basic postulates of quantum mechanics, uncertainty relations, Schrodinger wave equation, expectation value and Ehrenfest theorem. Relationship between space and momentum representation. **Applications:** One dimensional potential step, tunneling, Hydrogen atom, particle in a three dimensional box.

Section B.

Matrix Formulation of Quantum Mechanics:
Vector representation of states, transformation of Hamiltonian with unitary matrix, representation of an operator, Hilbert space. Dirac bra and ket notation, projection operators, Schrodinger, Heisenberg and interaction pictures. Relationship between Poisson brackets and commutation relations. Matrix theory of Harmonic oscillator.

Section C

Symmetry in Quantum Mechanics:
Unitary operators for space and time translations. Symmetry and degeneracy. Rotation and angular momentum; Commutation relations, eigenvalue spectrum, angular momentum matrices of J_+, J_-, J_z, J^2. Concept of spin, Pauli spin matrices. Addition of angular momenta, Clebsch-Gordon coefficients and their properties, recurssion relations. Matrix elements for rotated state, irreducible tensor operator, Wigner-Eckart theorem. Rotation matrices and group aspects. Space inversion and time reversal: parity operator and anti-linear operator. Dynamical symmetry of harmonic oscillator.

Applications: non-relativistic Hamiltonian for an electron with spin included. C. G. coefficients of addition for j =1/2, 1/2; 1/2, 1; 1, 1.

Section D

Approximation Methods for Bound State:
Time independent perturbation theory for non-degenerate and degenerate systems upto second order perturbation. Application to a harmonic oscillator, first order Stark effect in hydrogen atom, Zeeman effect with electron spin. Variation principle, application to ground state of helium atom, electron interaction energy and extension of variational principle to excited states. WKB approximation: energy levels of a potential well, quantization rules. Time-dependent perturbation theory; transition probability (Fermi Golden Rule), application to constant perturbation and harmonic perturbation. Semi-classical treatment of radiation. Einstein coefficients; radiative transitions.

Books Recommended

1. L. I. Schiff, Quantum Mechanics (McGraw Hill).
2. V. K. Thankappan, Quantum Mechanics (Wiley Eastern).
3. P. M. Mathews and K. Venkatesan, A Text-Book of Quantum Mechanics (TMH)
4. C. Cohen-Tannoudji, Bernard Diu, Franck Loloe, Quantum Mechanics Vols-I&II (John Wiley).
5. J. J. Sakurai, Modern Quantum Mechanics (Addison-Wesley).
6. A. K. Ghatakh and S. Lokanathan, Quantum Mechanics 3rd ed. (MacMillan).

SOP/FOS/PHY/C011: Laboratory Course-I

SOP/FOS/PHY/C012: Laboratory Course-II

List of experiments: At least 10 experiments are to be performed

1. Multivibrator bistable/monostable/Astable
2. Ionisatin potential of Mercury using gas filled diodes
3. Michelson interfermeter
4. Fabry Pert interferometer
5. Fresnals law
6. Determination of absorption coeficient of iodine vapour
7. B-H curve
8. Study of amplitude modulation and demodulation
9. Study of frequency modulation and demodulation
10. Lecher wire experiment
11. Determination of magnetic susceptibility
12. Study of CRO.
13. Velocity of Ultrasonic waves
14. Linear Air track
15. Determination of Planks constant

Seminar: Two seminars for each student are compulsory

Laboratry Course: Internal assessment through a written test

M.Sc. Semester III

SOP/FOS/PHY/C013: ADVANCED QUANTUM MECHANICS

Section A

Scattering Theory:
General considerations; kinematics, wave mechanical picture, scattering amplitude, differential and total cross-section. Green's function for scattering. Partial wave analysis: asymptotic behaviour of partial waves, phase shifts, scattering amplitude in terms of phase shifts, cross-sections, Optical theorem. Phase shifts and its relation to potential, effective range theory. Application to low energy scattering; resonant scattering, Breit-Wigner formula for one level and two levels, non-resonant scattering. s-wave and p-wave resonances. Exactly soluble problems; Square-well, Hard sphere, coulomb potential. Born approximation; its validity, Born series.

Section B

Identical Particles:
The Schrodinger equation for a system consisting of identical particles, symmetric and anti-symmetric wave functions, elementary theory of the ground state of two electron atoms; ortho- and Para-helium. Spin and statistics connection, permutation symmetry and Young tableaux. Scattering of identical particles.

Section C

Relativistic Wave Equations:
Generalization of the Schrodinger equation; Klein-Gordon equation, plane wave solutions, charge and current densities, interaction with electromagnetic fields, Hydrogen-like atom (to show it does not yield physical spectrum), non-relativistic limit. Extension of Klein-Gordon equation to spin 1 particles.

Dirac Equation; relativistic Hamiltonian, probability density, expectation values, Dirac gamma matrices, and their properties, non-relativistic limit of Dirac equation. Covariance of Dirac equation and bilinear covariance, plane wave solution, energy spectrum of hydrogen atom, electron spin and magnetic moment, negative energy sea, hole interpretation and the concept of positron. Spin-orbit coupling, hyperfine structure of hydrogen atom.

Section D

Quantization of wave fields: The quantization of wave fields, Classical and quantum field equations quantization of non-relativistic Schrodinger equation, second quantization, N-representation, creation and annihilation operators.

Books Recommended

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics (TMH)
2. A. S. Davydov, Quantum Mechanics (Pergamon).
3. L. I. Schiff, Quantum Mechanics (McGraw Hill).
4. J. D. Bjorken and S. D. Drell, Relativistic Quantum Mechanics (McGraw Hill).
5. J. J. Sakurai, Advanced Quantum Mechanics (Addison Wesley).
6. V. K. Thankappan, Quantum Mechanics (Wiley Eastern).
7. R.P Feynman and A.R.Hibbs; Quantum Mechanics and Path Integrals.
8. L.H. Ryder, Quantum field Theory (Academic Press).

SOP/FOS/PHY/C014 : NUCLEAR PHYSICS

Unit I

General Properties & Models-: Nuclear size, nuclear angular momentum (Spin), Nuclear magnetic moments, statistics, Binding energy, Liquid drop model, Shell model, Collective model.

Unit II

Nuclear Forces and Detectros – Ground state of deuteron, Low energy neutron-proton scattering and proton-proton scattering, Exchange and tensor forces, G.M. Counter, Electron & Proton Synchrotron.

Unit III

Radioactive decay: Radioactive decay equation equilibrium units, Gamow's theory of alpha decay and Geiger Nuttal law, Fermi's theory of beta decay, parity violation in beta decay, electromagnetic decays.

Unit IV

Nuclear Reactions- Q-value of nuclear reaction, Bohr's Theory of compound nucleus, Scattering cross section of nuclear reaction (phase shift method), Breit Wigner single level resonance formula for scattering cross section.

References Books:

1- I. Kaplan: Nuclear Physics
2- H.A. Enge : Nuclear Physics
3- R.Roy & B.P. Nigam : Nuclear Physics
4- R.D. Evans: Nuclear Physics
5- W.E. Bucham & M. Jobes : Nuclear & Particle Physics (AWL)
6- D. Halliday : Nuclear Physics
7- E. Segre : Nuclei & Particles.
8- B.R. Martin : Nuclear & Particle Physics.
9- B.L. Cohen : Concepts of Nuclear Physics.
10- S.S.M. Wong : Introductory Nuclear Physics
11- S.B. Patel : Nuclear Physics
12- M.K. Pal : Theory of Nuclear Structure
13- S.N. Ghoshal : Nuclear Physics.

SOP/FOS/PHY/C015: Laboratory Course- I (General)

List of experiments: At least10 experiments are to be performed

1. e/m by Zeeman effect
2. G.M.counter
3. Study of IC- Based Power supply
4. Absorption spectroscopy by spectrophotometer
5. Study of optoelectronic devices
6. Design and study of FET amplifier

7. Design and study of Mosfet amplifier
8. Study of SCR
9. Measurement of wavelength of He-Ne laser using interference and diffraction pattern
10. Measurement of thickness of thin wire using laser.
11. Logicom AND/or/NAND/NOR/NOT gates
12. Design and study of UJT relaxation oscillator
13. Study of pin connection and biasing of various linear IC's and timers 555
14. Design and study of phase shift oscillator
15. Study of operational amplifier

Seminar: Two seminars for each student are compulsory

Laboratory Course: Internal assessment through a written test

SOP/FOS/PHY/E001 : CONDENSED MATTER PHYSICS- A

Unit-1

Defects in crystals:Point defect, Impurities, Vacancies, Frenkel defects, Schottky defects, Intrinsic vacancies, Concentration of Schottky defects, Concentration of frankel defects, extrinsic vacancies, Diffusion, Colour centres, F-Centre, V-Centre, dislocation, Line defects, edge dislocation, screw dislocation, Burger vector.

Unit-2

Magnetism: Dia, Para and ferromagnetism, Langvin"s theory of paramagnetism, Ferromagnitiam, Weiss molecular theory, Ferromagnetic domains, Antiferromagnitism, Neel"s theory, Two sublattice model, ferrites.

Unit-3

Energy Bands: Origin of energy gap, Magnitude of the energy gap, Bloch function, Bloch theorem, Kronig penny model, Number of possible wave fuction in a band, crystal momentum, the concept of effective mass, concept of holes, hole band construction, metal, insulator and semiconductor.

Unit-4

Dielectric and electrical properties of insulators: Macroscopic description of dielectric constants, static, electronic and ionic polarizability of molecules, orientational polarization, Internal Lorentz field static dielectric constant, Complex dielectric constant, Dielectric loss and relaxation time, Optical absorption.

Reference Books:

1. Kittel: Introduction to solid state Physics
2. Ziman: Principles of theory of solids
3. J. Callaway: Quantum theory of solids
4. A.J. Dekker: Solid State Physics
5. Animalu: Intermediate Quantum theory of crystalline solids
6. Solid State Physics: N W Ashcroft and N David Mermin

7. Solid State Physics: Ajay Kumar Saxena

SOP/FOS/PHY/E002 : ELECTRONICS- A

Unit I

Number Systems, Boolean Algebra & Basic Logic Gates: Binary, Octal, Decimal & Hexadecimal Numbers, Base conversions and arithmetic, Complements, Signed Binary numbers, Binary codes (Weighted,BCD,2421,Gray code, Excess 3 code, Error detecting code, Error correcting codes, ASCII,EBCDIC), Conversion among codes.

Boolean postulates and laws, Dual & Complement, De-Morgan's Theorem, Boolean expressions and functions , Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS), Minterms & Maxterms, Karnaugh maps and minimization.

Unit II

Logic Gates & Combinational Circuits: Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR, Universal Gates, Positive and Negative Logic, Implementations of Logic Functions using gates, TTL and CMOS Logic and their characteristics, 7400 Series. Adders, Subtractors, Serial adder/ Subtractor, Parallel adder/ Subtractor, Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer, Demultiplexer, Encoder, Decoder, Parity-checker, Code converters

Unit III

Sequential Circuits: Flip flops: Latches, RS, JK, T, D and Master-Slave, Characteristic table and equation, Edge triggering, Level Triggering. Registers & Counters: Asynchronous/ Ripple counters, Synchronous counters, Modulo–n Counters, Shift registers, Universal shift register, Shift counters, Ring counters.

Unit IV

Memory Devices & IC-Technology: Classification of memories, RAM organization, Write/Read operations, Memory cycle, Timing wave forms, Memory decoding, Memory expansion , Static RAM Cell-Bipolar RAM cell, MOSFET RAM cell, Dynamic RAM cell, ROM organization – PROM, EPROM, EEPROM, EAPROM ,Programmable Logic Devices, Programmable Logic Array (PLA), Programmable Array Logic (PAL)

Basic Ideas of IC-Technology, Monolithic IC's, IC Components- Resistors (Integrated, Diffused, Thin Film), MOS Capacitors, Inductors, Bipolar Transistors, Thin Film Technology, LSI, MSI.

Reference Books:

1. Malvino & Leach: Digital Principles and Applications
2. Morris Mano: Digital Design
3. Thomas L. Floyd: Digital Fundamentals
4. Millman & Halkias: Integrated Electronics

SOP/FOS/PHY/E003: LASER PHYSICS- A

Unit I

Basic principles: Basic principles and theory of absorption and emission of radiation, Einstein's coefficients, line-broadening mechanisms, rate equations for three and four level laser systems, population inversion, theory of optical resonators, laser modes, spatial and temporal coherence,

Unit II

Types of lasers: Gas lasers, He-Ne, argon ion, N_2, CO_2 lasers; dye lasers, solid state, Semiconductor lasers: Ruby, Nd:YAG and Nd:glass lasers, Fabrication technology of lasers, diode lasers, colour centre and spin flip lasers, laser spikes, mode locking Q-switching, CW and pulsed lasers.

Unit III

Non linear optics: Theory of non linear phenomenon, second and third harmonic generation, phase matching, parametric generation, self focussing,

Unit IV

Laser spectroscopy: Laser fluorescence spectroscopy using CW and pulsed lasers, Single photon counting, Laser Raman apectroscopy, multiphoton processes, photo accoustic and photon electron spectroscopy, stimulated Raman spectroscopy, Coherent antistokes Raman spectroscopy.

Reference Books:

1. Ghatak and Thyagrajan: Lasers
2. O. Svelto: Principles of Lasers
3. Silvfast: Lasers
4. B.B.Loyd: Lasers

SOP/FOS/PHY/E004: HIGH ENERGY PHYSICS A

Section A

Classical and Quantum Field Equations, Coordinates of the field, Classical Lagrangian Equation, Classical Hamiltonian Equations, Quantum Equations for the Field, Fields with more than one component, Complex Field, Quantization of the Non-relativistic Schrodinger Equation, Classical Lagrangian and Hamiltonian Equations, Quantum Equations, The N-representation, Creation and Destruction Operators, Number Operators, Anticommutation Relations, Equations of Motion, Physical Implications of Anticommutation, Representation of Anticommuting operators

Section B

Quantization of fields: Quantization of neutral and complex scalar fields, U (1) Gauge Invariance, Quantization of Dirac field covariant anticommutation relations, Quantization of electromagnetic field. Interaction Lagrangian for the fields, QED Lagrangian.

Section C

Scattering Matrix and Feynman Rules: The S-Matrix reduction of S- Matrix chronological product, Wicks theorem Furry's theorem Covariant perturbation theory interaction lagrangian for QED, Feynman Diagrams and Feynman rules for QED in configuration and momentum space, Electron- Positron scattering, Coulomb scattering of Electrons, electron – positron annihilation , Compton scattering.

Section D

Renormalization of QED: Self energy correction, vacuum polarization and vertex correction, classification of Divergences, Renormalization of mass and charge, wave function renormalization .

Reference:

1. Theory of photons and electrons, J.M. Jauch and E. Rohrlich
2. Relativistic Quantum field, J.D. Bjorken and S. D. Drell.
3. Quantum electrodynamics , A.I. Akhiezer and Berestetski
4. Quantum Electrodynamics, Walter Greiner

SOP/FOS/PHY/E005 : ASTROPHYSICS- A

Unit I

Physics of the Stars : Apparent and Mean Position of stars. Effects of atmospheric refraction, aberration, parallax, precession, nutation and proper motion on the coordinates of stars. Reduction from apparent to mean places and vice versa. Spectra of Stars. Distribution of stars in space. Statistical parallaxes. Local standard of rest. Solar motion and its determination. Peculiar velocities. Single and Two star stream hypothesis. Velocity ellipsoid. Comparison with solar neighbourhood. Bottlinger's diagram. HR diagram, HD and MK spectral classification of stellar spectra. Radiation laws and basic ideas on spectral line formation. Explanation of stellar spectra in terms of Boltzmann and Saha equations. Spectroscopic parallax.

Unit II

Fundamental Equations: Equation of mass distribution. Equation of hydrostatic equilibrium. Equation of energy transport by radiative and convective processes. Equation of thermal equilibrium. Equation of state. Stellar opacity. Stellar energy sources.Stellar models:The overall problem and boundary conditions. Russell-Voigt theorem. Dimensional discussions of mass-luminosity law. Polytropic configurations. Homology transformations.

Unit III

Stellar Evolution : Abundance of elements in the sun by the method of fine analysis-Stromgren's method, use of weight functions, abundances of elements in normal stars. Composition of differences in population I and II stars. Anomalous abundances in cool stars. Peculiar A stars and metallic line stars. Magnetic field in stars. Jean's criterion for gravitational contraction and its difficulties. Pre-main-sequence contraction under radiative and convective equilibrium. Evolution in the main sequence. Growth of isothermal core and subsequent development. Ages of galactic and globular clusters.

Unit IV

Superdense Objects : Mechanism of Mass transfer in Binary Stars. Use of polytropic models for completely degenerate stars. Mass-radius relation. Non-degenerate upper layers and abundance of Hydrogen. Stability of white dwarfs. Final cooling of white dwarfs. Accretion by white dwarfs and its consequences. Pressure ionisation and mass-radius relation for cold bodies. Formation , features and properties of Neutron stars, Pulsars and black holes.

Reference Books:

1. D.Mihalas: Galactic Astronomy
2. S.Chandrasekhar: Principles of Stellar Dynamics
3. James Binney and Scoth Tremaine: Galactic Dynamics (Princeton University Press)
4. K.C.Freeman: Galaxies and Universe
5. D.Mihalas and J.Binney: Galactic Astronomy
6. S.D.M.White: The Origin and Evolution of Galaxies
7. S.M.Alladin: Lecture notes on "Dynamics of Stellar Systems".
8. W.M.Smart: Text book of Spherical Astronomy
9. K.D.Abhyankar: Astrophysics:Stars and Galaxies (Tata McGraw Hill Publication)
10. G.Abell: Exploration of the Universe.

SOP/FOS/PHY/E006: Laboratory Course (Circuit Design)

Electronics:

List of experiments : At least 5 experiments are to be performed

1. Study of regulated power supply (723).
2. Study of Timer (555).
3. A to D and D to A convertor
4. 1 of 16 Decoder/Encoder
5. Study of Multiplexer/Demultiplexer
6. Study of Comprator and Decoder
7. Study of different flip- flop circuits (RS, JK, Dk type, T-type, Master slave).
8. Study of Digital combinational and sequential circuits
9. Study of Microprocessor (8085)
10. Study of SCR, DIAC, TRIAC
11. Study of IC- Based Power supply
12. Microwave experiment.
13. Shift Registers
14. Fiber Optics communication

High Energy Physics:

List of experiments : At least 5 experiments are to be performed

1. Characteristic curve of a GM Detector and Absorption coefficient of a using aluminum GM Detector.
2. Energy spectrum of gamma rays using gamma ray spectrometer.
3. Absorption coefficient of aluminum using gama-ray spectrometer.
4. Characteristics of Scintillation Detector.
5. Study of gama-gama unperturbed angular correlations.
6. Study of particle tracks using a Nuclear Emulsion Detector.
7. Classification of tracks in interaction with Nuclear Emulsion and determination of excitation energy.
8. Mossbauer spectrometer

Condensed Matter Physics:

List of experiments : At least 5 experiments are to be performed

1. Determination of elastic constant of crystals by optical methods
2. Study of fluorescence spectra of a given compound
3. Study of colour centers
4. Determination of lattice parameters using powder method.
5. Determination of hall coefficient using Hall effect
6. Determination of Energy gay of a semiconductor by four probe method
7. ESR
8. Dielectric constant

Astrophysics:

List of experiments : At least 5experiments are to be performed

1. Study of Hubble's law (from given data)
2. Study of constant density neutron star
3. Study of the static parameters of a Neutron Star model with inverse square density distribution
4. Study of star cluster from a given data
5. Study of Extinction coefficients
6. Study of variability of stars

Laser Physics:

List of experiments : At least 5 experiments are to be performed

1. Study of the vibrational levels of Iodine.
2. Measurement of the fluorescence spectra of Uranyl Nitrate Hexahydrate.
3. Determination of the intrinsic life time for a dye molecule.
4. Determination of change in dipole moment in excited state using Solvatochromic shift method.
5. Measurement of non radiative decay rate for a known sample.
6. Determination of the quantum yield of known samples using steady state spectroscopy.
7. Study of electro optic effect
8. Study of Acousto-optic effect

M.Sc. Semester IV

SOP/FOS/PHY/C016 : COMPUTATIONAL PHYSICS

Unit I

Roots of functions, interpolation, extrapolation, integration by trapezoidal and Simpson's rule, Runge-Kutta Method, Least square fitting method.

Unit II

Eigenvalues and eigenvectors of matrices, power and Jacobi method, solution of simultaneous linear equations Gaussian elimination, Pivoting, Iterative method, matrix inversion.

Unit III

Flowchart and algorithons-Problem analysics flowchart of some basic problems. The concept and properties of algorithmic languages, elementary algorithm development algorithm involving decision and loops.

Unit IV

C-Programming : selection of C and Fortran 90/95 programming loops and control, constructs, arithmetic and logic operators, Strings, arrays, pointers, floats and other types, input, output, control constructs, recursion structures, sub programmes and modules.

Reference Books:

1.B.D.Hahn: Fortran 90 for Scientists and engineers.
2.V Rajaraman: Computer Programming in c.
3.Rajaraman: Computer Oriented numerical methods.
4.Wong: Computational methods in Physics and engineering.
5.S.Balachandra Rao: Numerical Methods.
6.Stephen j Chapman: Fortran 90/95 for Scientists and Engineers.

SOP/FOS/PHY/C017: PARTICLE PHYSICS

Unit I : **Classification and Properties of Elementary Particles**

Elementary Particles,their classification on the basis of their mass and spins

(Leptons, Mesons, Baryons) and field quanta. Their general properties (mass, spins, life time and their production and decay modes), Antiparticles.

Unit II: Conservation Laws and Gauge Invariances

Conservation of Energy, Linear and Angular momentum, Spin, Charge, Lepton No., Baryon No. Isospin, Hypercharge, Parity, Strangeness, Charge conjugation, Time Reversal,CP, CPT theorem, Global and Local gauge invariances.

Unit III: Fundamental Interaction

Qualitative ideas (Relative strengths, Ranges, Characteristic times and Mediators) of Gravitational, Electromagnetic, Strong and Weak Nuclear interactions. General idea of Electro-week and Grand unifications.

Unit IV: Quark Model

Eight fold way, Quarks as building blocks of hadrons, six quarks (u,d,s,c,t and b), Antiquarks, General properties of quarks (Charge, Mass, Colour - A new degree of freedom, quark confinement, Asymptotic freedom) Evidences for Quarks (Lepton scattering, Hadron Spectroscopy, Jet production), Quark compositions of Mesons and Baryons. General idea of Standard Model. Idea of Higgs Boson.

Books and References:

1- Introduction to High Energy Physics-D.H.Perkins. (Addision – Wesley-1986)
2- Introduction to Nuclear & Particle Physics-VK Mittal, R.c. Verma & S.C.Gupta (Prentice Hall of India, Pvt.Ltd., New Delhi, 2009) (All units approx.)
3- Concepts of Modern Physics- Arthur Beiser (Tata Mc Graw Hill Edu.Pvt Ltd., New Delhi, Sixth Ed. 2009) Chapter 13 page 529.
4- Quarks and Leptons- An Introductory course in Modern Particle Physics-Francis Halzen & A D.Martin(John Wiley & Cons,Inc. Canada,1984),Gauge invariance page-314,315,316, Unit III and Unit IV
5- Nuclear and Particle Physics-W.E. Burcham & M. Jobes(Essex,England ISE Reprint 1998) Unit-II, III, & IV Gauge Invariances pages 484, 485, 486, 487
6- Introduction to Particle Physics-M.P. Khanna (Prentice Hall of India, 1999) Unit II,III,IV
7- Introduction to Elementary Particle Physics-D.Griffiths (John Wiley 4 sons,1987)
8- Elementary Particle Physics-Gasiorowicz (John Wiley & sons, 1966).
9- Nuclear & Particle Physics-B.R. Martin & G. Shaw(John wiley & sons, 1997)
10- A Modern Introduction to Particle Physics- Riyazuddin and Fayazuddin
11- Particle Physics- M.Leon
12- Principles of Physics- Resnick, Halliday & Walker (John wiley & sons,England) 9th Extended edition, 2013, chapter 44)

SOP/FOS/PHY/C018 : Laboratory Course

List of experiments:

1. Study of computational softwares
2. Study of numerical techniques.
3. Computer programming.

SOP/FOS/PHY/E007: **CONDENSED MATTWER PHYSICS- B**

Unit-1:

Nearly free electron model, One dimensional free electron case, Nearly free electron case, energy bands in one dimension, tight binding approximation, energy surfaces, Wigner Seitz cellular method, Orthogonalized plane wave (OPW) method, Pseudo potential method, Limitations of band theory (Mott Transition)

Unit-2

Dielectrics and ferroelectrics: Polarization, Macroscopic electric field, depolarization fiels, local electric field at an atom, fields of dipoles inside cavity, dielectric constant and polarizability, electronic polarizability, structural phase transition, ferroelectric crystals, classification of ferroelectric crystals, displacive transition, soft optical phonons, landau theory of phase transition, Second and first order transition, antiferroelectricity, ferroelectric domains, piezoelectricity, ferroelasticity, optical ceramics.

Unit-3

Superconductivity: Experimental Survey, Occirance of super conductivity, destruction of superconductivity by magnetic field and temperature, Meissner effects, Type-I and Type-II superconductors, Isotope effect, Thermodynamics of Superconducting transition, London Equations, Coherence length, BCS Theory, Cooper pairs, Josephson superconductor tunneling, AC & DC Josephson effect, High temperature superconductors, critical fields and critical currents.

Unit-4

Nano Material Science and Technology: History, Origin, Quantum dots, Synthesis, Applications and advantages, Quantum wires, Quantum well & application, Fullerenes, Carbon nanobuds, carbon nanotubes as quantum wires, Areas of Nanotechnology, nanomaterials, nanoelectronics, nanobiotechnology, nanofabrication, microelectromechanical systems (MEMS)

Text and Reference books

1. Principle of condensed matter Physics : Chaikimand Lubensky
2. Solid State Physics : Kubo and Ngamia
3. Elements of Solid State Physics : Srivastava
4. Introduction to Solid State Physics : Madelung
5. Introduction to Solid State Physics : Paterson
6. Introduction to Solid State Physics : Kittel
7. Solid State Physics-N W Ashcroft & N David Mermin
8. Solid State Physics-Ajay Kumar Saxena

SOP/FOS/PHY/E008 : ELECTRONICS- B

Unit I

Modulation – Amplitude Modulation-Theory, Plate Modulated class C amplifier, Balanced Modulator, Single Side Band modulation (phase shift method), Frequency modulation – Theory, Reactance tube modulator, transistor reactance modulator, FET reactance modulator.

Demodulation- Envelope diode detector, super regenerative detection, Foster Seely phase discriminator, Ratio Detector.

Transmitters & Receivers- A.M Transmitter, F.M. transmitter, TRF Receiver, Super heterodyne receiver, amplitude limiting.

Unit II

Transmission Lines– TL Equations and their solutions, characteristic impedance, lossless open and short circuited lines, standing wave ratio and refection coefficient, stub matching, quarter wave length and half wave length lines.

Antenna – Radioactive field strength, power and radiation patterns of an elementary electric doublet and linear antenna, effects of ground reflection. Hertz antenna, Marconi antenaa, Yagi antenna, loop antenna, direction finding, Resonant & Non resonant Antenna, Antenna array (Broad side & End fire arrays), T.V. aerials. Horn Antenna, Parabolic reflectors, Lens Antenna.

Unit III

Propagation of Radio Waves-

Electes-Larmor theory, Applecton – Hartree theory of sky wave propagation, skip distance and maximum usable frequency, Chapmann's theory of layer formation.

Pulse method for measuring the height of ionospheric region.

Unit IV

Television Systems-

General Principle of Image transmission and reception of signals, pick up instruments (Iconoscope, Image orthian and Videocon) Image scanning sequence, scanning synchronization, composite video signal, colour television.

Radar Systems-

Principle of Radar, Basic arrangement of Radar system, Azimuth and Range measurement, operating characteristics of systems, Radar transmitters and Receivers, Duplexers, Indicator unit, maximum range of a Radar set.

References Books :

1. F.E. Terman – Radio Engineering
2. G. Kennedy & B. Davis – Electronic Communication Systems
3. G.K. Mithal – Radio Engineering Vol. II
4. G. Keiser – Optical Fiber Communication
5. C.K. Sirkar & S.K. Sirkar, Fiber optical Communication Systems.
6. Gupta & Kumar – Handbook of Electronics
7. S.D. Parsonick – Fiber Opitics
8. Introduction to Fiber optics – Ghatak & Thyagarajan.
9. Frenzel – Communication Electronics
10. Rody & Coolen - Communication Electronics.
11. L.E. Frenzel – Communication Electronics
12. A. Ghatak & K. Tyagrajan – Fiber optics & Lasers.
13. M. Satish Kumar – Optical Fiber Communication

SOP/FOS/PHY/E009: LASER PHYSICS- B

Unit I

Electro optic effect, longitudinal and transverse phase modulation, consideration of modulator designs and circuit aspects, acousto optic effect, Raman Nath and Bragg regimes, acousto optic modulators, magneto-optic effect, integrated optics, optical directional couplers and optical switches, phase modulators.

Unit II

Optical sources and detectors: Laser devices, radiation pattern and modulation, LED structures, light source materials, liquid crystal diodes, photoelectric, photovoltaic and photconductive methods of detection of light, photodiodes: structure, materials and working, PIN photodiodes, avalanche photodiodes, microchannel plates, photodetector noise responsivity and efficiency, photomultipliers, image intensifier tubes, Videocon and CCD.

Unit III

Fibre optics: Basic characterstics of optical fibres, fibre structure and fundamentals of waveguides, step and graded index fibres, signal degradation in optical fibres, absorption scattering, radiation and core cladding losses, Design considerations of a fibre optical communication system, analogue and digital modulation, optical fibre amplifiers.

Unit IV

Holography: Basic principles, construction and reconstruction of holograms, applications of holography, laser interferometry, laser applications in industry and medicines

Reference Books:

1. Ghatak and Thyagrajan :Optical Electronics
2. Hawks : Optoelectronics
3. Keiser : Optical fibre communications
4. Ghatak and Thyagrajan:Introduction to fibre optics
5. I.P. Csorba: Image tubes
6. Ed.L.M.Bibermman and S.Hudelman : Photoelectronics

SOP/FOS/PHY/E010: HIGH ENERGY PHYSICS- B

Section-A

Symmetries and conservation laws, Noether's Theorem, U (1) Gauge Invariance, Baryon and Lepton number conservation, The concept of gauge invariance; Global and Local gauge invariance, spontaneous Breaking of Global gauge invariance, Goldstone Bosons, the Higgs mechanism, Generalized local gauge invariance-Abelian and non Abelian gauge invariance.

Section-B

Weinberg- Salam theory of electroweak unification, The matter fields, the gauge fields, the gauging of SU (2) XU (1), The vector bosons, The fermion sector, Helicity states, parity, charge conjugation Fermion masses, Fermion assignments in the electroweak model, spontaneous symmetry break down, Fermion Mass generation, The color gauge theory of strong interactions.

Section C

Color gauge invariance and QCD, The standard model of fundamental interaction, general mass terms, Cabibbo Angle, Kobayashi- Maskawa matrix and CP violation, The SU (5) Grand unified theory, The generators of SU (5), The choice of Fermion representations spontaneous breaking of SU (5) symmetry Fermion masses and mixing angles.

Section D

The classic predictions of SU (5) Grand Unified, Theory, quark and Lepton masses, The SO(N), The SO (10) Grand Unified Theory, Fermion Masses in SO (10), Neutrino Mass in SO (10).

References:

1. A Modern Introduction to Particle Physics, Riazuddin and Fayyazudin.
2. Modern Elementary Particle Physics G. L. Kane (Addison- Wesley 1987).
3. Grand Unified theories, Graham Ross.
4. Gauge Theories of Strong, Weak and Electromagnetic Interactions, C. Quigg (Addison – Wesley)
5. Gauge Theory of Elementary Particle Physics , T.D. Cheng and Ling Fong Li (Clarendon Oxford)

SOP/FOS/PHY/E011 : ASTROPHYSICS- B

Unit-1

Detectors ,Photometry and Spectroscopy: Detectors for optical and infrared regions. Application of CCD's to stellar imaging, photometry and spectroscopy. Techniques of observations of astronomical sources from space in infrared. EUV, X-ray and gamma-ray regions of the electromagnetic spectrum.

Astronomical photometry. Simple design of an astronomical photometer. Observing technique with a photometer Correction for atmospheric extinction. Tansformation to a standard photometric system. Astronomical spectroscopy. Spectral classification. Simple design of astronomical spectrograph. Radial velocity measurements.Radio Astronomy Techniques. Electro-magnetic spectrum. Radio window. Design and construction of a simple radio telescope. Receiver systems and their calibration. Design and construction of a simple radio interferometer.

Unit-2

Galactic System: Interstellar Matter:Composition and properties. of interstellar matter. Oort limit. Interstellar extinction. Estimate of colour excess. Visual absorption. Interstellar reddening law and Polarisation. Spin temperature. Interstellar magnetic fields. Stromgren's theory of H II regions. Physical processes in planetary nebulae. Gallastic Structure: General galactic rotational law. Oort’s theory of galactic rotation. Determination of Oort’s constants. Spiral structure of our Galaxy from optical and radio Observations. Size and mass of our galaxy.

.**Unit -3**

Extragalactic Systems:Classification of galaxies and clusters of galaxies. Hubble sequence. Galaxy interactions. Determination of the masses. Determination of extragalactic distances. Active Galaxies: Active galaxies and galactic nuclei. Properties of Radio galaxies and Quasars. Their energy problem and accretion discs. Dark matter in galaxies and clusters of galaxies.

Unit-4

Gravitation & Cosmology: Conceptual foundations of GR and curved spacetime: Principle of equivalence, Connection between gravity and geometry,Form of metric in Newtonian, limit Metric tensor and its properties, Einstein's field equations, observational tests of general relativity. Models of the universe : Steady State Models. Standard Model: The expanding universe, Hubble's law . Microwave background radiation Friedmann-Robertson-Walker models, The early universe, Thermodynamics of the early universe Primordial neutrinos. Elementary ideas on structure formation . Implications of the dark matter in modern cosmology.

References Books :

1. A.Unsold: New Cosmos.
2. Baidyanath Basu: Introduction to Astrophysics.
3. Harold Zirin: Astrophysics of the Sun.
4. Gibson: The Quiet Sun.
5. G.Abell: Exploration of the Universe.
6. K.D. Abhayankar: Astrophysics of the solar system.
7. M.Schwarzschild:Stellar Evolution
8. S.Chandrasekhar:Stellar Structure
9. K.D.Abhyankar:Astrophysics: Stars and Galaxies
10. Menzel,Bhatnagar and Sen:Stellar Interiors.
11. Cox and Guili:Principles of Stellar Interiors - Vol.I and II.
12. Shapiro and Tevkolsky: White Dwarfs, Neutron Stars and Black Holes.
13. R.Bowers and T.Deeming:Astrophysics(John and Barlett.Boston).

SOP/FOS/PHY/E012 : Project work for all specializations

This course will be based on preliminary research oriented topics both in theory and experiment. The teachers who will act as supervisors for the projects will float projects and any one of them will be allocated to the students. At the completion of the project by the semester end, the student will submit Project Report in the form of dissertation which will be examined by the examiners. The examinations shall consist of presentation and comprehensive viva-voce. Marks allotment- **Project and viva of Project-Evaluation by internal + External- -Project =60, Viva=20, (Separately sealed), Internal assessment=20(Separate sealed envelope for internal evaluation)**

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SELF STUDY COURSE/PAPERS

Any one of the following, in third or fourth semester, will be conducted and evaluated at Department level

SOP/FOS/PHSS001: QUANTUM ELECTRODYNAMICS

Dirac equations, Properties of Dirac Matrices, Projection Operators, Traces< Feynman's theory of Position.

Second quantization of Klein Gordon field,Creation and annihilation operators, commutation relations, Quantisation of electromagnetic field, Creation and annihilation operators, commutation relation, Fock space representation, interaction fields. Dirac (interaction) picture, S-matrix and ita expansion. Ordering theorems, Feynman graph and Feynman rules. Application to some problems, like Rutherford Scattering and Compton scattering, calculations of cross sections using Feynman graphs.

Reference Books:

1.Bjorken and Drell: Relativistic Quantum Fields

2. Muirhead: The Physics of Elementary Particles

3. Schweber, Bethe and Hoffman: Mesons and Fields

4.Sakurai: Advanced Quantum Mechanics

5.Mandal: Introduction to Field Theory

6. Lee: Particle Physics and Introduction to Field Theory

SOP/FOS/PHSS002: PHYSICS OF LIQUID CRYSTALS

Introduction: States of Matter, Liquid crystals, Symmetry, Structure and order, Mesogenic Molecules, Liquid Crystals of Chiral and Chiral Molecules, Calamitic, disc Shape and Polymer liquid Crystals.

Physical Properties: Order parameters, measurement by magnetic resonance spectroscopy, Optical anisotropy, refractive index, Dielectric anisotropy, Dielectric Permittivity, diamagnetic anisotropy, magnetic susceptibility, Transport Properties, Eleastic Constants, Continum Description.

Statistical Theories of Nematic Order: Landau- de- Gennes, Theory, hard particle, Maier Saupe and Van der Walls type theories.

Nematic-Smectic A Transition: Phenomenological description, McMillan Theory, polymorphism in smectic A Phase.

Ciral Liquid Crystals: Chirality in liquid crystals, Chiral nematic Phase, Optical Properties, field induced nematic Cholesteric Phase Change, Distortion of Structure by magnetic field, Blue Phase, Chiral smectic phases,

origin of ferroelectricity: Structure, symmetry and ferroelectric ordering in Chiral Smectic C Phase, Antiferroelectric and ferroelectric Chiral smectic C Phase.

Application of Liquid Crystals.

Reference Books:

1. Liquid Crystals: S Chandrashekhar
2. 2.The Physics of Liquid Crystals: P G de Gennes and J Prost
3. Liquid Crystals, Fundamentals: S Singh

SOP/FOS/PHSS003: ATMOSPHERIC PHYSICS

Introduction to Atmosphere:

Atmosphere and its composition; Physical and Dynamical processes on layer formation Troposphere, Stratosphere and ionosphere; Vertical variation of temperature, ozone and its spatial and temporal variation; Measurement of ionization density, Ozone Density; Temperature, pressure and wind distribution in the atmosphere and general circulation.

Mathematical and Statistical Methods:

First and second order differential coefficients and their applications to atmosphere variabilities. Autocorrelation theory, Standard statistical distributions (Normal, binomial, gamma, students, t, x2). Application of Auto correlation and auto regressive processes applied to atmospheric variabilities. Error Analysis, Sampling and Test of Hypothesis, Analysis of variance. Interpolation and de extrapolation techniques, Grid point interpolation. Harmonic analysis and Spectral analysis and their use in atmosphere science.

Observational Techniques leading to understanding of the atmosphere:

Working principle, application and circuit description in blocks of the system: Ionospnde, Radiosonde,, Ozone sonde, LIDARS, DIAL, SODARS, AWS, Weather satellites, Doppler Radar, ST Radar and MST Radar

Atmosphere and their role in the wave propagation:

Super and refraction conditions and mm/cm propagation. Rain attenuation of waves in atmosphere, Ionopshere and its role in brief on radio propagation.

Atmospheric Thermodynamics and radiation budget:

Radiative Transfer in the Atmosphere, aerosol scattering (Rayleigh, Mie), Role of aerosol and atmospheric dust in radiation balance; Calculation of radiative heating and Cooling and energy balance. Energy exchange processes through waves and instabilies

Reference Books:

1.H G Houghton: Physical Meteorology

2.J M Vallance and P V Hobbs: Atmospheric Sciences: An Introductory Survey

3.R R Rogers: A Short Course on Cloud Physics

4.J R Holton:An Introduction to Dynamic Meterology

5. S L Hess: Introduction to Theoretical Meterology

6. T Beer: Atmospheric Waves

7.Chapman and Lindzen Riedel: Atmospheric Tides

SOP/FOS/PHSS004: BIO PHYSICS

Introduction to Bio Physics: Molecular Organisation, Different levels, Organization of Proteins- Primary, Secondary, teriary and quaternary structures, Osmosis, Diffusion and Donnan Equilibrium.

Conformational Analysis: Nucleic acids and their organization in living cells; interactions of Nucleic acids.

Methods in BioPhysical Analysis: CD, ORD & Fluorescence Spectroscopy, Raman Spectroscopy,

Separation and Characterization of bio molecules using centrifugal, electrophoretic and chromatographic techniques.

Absorption and Emission Spectroscopy- Principles and applications of visible, UV, IR, AAS, NMR, ESR and MS Spectroscopy.

Characterization of macromolecules using X-ray diffraction analysis.

Use of analytical microscopy in elucidating the structure function relationship in-

Prokaryotes: Electron Microscopy, Phase Contrast and Fluorescence microscopy and scanning tunneling microscopy.

Radio Isotope Techniques: Detection and measurement of radioactivity, Geiser Muller Counters, Scintillation counting, Autoradiography and RIA; Applications of isotopes in biological studies.

Reference Books-

1.David Freifelder: Physical Biochemistry

2.Willard Merrit, Dean and Settle: Instrumental methods of analysis

3.D R Browning: Spectroscopy

4. Wilson and Walker: Principles and Techniques of Practical Biochemistry

5. D A Skoog: Instrumental methods of analysis

SOP/FOS/PHSS005: PHYSICS OF NANO MATERIALS

Nanoparticles: Synthesis and Properties:

Method of Synthesis: R F Plasma Chemical Methods, Thermolysis, Pulsed laser Methods, Biological Methods, Synthesis using micro-organisms, Synthesis using Plant extract, Metal Nanoclusters, Magic Numbers, modeling of Nano Particles, Bulk of Nano Transitions.

Carbon Nano Structures:

Nature of Carbon Clusters, Discovery of C60, Structure of C60 and its crystal, Superconductivity in C60, **Carbon Nano Tubes:** Synthesis, structure, Electrical and Mechanical Properties. **Graphene**: Discovery, Synthesis and Structural Characterization through TEM, Elementary concept of its applications.

Quantum Wells, Wires and Dots:

Preparation of Quantum Nano Structures, Size Effects, Conduction Electrons and Dimensionality, Properties Dependent on Density of States.

Analysis Techniques for Nano Structures/Particles:

Scanning Probe Microscopes(SPM), Diffraction Techniques, Spectroscopic Techniques, Magnetic Measurements.

Bulk Nano Structure Materials:

Methods of Synthesis, Solid Disorders Nano Structures, Mechanical Properties, Nano Structure Multilayers, Metal Nano Cluster, Composite Glases, Porous Silicon.

Reference Books:

1. Introduction to Nano Technology: Poole and Owners
2. Quantum Dots: Jacak, Hawrylak and Wojs
3. Handbook of Nano Structureed Materials and Nano Technology: Nalva(Editor)
4. Nano Technology/ Principles and Practices: S K Kulkarni
5. Carbon Nano Tubes: Silvana Fiorito
6. Nano Technology: Richard Booker and Earl Boysen

SOP/FOS/PHSS006: ENVIRONMENTAL PHYSICS

Essentials of Environmental Physics: Structure and thermodynamics of the atmosphere. Composition of air, Green House Effect, Tramnsport of Matter, Energy and momentum in Nature. Stratification and stability of atmosphere.Laws of motion, hydrostatic equilibrium.

Solar and Terrestrial: Physics of Radiation, Interaction of light with matter,Rayleigh and Mie scattering, laws of radiation(Kirchoff's law, Plank's law, Wein's displacement law etc.) , solar and terrestrial spectra, UV radiation. Ozone depletion problem, I R absorption.

Environmental Pollution and Degradation: Elementry fluid dynamics, Diffusion, Turbulence and turbulent diffusion, Factors Governing air, water and noise Pollution, Air and water quality standards. Waste Disposal. Gaseous and particulate matters, wet and dry deposition.

Environmental Changes and Remote Sensing: Energy sources and combustion processes. Renewable Sources of energy: Solar energy, wind energy, bioenergy, hydropower, fuel cells, Nuclear energy.

Global and regional Climate: Elements of whether and climate. Stability and vertical motion of air, Horizontal motion of air and water, Pressure gradient forces, viscous forces.

Inertia forces, Reynolds number, enhanced Greenhouse effect, Global Climate Models.

Referene Books:

1. Egbert Boeker & Rienk Van Groundelle : Enviromental Physics (john wiley)
2. J.T. Hougtion : The Physics of Atmosphere (Cambridge Univ.Press. 1977)
3. J. Twidell and J.Weir : Renewable Energy Resources (Elbs, 1988)
4. Sol Wieder : An Introduction to Solar Energy for Scientists and Engineers (John Wiley,1982
5. R.N. Keshavsamurthy and M.Shankar Rao : The Physics of Monsoons(Allied Publuishers,1992)
6. J. Haltiner and R.T. Williams : Numerical Weather Prediction (John Wiley, 1980**)**

SOP/FOS/PHSS007: PLASMA PHYSICS

Plasma Physics : Elementary concepts, plasma oscillations, Debye shielding, Plasma Parameters, Magneto Plasma, Plasma Confinement, First , Second and Third Adiabatic Invariants(Pinch effect, Magnetic Mirrors), Formation of Van Allen Belt.

HydrDynamical Description of Plasma:

Fundamental Equations, Hydromagnetic Waves, Magnetosonic and Alfven Waves, Magnetoconvection and sun spots, Bipolar magnetic regions and magnetic Buoyancy, Magnetised winds (Solar Wind).

Wave Phenomena in Magnetoplasma:

Polarisation, Phase velocity, Group velocity, cut offs, resonance for Electromagnetic Wave Propagating Parallel and Perpendicular to the Magnetic Field, Propagation at Finite angle.

Reference Books:

1- W.K.H. Panofsky and M. Phillips : Classical Electricity and Magnetism.
2- A Bittencourt : Plasma Physics
3- F.F. chen : Palsma Physics and Controlled fusion
4- J.D.Jackson : Classical Electrodynamics

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – PLANT PHYSIOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

High Altitude Plant Physiology Research Centre (HAPPRC)
Ph.D. Plant Physiology-Syllabus for Entrance Examination

Advances in Plant Physiology

Structural and functional modifications in plants in relation to environment; developmental processes and reproduction in plants; ecology and adaptation. Plant environment and its components; scope and problems of environmental plant physiology; tropical, temperate and alpine environments; principles of plant response to environment; plant responses and adaptations to radiation, temperature, water, wind and salinity stresses; pollutants and plant responses; allelopathy and herbivory; plant-microbial interactions, modern concepts of climate change in relation to plant physiology.

Research Methodology and Instrumentation

Colorimetry; spectrophtometry; fluorometry; chromatography; electrophoresis; centrifugation; densitometry; fluorescence measurements; methods of plant growth analysis; gas exchange; radiation measurements; leaf area measurements; determination of stomatal aperture; leaf temperature measurements; determination of biomolecules; enzyme assays and bioseparation techniques; microscopy methods; microbial technology; recombinant DNA technology; clonal propagation.

Seed biology and reproductive physiology

Physiology of seed development and maturation; effect of environmental factors on seed development and maturation; definition and measurement of seed germination; seed viability relationship with water and solutes; seed vigour; seed dormancy; inception of germination; environmental factors and photoreceptors; growth regulators, membranes and germination; Juvenility; photoperiodism, vernalization and physiology of flowering; vegetative propagation.

Photosynthesis and productivity

Biochemical and physical processes of photosynthesis; effects of environmental factors on photosynthesis; water relations and photosynthesis; photosynthesis in different plant forms; characteristics of C3, C4 and CAM species and their ecological significance; photosynthetic, light and water use efficiencies of plants; leaf and canopy photosynthesis; respiration and environmental factors; plant adaptation to temperature and light and their relationship to photosynthesis; root/shoot interactions; total dry matter production; modeling of photosynthetic and productivity responses to environment.

Biophysical plant physiology and ecology

Importance and problems; atmospheric environment and its components - Radiation (radiation laws, radiation in natural environment, radiation fluxes in and within plant communities, radiation coupling, adaptations of plants to low and high radiation); Temperature (temperature relations of plants, plant adaptation and resistances to low and high temperatures, atmospheric temperature in relation to leaf temperature); Wind (response of single leaves and whole plant to wind and its ecological significance); Plant and water relations (physical and chemical properties of water, cell water relations, liquid phase transport processes); Exchange processes in plants : radiation exchange; CO2 exchange (photosynthesis as a resistance process); exchange of water vapour (transpiration as a resistance process, resistance network); exchange of heat energy (mechanism of leaf energy balance and its significance); Altitude, latitude and plant growth; Ecological energetics.

Biotechnological advances in plant stress biology

Plant Stress Biology; Plant Stress Tolerance Traits; Genetic engineering in relation to plant stress biology; Physiological role of Plant Secondary Natural Products (PSNP); Ecological aspects of PSNPs; Diversity in relation to plant adaptations under stress; Structure, biosynthetic pathways, storage and accumulation of PSNPs in sub-cellular organelles; Phytochemical analysis of PSNPs from plant extracts; in vitro production and evaluation of PSNPs using molecular biology tools and techniques; molecular genetics techniques for improvement of PSNP production.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – POLITICAL SCIENCE

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Department of Political Science
HNB Garhwal University, Srinagar, Uttarakhand

M.A. Courses

Courses in the M.A. Programme at a Glance

FIRST SEMESTER

Course and Course no.	***Name of the Course***	***L***	***T***	***P***	***C***
SOS-POL.SC.C-111	*Western Political Thought*				*3*
SOS-POL.SC.C-112	*Comparative Politics*				*3*
SOS-POL.SC.C-113	*Indian Political System*				*3*
SOS-POL.SC.C-114	*International Relations*				*3*
SOS-POL.SC.C-115	*Research Methodology*				*3*
SOS-POL.SC.C-116	*Local Self Government in India*				*3*

SECOND SEMESTER

Course and Course no.	***Name of the Course***	***L***	***T***	***P***	***C***
SOS-POL.SC.C-117	*Western and Modern Political Thought*				*3*
SOS-POL.SC.C-118	*Modern Political Systems*				*3*
SOS-POL.SC.C-119	*International Organizations*				*3*
SOS-POL.SC.C-120	*Foreign Policies of Major Powers*				*3*
SOS-POL.SC.C-121	*Indian Administration*				*3*
SOS-POL.SC.C-122	*Project Work*				*3*

THIRD SEMESTER

Course and Course no.	***Name of the Course***	***L***	***T***	***P***	***C***
SOS-POL.SC.C-123	*Indian Political Thought*				*3*
SOS-POL.SC.C-124	*India's Foreign Policy*				*3*
SOS-POL.SC.C-125	*Public Administration*				*3*
SOS-POL.SC.E-126-B	*Regional Development in India*	*3*			
SOS-POL.SC.E-126-C	*Parties and Electoral Politics in India*	*3*			
SOS-POL.SC.E-127-B	*Politics of Himalayan States*	*3*			
SOS-POL.SC.E-127-C	*Contemporary Politics in India*				*3*
SOS-POL.SC.E-	*Financial Administration in India*				*3*
SOS-POL.SC.E128-C	*Women Empowerment*				*3*

FOURTH SEMESTER

Course and Course no.	***Name of the Course***	***L***	***T***	***P***	***C***
SOS-POL.SC.C-129	*Theories of International Politics*				*3*
SOS-POL.SC.C-130	*International Law*				*3*
SOS-POL.SC.C-131	*Dissertation*				*3*

SOS-POL.SC.E-132-A	*Political Philosophy of Mahatma Gandhi*				*3*
SOS-POL.SC.-E-132-B	*Human Rights*				*3*
SOS-POL.SC.E-132-C	*Global Terrorism*				*3*
SOS-POL.SC.E-133-A	*Politics of Environment and Development*				*3*
SOS-POL.SC.E-133-B	*Modern Political Ideologies*				*3*
SOS-POL.SC.E-133-C	*Peace, Security and Conflict Resolution*				*3*

M.A. COURSES: POLITICAL SCIENCE

FIRST SEMESTER
CORE/ COMPULSORY COURSES
ALL COURSES SHALL CARRY 3 CREDITS

COURSE –I: WESTERN POLITICAL THOUGHT

Unit-I: Plato-Theory of Justice, Education, Communism, and Ideal State

Unit-II: Aristotle-Origin of State, Classification of Governments, Revolution, Theory of Slavery, Justice

Unit-III: St. Augustine- Theories of two Cities, Justice; St. Thomas Aquinas-Views on State and Church.

Unit-IV: Political ideas of Marsilio of Padua, Machiavelli Separation of ethics from Politics,

Theory of Space craft.

Readings Recommended:

Barker, E., Greek Political Theory
Dunning, A History of Political Theory
Ebenstien, Great Political Thinkers
Fadiya, B.L., Rajnitik Chintan Ka Ithihas
Mehta, Jiwan, Rajnitik Chintan Ka Ithihas
Nelson, B.R., Western Political Thought
Russell, Bertrand, History of PoliticalPhilosophy
Sabine, G.H., History of Political Theory
Sharma, Prabhu Dutt, Rajnitik Chintan KaIthihas
Strauss, L. and Joseph Cropsey, History of Political Philosophy
Bedalankar, Hari Dutt, Adhunik RajnitikChintan
Vedalankar, Hari Dutt, Pashchatya Rajnitik Chintan
Verma, K.N., Rajdarshan Bhag-1 and 2
Wayper, C.L., Political Thought

Course Outcome:
Complete appreciation of the foundations of political philosophy.

COURSE- II: COMPARATIVE POLITICS

Unit- I: Comparative Politics—meaning, nature, scope, evolution and approaches; political culture, political development.

Unit- II: The concept of political system; structural-functional approach.

Unit-III: Forms of Political Systems—federal versus unitary system; Separation of powers and checks and balances, judicial review.

Unit-IV: Representation--theories of representation, proportional representation; Public

opinion, mass media and Pressure group

Readings Recommended:

Almond, G.A. and J.S. Coleman, The Politics of the Developing Areas, Princeton NJ, Princeton University Press 1960.
Almond, G.A., and B. Powell, Comparative Politics: A Developmental Approach, Little Brown, 1966.
Apter David A. and E. Eckstein (ed.), Comparative Politics.
Apter, David A., Introduction to Political Analysis.
Apter, D.A., The Politics of Modernization, Chicago, University of Chicago, Press 1965.
Bara, Judith and Mark Pennington, Comparative Politics, Sage 2009
Gena, C.B., Tulnatmak Rajniti.
Jain, R.B., Tulnatmak Shashan Aur Rajniti.
Johari, J.C., Tulnatmak Rajniti.
Lipset, Seymour Martin, Political Man.
Maheshewari, S.R., Tulnatmak Rajniti.
Maheshwari, S.R., Comparative Government and Politics.
Ray, S.N., Modern Comparative Politics: Approaches, Methods and Issues, Prentice Hall
Sharan, Parmatama, Tulnatmak Shasan Pranaliyan.
Sharma, Prabhu Dutt, Tulnatmak Rajnitik Sansthayain.
Stephen, A., Arguing Comparative Politics, Oxford, 2001
Tornquist, O., Politics and Development, Delhi, Sage, 1999.

Course Outcome:
A proper understanding of contemporary political systems and concepts.

COURSE-III: INDIAN POLITICAL SYSTEM

Unit- I: Background of the constituent Assembly of India, Composition and working; Preamble, Fundamental Rights, Directive Principles of State Policy.

Unit-II: Nature of Indian Federalism; Centre State Relations.

Unit-III: The Parliament: Structure, Functioning; The Union Executive: President, Prime Minister; The Judicial System: Supreme Court, Judicial Review and Judicial Activism.

Unit-IV: Election Commission and Electoral Reforms.

Readings Recommended:

Aiyar S.P., and U. Mehta-Essays on Indian Federalism, Bombay, Allied Publishers, 1965
Awasthi, A.P., Bhartiya Sashan Aur Rajniti
Baxi, U., The Indian Supreme Court and Politics Delhi, Book Company, 1980

Basu, D.D., An Introduction to the Constitution of India, New Delhi Prentice Hall, 1994

Basu, D.D., Bharat Ka Samvidhan: Ek Parichaya

Bhambri, C.P., The Indian State : Fifty Years , New Delhi,1999
Dubey, S.N., Indian Government and Politics.
Jain, S.N., Bhartiya Sashan Aur Rajniti.
Jaiswal, R.K., Bhartiya Sashan Aur Rajniti
Johari, J.C., Indian Government and Politics
Jones, Morris, The Government and Politics of India.
Kaushik, Sushila, Bhartiya Sashan Aur Rajniti.
Narain, Iqbal, Politics in India

Pandey, Jaya Narain, Indian Constitution

Pylee, M.V., Constitutional Government in India.
Singh, M.P. and Rekha Saxena, Indian Politics, Prentice Hall of India, 2008
Singh, R.L. and C.P. Sharma, Bhartiya Sashan Aur Rajniti.
Political System of India- Dr. Hari Hara Das

Course Outcome:
Proper comprehension of the foundations, structure and functioning of the Indian political system.

COURSE- IV: INTERNATIONAL RELATIONS

Course – IV International Relations
Unit- I *History of International Relations: Emergence of International system (19thCentury) First word war and Second world war- Reason and Consequences*

Unit –II *Cold war: phases of bipolarity, Decolonization and third worldism, End of Cold war*
Unit-III_ *New Economic Order: IMF and WTO, Structural Adjustment,* ***the world Bank, ASEAN, EUROPEAN UNION.***
UNIT-IV- *Emerging Global Challenges, Climate change, Migration and Ethnicity and Terrorism.*

Readings Recommended:

Baral, J.K., International Politics.
Bindra, S.S. India and Her Neighbour.

Basu, Rumki., International Politics: Concepts, Theories and Issues, SAGE, 2012.

Baylis, John., Steve Smith, Patricia Owens, The Globalization of World Politics: An Introduction to International Relations, Oxford University press, 2014.
Brown, Chris and Kirsten Ainlegy, Understanding International Relations, Palgrave Macmillan Publishing, 2005.

Calvocoressi, Peter, World of Politics since 1945, Longman, 1989 edn.M.A. POLITICAL SCIENCE (SEMESTER SYSTEM) SYLLABUS 10
Chaturevedi, D.C., Antrashtiya Rajniti.
Claude, I., Power and International Relations, New York, Random House,1962.
Couloumbus & Wolfe, Introduction to International Relations.
Crowely, An Introduction to International Relations.
Dwivedi, Dhirendra, SAARC : Problems and Prospects, Adhyayan Publishing, 2008.

Hobsbawm, Eric., Age of Extremes, The Short Twentieth Century, 1914-91, Viking, 1995.
Holsti, K.J., International Politics: A Framework of Analysis. Englewood Cliffs, Prentice Hall,1967.
Johari, J.C., International Relations.
Kaushik, P.D., Antrastiya Sambandh.
Kennedy, Paul., The Rise and Fall of Great Powers : Economic Change and Military Conflict from 1500 to 2000, Fontana, 1988.
Kennedy, Paul., Preparing for the Twenty-First Century, Indus, Harper Collins, 1993
Khanna, V. N., International Relations, S.Chand (G/L) & Company Ltd; 7th edition 2013.
Malhotra, Vinay Kumar, Introduction to International Relations.
Morgenthau, H.J., Politics Among Nations.
Nautiyal, Annpurna (ed.), India and the New World Order.
Northedge, F.S., The International Political System. London,1976.
Palmer, Norman D. and H.C. Perkins, International Relations.
Pant, Pushpesh, Antrashtiya Sambandh.
Rajan, M.S., Non alignment and the Non alignment Movement in the Present World Order, Delhi Konark,1994.
Reus-Smit., Christian and Duncan Snidal, The Oxford Handbook of International Relations, OUP, 2010.
Roach, Steven C., Critical Theory of International Relations, Routledge, 2009.
Schlecher, International Relations.
Sharma, M.L., Antarrastiya Sambandh (1945 to Present).
Sheth, Praven, Theory and Praxis of Environmentalism.
Sood, C.S. and Niranjana Bahuguna, Antarrashtriya Rajniti.
Wright, Quincy, A Study of International Relations.
Viotti, Paul R., International Relations And World Politics: Security, Economy, Identity , Prentice Hall- Gale, 1996.
Buzan, Barry and George Lawson. "The Global Transformation: The Nineteenth Century and the Making of Modern International Relations." International Studies Quarterly, vol.57, no.3 (September 2013):620-634

Course Outcome:
Comprehension of the conceptual framework of contemporary international relations.

Course Outcome:
Comprehension of the conceptual framework of contemporary international relations.

COURSE- V: RESEARCH METHODOLOGY

Unit-I: Meaning, relevance of Research methodology; Scientific Methods: Main Steps of Scientific Methods.

Unit-II: Selection and Formulation of Research Problem.

Unit-III: Hypothesis, Research Design, Techniques of Data Collection-Observation, Interview, Questionnaire and Schedule Method.

Unit-IV: Sampling: Meaning, Types; Introduction to Statistics; Data Processing; Thesis Writing.

Readings Recommended:

Blalock, H.N., An Introduction to Social Research, Englewood Cliffs NJ, Prentice Hall, 1970.
Eulau, H., The Behavioural Persuasion in Politics, New York, Random House, 1964.
Evera, S.V., Guide to Methods for Students of Political Science , Ithaca ,NY ,Cornell University Press, 1997.
Frohock, F.M., The Nature of Political Inquiry, Homewood Illinois, Dorsey Press, 1967.
Galtung, John,Theory and Practice of Social Research.
Gilbert, N. (ed.), Researching Social Life, London, Sage, 1993.
Gosh, B.N., Scientific Methods and Social Research.
Good &Hatt , Methods in Social Research.
Gopal, M.H., An Introduction to Research Procedures in Social Sciences.
Kaplan, A., The Conduct of Inquiry, Methodology for Behavioural Science.
Kaugman:Methodology of Social Sciences.
Kerliger, F. N., Behavioural Research, New York, Holt, Rinehart and Winston, 1979.
Lsaak, A. C., Scope and Methods of Political Science, Homewood lllinois, Dorsey Press 1985.
Marsh, D. and G.Stoke (ed.), Theory and Methods in Political Science, Macmillan,1995.
Merton, R. K. (ed.), Social Theory and Social Structure, New York, The Free Press, 1957.
Rubin, H. J., Applied Social Research, Columbus, North Ulinos University Press, 1983.
Verma, S.L., Rajniti Vigyan Mein Sodh Pravidhi.
Young, P.V., Scientific Social Survey and Research.

Course Outcome:
Acquisition of basic ability to conduct research.

COURSE- VI: LOCAL SELF GOVERNMENT IN INDIA

Unit-I: Concept of Local Self Government: Meaning and Importance, Brief history during British period and after Independence.

Unit-II: Rural Local Government: Village Panchayat, Block Panchayat and Jila Panchayat.

Unit-III: Urban Local Government: Municipalities, Municipal Corporation.

Unit-IV: Rural and Urban Government: Challenges, Remedies. Achievements of Panchayati Raj System.

Readings Recommended:

Asaithambi, S., A. Mohamed Abdullah, N. Kannan: The Changing Face of Rural India , Abhijeet Publication, 2008.
Baker, Benjamin, Urban Government.
Bambhri , C.P., Public Administration in Theory and Practice.
Bryce, James, Modern Democracies.
Chand, Gyan, Local Financial in India.
Dharmaraj, S., Panchayati Raj System in India, Abhijeet Publication, 2008,
Gerber, David NLocal democracy in South Asia,
Jain, L.C. (ed) , Decentralization and Local Government.
Jain, Mukesh, Excellence in Government, Atlantic Publishers, 2001.
Kapur, Devesh & Pratap Bhanu Mehta , Public Institutions in India.
Maheshwari , S.R., Local Government in India.
Mathur, B.N. Decentralized Democracy and Panchayati Raj, Swastik Publication, 2009.
Mishra, A.D., Decentralized Planning, Abhijeet, 2009.
Palanithurai, G., Decentralization in India Critical issues from the field.
Singh, Kartar, Rural development, Principles, policies and Management.
Sinha Roy, Bhaktapada Panchayati Raj Rural and Development, Abhijeet Publication, 2008.
Wadouy , Russell W., Issues in states and local government.

Course Outcome:
Comprehension of the structure and functioning of decentralization and grassroots democracy in India.

SECOND SEMESTER

CORE/ COMPULSORY COURSES

COURSE- VII: WESTERN AND MODERN POLITICAL THOUGHT

Unit-I: Hobbes, Locke, Rousseau- A Comparative Study; Jeremy Bentham-Utilitarianism, Political and Legal Reforms,

*Unit-II: J.S.Mi**l** on Liberty, Jean Bodin-Concept of Sovereignty.*

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.Unit-III: Hegel-Dialectics, Theory of State; T.H. Green- Liberty, Rights and State;

Unit-IV: Karl Marx- Dialectical Materialism, Theory of Class Struggle, Theory of State.

Readings Recommended:

Dunning, A History of Political Theory.
Ebenstein, Great Political Thinkers.
Mehta, Jiwan, Rajnitik chintan ka Itihas.
Nelson, B.R., Western Political Thought.
Russell, Bertrand, History of Political Philosophy.
Sabine, G.H., History of Political Theory.
Strauss, L., and Joseph Cropsey, History of Political Philosophy.
Wayper, C.L., Political Thought.

Course Outcome:
A holistic understanding of the evolution and diversity of modern political philosophy.

COURSE: VIII- MODERN POLITICAL SYSTEMS (UK-USA-CHINA-FRANCE)

Unit-I: Typology of political systems: written– Unwritten, Flexible-Rigid, and Presidential-

Parliamentary; Rule of Law-Administrative law with reference to India, U.S., U.K. and China.

Unit-II: US Political System: President, Congress and Judiciary.

Unit III: French Political System: The Presidency, Executive and Judiciary.

Unit-IV: China: Constitutional Framework–Executive, Legislature, Role of Communist party.

Readings Recommended:

Almond G.A. and B. Powel, Comparative Politics: A Developmental Approach

Apter David A. and E. Eckstein (edt.)-Comparative Politics

Apter, David, The Politics of Modernization, University of Chicago Press, 1965.

Ball, Alan, Modern Politics and Government, Macmillan, 1977

Birch, A.H., The British System of Government, Allen & Unwin, 1980

Gena, C.B., Tulnatmak Rajniti.

Irish, M. and J.W. Prothro , The Politics of American Democracy, Prentice Hall, 1968.

Johari, J.C., Tulnatmak Rajniti.

Maheshwari, S.R., Comparative Government and Politics

Madgwick, P.J., Introduction to British Politics, Hutchinson, 1971

Pye, Lucian, The Spirit of Chinese Politics, Cambridge, 1970

Ward, Robert and Roy Macrides (Ed.), : Modern Political Systems, 1972.

Weller, D.J., The Government and Politics of Communist China, Huthchison, 1970

Wesson, Robert, Communism and Communist Systems, Prentice Hall, 1978

Course Outcome:
Awareness of the various types and forms of contemporary political systems and their functioning.

COURSE- IX: INTERNATIONALORGANISATION

Unit-I: Meaning, Nature and Classification of International Organizations.

Unit-II: Historical Development- League of Nations: Main Organs, Causes of Failure.

Unit-III:The United Nations- Origin, Objectives, Principal Organs

Unit-IV: Need for the revision of UN Charter, Relevance of U.N. in Present Era

Readings Recommended:

Bachr, P. and L.Gordenker, The United Nations in the 1990s, 0up, 1992.
Basu, Rumki, The United Nations.
Bennet, A.L., International Organization: Principles and Issues.
Bilgrami, S.J.R., International Organization, New Delhi, Vikas,1977.
Gairola, R.N., Antarastriya Sangatan.
Gaur, M., United Nations for a Better World, Alfa Publications, 2009.
Kamath, P.M., Reforming and Restructuring the United Nations , Anamika Publishers 2007.
Kaushik, P.D., Antarrashtriya Sangathan.
Kumar, S. (ed.), The United Nations at 50: An Indian View, Delhi, UBSPD, 1995.
Leonard, L.L., International Organisation.
Mahajan, V.D., International Organisation.

Mehrish, B.N. and C.Archer, International Organizations.
Mehrish, B.N., International Organizations: Structures and Processes.
Potter, P.B., International Organisation.
Rajan, M. S. (ed.)-United Nation at Fifty and Beyond, Lancer Books, New Delhi, 1993.
Roy, M.P., Antarrshtriya Sangathan.
Saxena, K.P., Reforming the UN : The Challenge of Relevance.
Singh, Nagendra, International Organisation.
Srivastava, L.N., International Organization.
The UN Year Book- Latest Edition.

Course Outcome:
Acquaintance of the most significant contemporary international organizations.

COURSE- X : FOREIGN POLICIES OF MAJOR POWERS

Unit I – Foreign Policy Analysis: Meaning, Determinants, objectives.

Unit II – Foreign Policy of USA: Salient Features, American approach to Major Global Issues, Relations with South Asia, China, Russia, Middle East.

Unit III– Foreign Policy of U.K.: Salient Features, Relations with Europe, South Asia, Middle East.

Unit IV – Foreign Policy of China: Salient Features, Relations with USA, Russia, South Asia

Readings Recommended:

Arora, V.K., Pranukh Deshon ki Videsh Nitiyan.
Black and Thompson (ed.), Foreign Policies in a changing World.
Hastedt, Glean P., American Foreign Policy : Past, Present and Future.
Kux, Dennis, Estranged Democracies- India and The United States, New Delhi: Sage Publications, 1993. Levi, Modern China's Foreign Policy.
Macridis, Roy C. (ed.), Foreign Policy in World Politics.
Rai, Kul B., David Walsh, Paul J. Best (ed.), American Foreign Policy in 21st Century.
Sharma, M.L., Pranukh Deshon ki Videsh Nitiyan.
Tellis, Ashley J., India's Emerging Nuclear Posture, Oxford, 2001

Course Outcome:
Comprehension of the foreign policies of major world powers.

COURSE-XI: INDIAN ADMINISTRATION

Unit-I: Features of Indian Administration, Historical evolution of Indian Administration during Colonial Period.

Unit-II: Ministry of Home, Cabinet Secretariat and PMO.

Unit-III: UPSC and Civil Services in India, Recruitment, Training and Promotion.

Unit-IV: Financial Administration in India-Budget, Comptroller and Auditor General of India.

Readings Recommended:

Arora, R.K., Administrative Change in India
Bansal, P.L., Administrative Development in India
Bhushan, Vidya and Vishnu Bhagwan, Indian Administration
Chandra, Asok, Indian Administration
Chatterjee, S.K., Indian Administration
ChaturvediT.N. (Ed.), Strategies for Administrative Culture inIndia
Jain, R.B., Contemporary issues in Indian Administration
Jain, R.B., Contemprary Issues in Indian Administration
Maheswari, S.R., Indian Administration
Sharma, P.D., Bhartiya Prasasan
Indian Administration, Bidyut Chhakrabarty, Prakash Chand, Sage Publication
Indian Administration, Avasthi & Avasthi

Course Outcome:
Introduction to the administrative system of India.

COURSE:XII- PROJECT WORK

Students shall prepare and submit a Project on a topic of their choice falling within the broad scope of Political Science under the supervision of a faculty member.

Course Outcome:
Acquisition of the ability to observe, gather and organize facts in a coherent manner.

THIRD SEMESTER

CORE/ COMPULSORY COURSES

COURSE: XIII- INDIAN POLITICAL THOUGHT

Unit-I: Overview of Indian Political Thought: Genesis and Development, The Indian Renaissance.

Unit-II: Ram Mohan Roy, Gopal Krishna Gokhale, Bal Gangadhar Tilak.

Unit- III: Sir Syed Ahmed Khan, V.D. Savarkar, M.K.Gandhi.

Unit-IV: Political Ideas: Jawahar Lal Nehru, B.R. Ambedkar, and J. P. Naryan.

Readings Recommended:

Appadorai, A., Documents on Political Thought in Modern India, 2 Vols.Bombay OUP 1970.
Awasthi, A. P., Bhartiya Rajnitik Vicharak.
Awasthi, Amrendra, Aadhunik Bhartiya Samajik Aur Rajnitik Chintan.
Azad, M.A., India Wins Freedom, Hyderabad, Orient Longman, 1988.
Bandhopadhyaya, J., Social and Political Thought of Gandhi, Bombay, Allied 1969.
Bose, N.K., Studies in Gandhism, Calcutta , Merit Publishers,1962.
Bourai, Himanshu, Gandhi and Indian Liberals: Abhijeet Publications, New Delhi, 2000
Chandra, B., Nationalism and Colonialism in Modern India, Delhi, Vikas,1979.
Damodaran, K., Indian Thought: A Critical Survey, Asia Pub. House 1967.
Fadia, B.L., Bhartiya Rajnitik Chintan.
Goshal, U.N., A History of Indian Political Ideas.
Gohkale, B.G., Indian Thought Through the Ages.
Grover, Political Thinkers of Modern India.
Jain, Pukhraj, Bhartiya Rajnitik Vicharak.
Mehta, V. R., Foundations of Indian Political Thought, Manohar, 1992.
Nanda, B.R., Gokhale, Gandhi and the Nehrus: Studies in Indian Nationalism, London, Allen and Unwin,1974.
Narayan, J. P. Prison Diary, Bombay, Popular Prakashan, 1977.
Spellman, J.W., Political Theory of Ancient India.
Verma, V.P., Modern Indian Political Thought.
Verma, V.P., Aadhunik Bhartiya Rajnitik Chintan.

Course Outcome:
Appreciation of the various streams and aspects of Indian political thought.

COURSE- XIV: INDIA'S FOREIGNPOLICY

Unit I
Principles and Conduct of Foreign Policy
Phases of Indian Foreign Policy

Unit- II:
India and Its Neighbors- Pakistan, Nepal, Bangladesh, Sri Lanka.

Unit- III
a) Re-working the Relations with USA and Russia
b) Sino-Indian Relations
c) India's 'Look East'/ Act East Policy
d) India and the Indian Ocean

Unit –IV
India and the Emerging World Order:
Climate Change, India's Role in the Global Economic Governance

Readings Recommended:

Arora, V.K., Pramukh Deshon ke Videsh Nitinyan.
Black and Thompson (Ed.), : Foreign Policies in a changing World.
Cohen, Stephen P., India Emerging Power, Oxford University, Press 2001
Dixit, J.N., 50 years of India's Foreign Policy, 2003
Dutt, V.P., India's Foreign Policy in a Changing World .Vikas Publishing House, New Delhi, 1999
Ganguly, Sumit (Ed.), India as an Emerging Power. Frank Cass, London, 2003,
Ganguly, Sumit, India Pakistan Tensions since 1947. Oxford Univ. press 2002
Gupta, K.R. and Vatsala Shukla, Foreign Policy of India , Atlantic, 2009
Jalan, Bimal, The Future of India. Penguin, New Delhi, 2005
Jetly, Nancy, India's Foreign Policy, Challenges and Prospects, Vikas Publishing House, New Delhi, 1999
Kapur, H., India's Foreign Policy: Shadow and substance.
Kaushik, P.D., Bhartiya Videsh Niti.
Malhotra, Inder, India Trapped in Uncertainty, UBSPD, New Delhi 1991
Mansingh, Lalit Etd (Ed.), India's Foreign Policy Agenda for the 21st century.
Menon, Raja, A Nuclear strategy for India, Sage, 2000
Misra, K.P., Studies in Indian Foreign Policy.
Misra, K.P., Bharat ki videsh niti.
Mohan, C. Raja, Crossing the Rubicon: The shaping of India's New Foreign Policy. Viking, 2003
Nautiyal, Anpurna (Ed.), India and New World Order : South Asia Pub. New Delhi 1995
Nautiyal, Anpurna (ed.) : Challenge to India's Foreign Policy in the New era.
Pant, Puspesh & Jain, Bhartiya Videsh Niti : Nayain Ayam
Prasad, Bimla, The origin of India's Foreign Policy.
Sharma, R.R., India and Emerging Asia.
Sikri, Rajiv, Challenge and Strategy, Sage,2009
Vanaik, Achin, India's Place in the World.' In Partha Chatterjee (Ed.) Wages of Freedom, Fifty years of the Indian Nation state, Oxford University press, Delhi, 1998

Khanna, V.N., Foreign Policy of India, Vikas Publishing House, Delhi, 2018.

***Malone, David., C. Raja Mohan, and Srinath Raghavan, The Oxford Handbook of Indian Foreign Policy, UK,* 2015.**
Gupta, Arvind and Anil Wadhwa (eds) India's Foreign Policy: Surviving in a Turbulent World, SAGE, New Delhi, 2020.
Pant, Harsh V. Indian Foreign Policy: An Overview, Manchester University Press, 2016.
Ganguly, Sumit (Ed.), Indian Foreign Policy, Oxford University Press, New Delhi 2019.

Bajpai, Kanti P. and Harsh V. Pant, India's Foreign Policy: A Reader, Oxford University Press, New Delhi 2013.

COURSE- XV: PUBLIC ADMINISTRATION

Unit-I: Public Administration: Meaning, Nature, Scope, Public and Private Administration.

Unit-II: Organization: meaning, Forms; Hierarchy, Span of Control, Unity of Command, structure of Organization.

Unit-III: Personnel Administration: Recruitment, Training.

Unit-IV: Financial Administration: Budget, Accounting and Auditing.

Readings Recommended:

Anderson, J.E., Public Policy Making, Boston, Houghton Miffin, 1990

Avasthi, A. and S. N. Maheshwari, Public Administration, Agra , Laxmi N. Agarwal, 1996.
Awasthi, Amreswar and A.P. Awasthi- IndianAdministration.
Bhagwan, Vishnoo and Vidhya Bhushan, Public Administration.
Chaturvedi, T. N., (Ed.), Strategies for Administrative Culture of India, New Delhi, Mittal, 1997.
Datta, Prabhakar, Public Administration and the State.
Dimock and Dimock:Public Administration
Dubashi, P. R., Recent Trends in public Administration, Delhi, Kaveri Books, 1995.
Fadiya, B.L., LokPrashasan
Maheshwari, S. R., Administrative Theories, New Delhi, Allied, 1994.
Pfiffner, Public Administration
Sharma, Harish Chandra, Lokprashasan ke Adhar
Sharma, Prabhu Dutt Public Administration.
Sharma, P.D., Lok Prashasan
Sharma, Prabhu Dutt, Lokprashasan Sidhant Aur Bayawahar
Singh, Birkeshwar Prasad, Lok Prashasan
Weber, M., The Theory of Organization: Readings in Public Administration, New York, Harper and Row , 1983.
White, L. D., Introduction to the Study of Public Administration, New York, Macmillan, 1955.

Course Outcome:
Knowledge of the basic concepts, principles and working of modern public administration.

THIRD SEMESTER

ELECTIVE/OPTIONAL COURSES:

COURSE- XVI-B: REGIONAL DEVELOPMENT IN INDIA

Unit-I: Regional Development-Meaning, Importance.

Unit-II: Regional Imbalances in India-Causes, Effects and Corrective measures.

Unit-III: Socio-Economic Problems and Issues of Development in India-- Poverty, Social Backwardness and Disparities, Displacement, Resettlement and Environmental degradation.

Unit-IV: Developmental Policies, Priorities and strategies in India and Target Groups; Democratic Decentralization and development in India.

Readings Recommended:

Aggarwal, S.K., Regional Development and Planning in India, New Delhi: Concept, 2009.
Bardhan, Pranab, The Political Economy of Development in India.
Balakrishna, Ramachandra, Regional Planning in India, Bangalore: Bangalore Printing and Publishing Co., 1948.
Bhattacharya, S.N., Development of Industrially Backward Areas, The Indian Style, New Delhi: Metropolitan, 1981.
Bhattacharya, S.N., Role of Indian Rural Institutions in Economic Growth: A Critical Study, New Delhi: Metropolitan, 1985.
Breze, Jean and Amartya K. Sen, Indian Development: Selected Indian Perspectives, Oxford University Press, 1997.
Breze, Jean and Amartya Sen, India, Economic Development and Social Opportunity, Clarendon Press, 1998.
Chakravarty, S., Development Planning: The Indian Experience.
Friedman, J. and W. Alonso (Ed.), Regional Development and Planning: A reader.
Hilhorst, J.G.M., Regional Development Theory.
Jalan, Bimal (ed.), The Indian Economy: Problems and Prospects.
Lewis, John P., India's Political Economy: Governance and Reform, Oxford University Press, 1995.
Mishra, Jagannath and Chakradhar Sinha, Planning and Regional Development in India, New Delhi: Gaurav, 1985.
Misra, R.P. K.V. Sundaram and V.L.S. Prakasa Rao: Regional Development Planning in India: A New Strategy, New Delhi: Vikas Publishing House, 1974.
Misra, R.P., Planning for Backward Areas: Some Contributions, Mysore, Institute of Development Studies University of Mysore, 1974.
NCAER, Economic Policy and Reforms in India.
Nair, K.R.G., Regional Experience in a Developing Economy, Wiley, 1983.
Ray Chaudhuri, Jayasri, An Introduction to Development and Regional Planning: With Special Reference to India, New Delhi: Orient Blackswan, 2001.
Sen, Amartya, Development as Freedom.
Sivaramakrishnan, K. and Arun Agrawal, Regional Modernities: The Cultural Politics of Development in India, Stanford: Stanford University Press, 2003.
Shukla, Amitabh, Regional Planning and Sustainable Development, New Delhi: Kanishka, 2000.
Singh, M.B. and Dubey, K.K., Regional Development Planning (Hindi).

Todaro, M.P., Development Planning, Models & Methods.
UNDP,Human Development Report,2001.
United Nations, Selected Experiences in Regional Development, 1970.

Course Outcome:
Awareness of the true state of regional development in India and the principal challenges to be encountered in its path.

COURSE- XVI-C PARTIES AND ELECTROL POLITICS IN INDIA

Unit-I: Political Parties, Meaning, and Characteristic.

Unit-II: National Political Parties: Congress and BJP: Ideology and Development,

electoral performance.

Unit-III: Regional political parties: Origin, role, impact.

Unit-IV: Electoral Politics in India: caste, class, and communalism.

Readings Recommended:

Chatterjee, Partha, (Ed.), State and Politics in India, OUP, 1999.

de Souza, Peter Ronald and E. Sridharan: India's Political Parties , Sage Publication, 2006

Hasan, Zoya (Ed.), Parties and Party Politics in India, New Delhi, Oxford, 2001.

Kohli, Atul, Centralization and Powerlessness: India's Democracy in a Comprehensive Perspective in Midgal, Joe, Atul Kohli and Vivenne Shue (Eds.), State Power and Social Forces, Cambridge University Press, 1994.

Mehra, Ajay Kumar, D.D. Khanna and Gert W. Kueck, (Ed.), Political Parties and Party Systems, New Delhi: Sage Publications, 2003.

Mendia, Dushyant, Electoral process and governance in South Asia

Mitra, Subrata K. and V.B. Singh, Democracy and Social Change in India: A Cross Sectional Analysis of the National Electorate, State, 1999.

Roy, Ramashray and Paul Wellace (Eds.) India's 1999 Elections and 20th Century Politics, New Delhi: Sage, 2003.

Shastri, Sandeep, K.C. Suri and Yogendra Yadav : Electoral Politics in Indian States, Oxford, 2009

Vora, Rajendra and Suhas Palshikar (Eds.) Indian Democracy, New Delhi: Sage, 2003.

Weiner, M., Party Politics In India.
Yadav, Krishna Kant: Emergence of Regional Political Parties in India , Adhyayan Publication, 2009

COURSE- : POLITICS OF HIMALAYAN STATES

Unit- I: Peculiarities and Legal status; Special category status.

Unit- II: Common Socio- Economics problems and Development of Himalayan states; Secessionist tendencies.

Unit –III: Emergence of Political Leadership and Political Parties and their role.

Unit-IV: Uttarakhand State: Historical background, Strategic importance, Problems and Challenges of development.

Readings Recommended:

Ahluwalia, Manjit S., Social, Cultural and Economic History of Himachal Pradesh, New Delhi: Indus, 1998.
Arora, Vibha and N. Jayaram, Routeing Democracy in the Himalayas: Experiments and Experience, New Delhi: Routledge India, 2013.
Bahadur, Jagadish, Indian Himalayas.
Bisht, N.S., Uttarakhand Himalaya Ki Arthvyavastha Kshetriya Arthshastra.
Calthoun, C., Social Theory and the Politics of identity.
Dabral, Shiv Prasad– Uttarakhand ka Itihas (Vol 1-6)
Das, Rochona, Perspectives on India's Northeast, Bibhasa 1998.
Das, Samir Kumar, Ethnicity, Nation and Security: Essays on Northeastern India, New Delhi: South Asian, 2003.
Datta, Sreeradha, The Northeast Complexities and Its Determinants, New Delhi: Shipra, 2004.
Frankel, G., Transforming India.
Gardener, Edward etal, Founders of Modern Administration in Uttarakhand 1815 to 1884, 2009.
Gassah, L.S., Regional Political Parties in Northeast India, Omsons, 1992.
Gulia, K.S., Politics and Women Empowerment in Himalayan States, 2007.
Husain Z., Uttarakhand movement: the politics of identity and frustration, a psycho-analytical study of the separate state movement, 1815-1995, Bareilly: Prakash Book Depot, 1995.
Joshi, M.P., A.C. Fanger and C.W. Brown, Himalaya Past and Present Vol. IV, Almora: Almora Book Depot, 2000.
Kothari, Smita, Social Movements and Redefinition of Democracy.
Kumar, Ashutosh (Ed.), Rethinking State Politics in India: Regions within Regions, New Delhi: Routledge India, 2011.
Kumar, Kireet and D.S Rawat: Water Management in Himalayan Ecosystem , Indus Publishing Company, 1996.
Mohan, Savita, Uttaranchal Samagra Adhyayan.
Naithani, S.P. & Mohan Naithani, Uttarakhand ka Atihasik aur Sanskritic Bhugol.
Nautiyal, R. R. and Annpurna Nautiyal Uttarakhand In Turmoil, 1996.
Pandey, G.C., Uttarakhand ki Arthvyavastha.
Fonia, Kedar S., Uttaranchal Rajya Nirman ka Sankshipt Itihas, Winsar, 2005.
Phukon, Girin, Ethnicisation of Politics in Northeast India, New Delhi: South Asian, 2003.
Raturi, Hari Krishna– Garhwal Ka Itihas.
Shah, Ghanshyam, Social Movements and the state.
Teng, Mohan Krishan and Santosh Kaul, Kashmir's Special Status, New Delhi: Oriental,

1975.
Teng, Mohan Krishan, State Government and Politics, Jammu and Kashmir, New Delhi: Sterling, 1985.
Tolia, R.S., Inside Uttarakhand Today, 2007.
Trivedi, B.R., Autonomy of Uttarakhand.
Verma, V., The Emergence of Himachal Pradesh: A Survey of Constitutional Developments, New Delhi: Indus, 1995.

Course Outcome:
Appreciation of the various aspects of the politics of Himalayan States making it easier to comprehend regional aspirations and challenges.

COURSE- XVII-C: CONTEMPORARY POLITICS IN INDIA

Unit-1 Contemporary Issues:- Communalism, Secularism, Internal Security Concerns, Good Governance, Role of Media.

Unit –II: Reservation Policy –Mandal Commission, Social Inclusion.

Unit –III: Demand for Separate States, Separatists Movements, Regional Issues.

Unit-IV: Challenges to Indian democracy: Political Institutions, Corruption, citizens social Empowerment.

Readings Recommended:

Awasthi, A.P., Bhartiya Sashan Aur Rajniti.
Basu, D.D., An Introduction to the Constitution of India,.
Basu, D.D., Bharat Ka Samvidhan.
Chandhok, Neera and Praveen Priyadarshi (Ed), Contemporary India: Economy, Society, Politics, New Delhi: Pearson, 2009.
Frankel, Francine R. and M.S.A. Rao, Dominance and State Power in Modern India: Decline of a Social Order, Oxford, 1990.
Frankel, Francine R., Transforming India: Social and Political Dynamics of Democracy, Oxford University Press, 2000.
Gehlot, N.S., New Challenges to Indian Politics, New Delhi: Deep and Deep 2002.
Hasan, Zoya, Politics and the State in India, Sage, 2000.
Jones, Morris, The Government And Politics Of India.
Kashyap, Subhash C., Coalition Government and Politics in India, New Delhi: Uppal, 1997.
Kothari, Rajni, Caste Class and Politics In India.
Narayan, V N and Jyoti Sabarwal, India At 50;Bliss Of Hope And Burden Of Reality.
Panandiker, V A Pai (Ed.), The Politics Of Backwardness.
Rangriz, Hassan (Ed.), Indian Democracy And Governance.
Rupa, C., Reservation Policy; Mandal Commission and After.
Shakir, Moin, State and Politics in Contemporary India, Ajanta, 1986.
Singh and Saxena, Indian Politics: Contemporary Issues and Concerns, PHI Learning, 2008.
Singh, Mahendra Prasad and Anil Mishra, Coalition Politics in India: Problems and Prospects, New Delhi: Manohar, 2004.
Yasin, Mohammad and Pradeep k Sengupta, Indian Politics: Process, Issues and Trends.

COURSE- XVIII-B: FINANCIAL ADMINISTRATION IN INDIA

Unit-I: Financial Administration: meaning, nature, scope; agencies of financial administration.

Unit-II: Budget system: Introduction of budget , Budgetary process, fiscal responsibility in India.

Unit-III: The Finance Ministry.
Unit-IV: Accounting and auditing system in India.

Readings Recommended:

Dubey, Ramesh & Harish Chandra, Bharat mein Lok Prashasan.
Gupta, R.K. and P.K. Saini, Financial Administration in India: Changing Contours and Emerging Challenges, New Delhi: Deep and Deep, 2007.
Lal, K.S., Public Administration.
Lall, Gurdev Singh, Financial Administration in India, H.P.J. Kapoor, 1969.
Lall, Gurdev Singh, Public Finance and Financial Administration in India, H.P.J. Kapoor, 1976.
Maheswari, S.R., Indian Administration.
Premchand, A., Control of Public Expenditure in India: A Historical Account of the Administrative, Audit and Parliamentary Processes, Allied Publishers, 1963.
Sarkar, Bimal Krishna, Grantha Prakash, 1975.
Sharma, M. P. & B.L. Sadana, Public Administration Theory & Practice.
Thavaraj, M. J. K., Financial Administration.
Wattal, Pyare Kisham, Parliamentary Financial Control in India, Minerva Book Shop, 1962.

Course Outcome:
Appreciation of the system of financial administration in India.

COURSE- XVIII-C: WOMEN EMPOWERMENT

Unit-I:– Women Empowerment: Meaning, Concept, Importance, Dimensions.

Unit-II:- Status of Women in India: Historical, Socio-Economic, Political, Educational, Role in the Decision Making Process.

Unit-III:- Women Empowerment: Issues and Strategies, Constitutional Mandate for Gender Equality, Positive Discrimination.

Unit-IV:- Empowerment through Reservation: Impact of 73rd & 74th Amendments, Role and status of women in Uttarakhand.

Readings Recommended:

Batliwala, S., Empowerment of Women in South Asia: Concepts and Practices.
Bhadauria, Mridula, Women in India: Some Issues.
Bhardwaj, Prem R. (Ed.), Gender Discrimination: Politics of Women Empowerment.
Bhuimali, Anil and Poddar, Development of Rural Women Through Education &

Empowerment
Devasia, L and V. V. Devasia, Empowerment of Women for Sustainable Development, New Delhi: Ashish Publishing House, 1994.
Dube, M.P. and Neeta Bora , Social Justice and Women in India.
Emerson, Elaine and P.G. Chakrabarti, Women, Gender and Disaster, Sage, 2009.
Goel, S.E. and Shalini Rajneesh, Panchayati Raj in India.
Gupta, Mukta, Issues Related to Women.
Herrick, Empowerment Practice and Social Change.
Jha, Uma Shankar, Arathy Mehta and Lathika Menon, (Ed.) Status of Women: Crisis and Conflict in Gender Issues. New Delhi: Kanishka Publishers, 1998.
John, Mary E (Ed.), Women's Studies in India: A Reader, Penguin, 2008.
Kumar, Arun, Empowering women, New Delhi: Sarup and sons Pub., 2002.
Kumari, Sumitra, Dynamics of Women Empowerment.
Letha Kumari, R., Women in Politics: Participation and Governance.
Palanithurai, G., T. Parthiban and J. Vanishree, Empowering Women , concept Publishing company, 2007.
Pillai, J.K., Women and Empowerment, New Delhi: Gyan Publishing House, 1995.
Purusothaman, Sangeeta, The Empowerment of Women in India Grassroot Women's Networks and State, New Delhi: Sage publications, 1998.
Seth, Mira, Women and Development. The Indian Experience. New Delhi, Sage Publications, 2001.
Singh Roy, D.K., Peasant Movements and Empowerment of Rural Women.
Toch, H., Social Psychology and Social Movements.

FOURTH SEMESTER

CORE/ COMPULSORY COURSES

COURSE- XIX: THEORIES OF INTERNATIONAL POLITICS

Unit-I:
Disciplinary lineage of IR, International Politics: Meaning, Nature, Scope and Development

Unit-II:
Realism and Neo-Realism
Liberalism and Neo-Liberalism

Unit- III:
English School
Constructivism

Unit- IV:
Marxist Theory
Feminism, Non-western IRT

General Readings

1. Jackson, R. and Sørensen, G. (2007) Introduction to International Relations: Theories and Approaches, Oxford: Oxford University Press.
2. John Baylis et al. (eds.), The Globalisation of World Politics: An Introduction to IR, Oxford: Oxford University Press.
3. Christian Reus-Smit and Duncan Snidal (eds.) The Oxford Handbook of IR, Oxford: Oxford University Press.
4. Carlsnaes, W; Thomas Risse and Beth A. Simmons (eds.) Handbook of International Relations, New Delhi SAGE Publications.
5. S. Burchill, A. Linklater, et al. Theories of International Relations. (London: Macmillan), 93–118.
6. Rumki Basu, R (2017) International Politics Concepts, Theories and Issues. New Delhi SAGE Publications.
7. Rumki Basu, (2019) Antarrashtreey Rajneeti: Avdharnayen, Siddhant tatha Mudde, New Delhi SAGE Publications.
8. Kumar Ajay (2019) Antarrashtriya Sambandhon ke Siddhanta: Ek Parichay, New Delhi: Pearson.

UNIT 1

Adler, E. and Pouliot, V. (2011) 'International Practices', International Theory, 3(1): 1- 36.
Brown, C. and Ainley, K. (2005) 3rd Edition, Understanding International Relations Houndmills: Palgrave Macmillan.
Snyder, J. (2004) 'One World, Rival Theories', Foreign Policy, 145: 52–62.
Walt, S. M. (1998) 'International Relations: One World, Many Theories,'Foreign Policy(Spring 1998): 29-46.

UNIT II

Doyle, M. (1997) Ways of War and Peace: Realism, Liberalism, and Socialism, New York: W.W. Norton & Company.
Keohane, R. O. and Nye, J. S. (2001) Power and Interdependence, Pearson, 4th edition.
Dunne, T. and Schmidt, B. (2008), 'Realism', in John Baylis et al. (eds.), The Globalization of World Politics, 3rded., Oxford: Oxford University Press.
Dunne, T. (2008), 'Liberalism' in John Baylis et al. (eds.), The Globalisation of World Politics: An Introduction to IR, Oxford: Oxford University Press.
Morgenthau, H. J. (1948) Politics among Nations: The Struggle for Power and Peace, New York: Alfred Knopf.
Waltz, K. (2010)Theory of International Politics, Reading: MA: Addison-Wesley. First Edition.

UNIT III

Barnett, M. (2008), 'Constructivism' in John Baylis et al. (eds.), The Globalisation of World Politics: An Introduction to IR, Oxford: Oxford University Press.
Bull, H. (1977) The Anarchical Society: A Study of Order in World Politics, New York: Columbia University Press.
Buzan, B. (2001), 'The English School: An Underexploited Resource in IR', Review of International Studies, 27 (3): 471-488.
Dunne, T. (2008), 'The English School' in Christian Reus-Smit and Duncan Snidal (eds.) The Oxford Handbook of IR, Oxford: Oxford University Press.
Hurd, I. (2008) 'Constructivism' in Christian Reus-Smit and Duncan Snidal (eds.) The Oxford Handbook of International Relations, Oxford: Oxford University Press: 298–316.
Wendt, A. (1992) 'Anarchy Is What States Make of It: the Social Construction of Power Politics,' International Organization, 46: 391-425.

UNIT IV

Acharya, A. and Buzan, B. (2009) Non-Western International Relations Theory: Perspectives On and Beyond Asia, London: Routledge.
Feminism", in John Baylis et al. (eds.), The Globalisation of World Politics: An Introduction to IR, Oxford: Oxford University Press.
Hobson, J. (2012) The Eurocentric Conception of World: Western International Theory, 1760-2010, Cambridge: Cambridge University Press.
Linklater, A. (1990) Beyond Realism and Marxism: Critical Theory and International Relations, Houndmills: Macmillan.
Tickner, J. A. and Sjoberg, L. (eds.) (2011), Twenty Years of Feminist International Relations: A Conversation about the Past, Present and Future. London and New York: Routledge.

COURSE- XX: INTERNATIONAL LAW

Unit- I: International Law: Meaning, Nature, Relation with Municipal Law; Sources of International Law.

Unit-II: Subjects of International Law, Diplomatic Envoys, Extradition and Asylum.

Unit-III: Settlement of Disputes: Amicable and Compulsive Means.

Unit-IV: War: Consequences and Termination, War Crimes, Neutrality, Blockade and Contraband.

Unit-V: Leading Cases: The Paquet Havana and the Lola, Corfu Channel, The Savarkar,The S.S. Lotus, The Zamora, The Chung Chichueng VS The King,The Albama Claims, Mighell Vs the Sultan of Johore, The Altmark.

Readings Recommended:

Fadiya, B.L., Antarastriya Vidhi.
Fenwick, International Law.
Friedmann, W., The Changing Structure of International Law, New York, 1964.
Gairola, R.N., Antarastriya Vidhi.
Hide, International Law.
Kapoor, S.L., Antarastriya Vidhi Aur Manav Adhikar.
Lawrence, Principles of International Law.
Oppenheim, International Law Vol. 1&2.
Starke, An Introduction to International Law.
Stowell, International Law.
Verma, S.K., An Introduction to Public International Law.

Course Outcome:
Initiation into the basics of international law.

COURSE-XXI: DISSERTATION

COURSE- : POLITICAL PHILOSOPHY OF MAHATMA GANDHI

Unit-I: Influence on Gandhi, Gandhiji`s Conception The end and means.

Unit-II- :Truth, Non-violence and Satyagrah.

Unit- III: Social ideas, Political ideas, Economic ideas.

Unit- IV: Contribution and relevance of Gandhi.

Readings Recommended:

Adhikari, G., Gandhism- AReview.Bombay,1940.
Alexander, Horace, and Others, Social and Political Ideas of Mahatma Gandhi.. New Delhi,1949.
BARR, f. Mary, Conversations and Correspondence with Mahatma Gandhi. Bombay,1949.
Bose, N. K., Studies in Gandhism. Calcutta,1947.
Catlin,G., In the Path of Mahatma Gandhi. London,1948.
Datta, d.m., The Philosophy of Mahatma Gandhi. Wisconsin, 1953.
Dhawan Gopinath, The Political Philosophy of Mahatma Gandhi, The Gandhi Peace Foundation, New Delhi, 1990
Hocking, W.E., Man and the State. Yale University PRESS, 1926- The Lasting Elements of Individualism. Yale University Press, 1937.
Kripalani, J. B.,The Gandhian Way. Bombay, 1938.
Kumari, Sanjay, Gandhian Philosophy in the 21st Century –, Jagat Parkashan, 2008
Merriam, C.E., Political Power. New York,1934.
Polak, H.S.L., Mahatma Gandhi. Madras,1930
Pyarelal, The Epic Fast.Ahmedabad, 1932.
Radhakrishnan, S.(ed.), Mahatma Gandhi –Essays and Reflections on His Life and Work. LONDON, 1939.
Rajendraprasad, Satyagraha in Champaran. Madras, 1928. (Also Ahmedabad, 1949).
Sharma, B.S., Gandhi as a Political Thinker. Allahabad, 1956.
Shelvankar, K.S., Ends Are Means. London, 1938.
Tendulkar , D.G.,Mahatma – Life of Mohandas Karamchand Gandhi, 6 Vols. Bombay,1951 -53.

COURSE- : HUMAN RIGHTS

Unit-I: Meaning, Nature, Significance and Development of Human Rights.

Unit-II: The U.N. Charter and Universal Declaration of Human Rights.

Unit-III: National Human Rights Commission of India: Organisation, Structure, Functions and Powers.

Unit-IV: Non State Actors: Amnesty International, Asia Watch and Green Peace.

Readings Recommended:

Agarwal, Hari Om, Implementation of Human Rights.
Alston, Philip (Ed.), The United Nations and Human Rights.
Arora, Lalit Kumar, Major Human Rights Instruments, Isha Books Publication, 2006.
Batra, T.S., Human Rights:A Critique.
Brownlie, Ian (Ed.), Basic Documents on Human Rights.
Donnelly, Jack, The Concept of Human Rights, London, 1973.
Diwan, P., Human Rights and Law.
Hingorani, Human Rights in India.
Iyer, Krishna, Human Rights and Law.
Kapoor, S.K., Manwadhikar.
Kazmmi, Fareed, Human Rights Myth and Reality.
Raju, M.V., Human Rights : Today and Tomorrow.
Robertson, A.H. Human Rights in the World.
Sastry, T.S.N., India and Human Rights, Concept, 2005.
Simmons, Beth A., Mobilizing for Human Rights, Cambridge, 2009.
Singh, B.P., Human Rights in India.
Solby, David, Human Rights.
Soni, S.K., 2007 Human Rights : Concept Issues, Emerging Problems.
Vijapur, A.P., Essays on Human Rights.
Vijapur, A.P., Implementing Human Rights in the Third World, Manak,2008.

COURSE- XXIII-C: GLOBAL TERRORISM

Unit-I: The Concept of terrorism: meaning, definition, nature, types.

Unit-II: Historic background: Origins of Terrorism, Terrorism in Early 20th Century, Terrorism in the Post World War II Era.

Unit-III: Causes of terrorism, its Objectives, Strategies and Impact.

Unit-IV: The twenty-first century scenario: changing tactics, transnational terrorist cooperation, use of ICT for coordinating terrorist activities, terrorism in the cyber space, vulnerability of the weapons of mass destruction.

Readings Recommended:

Bjorgo, Tore,(Eed.), Root Causes of Terrorism: Myths, Reality and Ways Forward, Routledge, 2005.

Burchall, Larry, Emergence of Terrorism, Atlantic Publishers, 2005
Ganor, Boaz, The Counter-Terrorism Puzzle: A Guide for Decision Makers, Transaction, 2005.
Gross, Emanuel, The Struggle of Democracy Against Terrorism: Lessons from the United States, United Kingdom and Israel, Virginia, 2006.
Gupta, K.R., Global Terrorism, Atlantic Publication, 2004
Gurr, Nadine & Benjamin Cole, The New Face of Terrorism: Threats from Weapons of Mass Destruction, Tauris, 2002.
Hoffman, Bruce, Inside Terrorism, Columbia UP, 2006.
Horgan, John, The Psychology of Terrorism, Routledge, 2005.
Katona, Peter, Michael Intriligator and John Sullivan, (Ed), Countering Terrorism and WMD: Creating a Global Counter-Terrorism Network, Routledge, 2006.
Weimann, Gabriel, Terror on the Internet: The New Arena, the New Challenges, US States Institute of Peace, 2006.
Martin, Gus, Understanding Terrorism: Challenges, Perspectives, and Issues, Sage, 2006.
Pillar, Paul, Terrorism and U.S. Foreign Policy, Brookings, 2003
Sageman, Marc, Understanding Terror Networks, Pennsylvania, 2004.
Weinberg, Leonard, Global Terrorism: A Beginner's Guide, Oneworld, 2008.
Wilkinson, Paul, Terrorism and the Political State.
Yadav, Virendra Singh, Atankvad Ka Anterrastriya Paridrishya: Chunautiya Aur Samadhan Ki Dishayen, 2011.

Course Outcome:
Comprehension of the spector of global terrorism and the threat posed by it.

COURSE-XXIV-A: POLITICS OF ENVIRONMENT AND DEVELOPMENT

Unit I - Environment and Development: Meaning, Definition, Problems and changing concepts – economic growth, Human development and sustainable development.

Unit II - Environment and Conflict of Resources: Forests, Biodiversity, protected areas.

Unit III - Poverty, Social Backwardness and disparities, Social Movements, Forest

Rights.

Unit IV -: Climate Change and impact on Development, Environment Protection.

Readings Recommended:

Dryzek, John S., The Politics of Earth: Environmental Discourses.
Guha, R., Environmentalism.
Gupta, R.D., Environmental Pollution: Hazards and Control.
Kandari, O.P. and O.P. Gusain: Garhwal Himalaya Nature, Culture and Society, Transmedia Publication, 2001.
Krishna, Sumi, Women's Livelihood Rights –Sage Publication, 2007.
Manihi, S. K., Environment and Development.
McNeill, J. R., John Robert McNeill, and Paul Kennedy, Something New Under the Sun: An Environmental History of the Twentieth Century World, 2001.
Menon, Ajit, Praveen Singh, Esha Shah and others, Community Based Natural Resource Management, Sage Publication, 2007.
Nag, P., Environmental Pollution and Development.

Naidu, G. S., Environmental Economics.
Pandy, Ashutosh, Bhoopal Singh and G.K Singh, Urbanization and Globalization in India , Radha Publication, 2008.
Redclift, Michael, Political Economy of Environment: Red and Green Alternatives.
Rao, M.G. Ramakant, Good Governance Modern Global and Regional Perspective, Kanishka Publishers, 2008.
Rathod, P.B., Women and Development, ABD Publications, 2009.
Rosenbaum, Walter A., Environmental Politics and Policy, East west press, 1991.
Shiva, Vandana, Ecology and the Politics of Survival, Sage, 1991.
Singh, Kartar and Anil Shishodia, Environmental Economics, Sage, 2007.
Singh, R. B. and S. Misra, Environmental law in India: issues and Responses.
Sinha, R.N.P., Environment and Human Response.

Course Outcome:
Understanding of the conflict between environment and development and the need and the means of reconciling them.

COURSE-XXIV-B: MODERN POLITICAL IDEOLOGIES

Unit-I: Liberalism and New- Liberalism

Unit-II: Idealism.

Unit-III: Socialism, Communism.

Unit-IV: Communitarisam

Readings Recommended:

Berki, R.N., Socalism.
Dubey, S.N., Rajnitik Vichardharyen.
Gupta, M.G.,Modern Socialist Theories.
Jain, Pukhraj,Rajnitik Vichardharyen.
Jay, D.,Socialism and the New Society.
Kitchen, M., Fascism.
Manning, D.J., Liberalism,Ancient and Modern.

Course Outcome:
Knowledge of the major ideologies influencing politics.

COURSE-XXIV-C: PEACE, SECURITY AND CONFLICT RESOLUTION

Unit-1 Peace: Approaches, Peace-Keeping, Peace-making, Peace-building, post –peace confidence building measures.

Unit-II: Concept of Security: Traditional Military-Perception, Conventional arms, nuclear arms, Modern Perception -Comprehensive Security

Unit-III: Conflict: Typology, Causes

Unit-IV: Conflict Resolution and Transformation: General Strategy and Tactics

Readings Recommended:

Bilgrami, S.J.R, Dynamics of Sanctions in World Affairs, Atlantic Publication, 2004.
Boulding, Elise, New Agenda for Peace Research.
Bondurant, J.V., Conquest of Violence.
Brown, Chris and Kirsten Ainlegy, Understanding International Relations, Palgrave Macmillan Publishing, 2005.
Fredrick, H.H., Relationship of Nations.
Galtung, J., Peace by peaceful Means.
Ghali, Boutras Boutros, An Agenda for Peace.
Mckinlay, R.D. and R.Little, Global Problems and World Order.
Parmila, N.K., Global Diplomacy, Manglam Publication, 2010.
Roach, Steven C., Critical Theory of International Relations, Routledge, 2009.
Sandole, Dennis and Hugo Van Merwe (Ed.), Conflict Resolution Theory and Practice.
Wallensteen, Pete, Peace Research: Achievements and Challenges.
Weber, Thomas, Conflict Resolution and Gandhian Ethics.

Course Outcome:
Understanding the importance of peace and security and the means of preserving them.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – PSYCHOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

M.A Psychology

SEMESTER-I
CORE COURSE

PSY C-101: PERSPECTIVES ON HUMAN BEHAVIOUR

Unit- I:

Introduction: - Understanding Psychology, Goals and areas of Psychology; Scientific Psychology.

Unit - II:

Perspective in behavior: Structuralism and functionalism. Psychoanalytic, Gestalt, and Behaviorism.

UNIT-III:

Humanistic, Cognitive, Psychobiology, Culture and Evolutionary view points.

BOOKS RECOMMENDED:

1- Karen Huffman (2000) Psychology in Action ,N.Y.: Wiley
2- Atkinson et al (1983) : Introduction to psychology. N.Y.: HBJ
3- Dennis Coon: Introduction to psychology_ Exploration and Application (8th edi.)
4- Particia H. Miller: Theories of developmental psychology.
5- Brennan James : Readings in the history and Systems of psychology.
6- Marx and Hillex: systems and Theories.
7- Chaplin,J.P. & Karwie, T.S:systems Theories of psychology.
8- Wolman: Historical Roots of contemporary psychology.
9- Ojha,R.K: manovigyan ke Sampradaya.

PSY C-102: Cognitive Psychology -I

1. **Introduction to Cognitive Psychology:-**
   - i. Concept of cognitive psychology.
   - ii. Emergence of cognitive psychology.
     - a) Early role of psychology
     - b) The early twentieth century.
   - iii. Research methods in cognitive psychology.
     - a) Laboratory or other controlled experiments.
     - b) Psychological research
     - c) Self report, case study & Naturalistic observation
   - iv. Applications of cognitive psychology
2. **Attention and Perception:-**
   - i. Attention:-
     - a) Divided and Selective attention.
     - b) Vigilance.
     - c) Signal detection.
   - ii. Approaches to the study of perception :-
     - a) Gestalt
     - b) Physiological (Hebb)
     - c) Information processing approach.
   - iii. Theories of attention process.
   - iv. Applications of:-
     - a) Subliminal perception.
     - b) Perceptual defense.
     - c) Extra sensory perception.
3. **Memory I:-**
   - i. Memory processes:-
     - a) Encoding.
     - b) Storage.
     - c) Retrieval.
   - ii. Stages of memory:-
     - a) Sensory memory.
     - b) Short term memory(STM)
     - c) Long –term memory(LTM)
   - iii. Episodic and Semantic memory.
   - iv . Theories of forgetting:-
     - d) Interference.
     - e) Decay.
     - f) Retrieval.

PSY C 103:-FOUNDATION OF BEHAVIOROAL RESEARCH -I

I- Nature of Experimental Research
II- Choice & Statement of Problem
III- Formulation of Hypothesis, Null Hypothesis & Directional Hypothesis.
IV- Variables- Types and Controlling Techniques.
V- Research Design – Randomized , Factorial.

Source Books:-

1. McBurry.D.H.(2002). Research Methods.USA:Wordsworth,Thompson.
2. Karlinger,F.N.(1994).Fundamentals of Behavioral Research.(3rd ed).
3. Shaughnessy, J.J.&Zechmiester, E.B.(1997).Research Methods in psychology (4th ed)
4. A.K singh , Test Measurement and research Methods in Behavioral sciences , Bharti bhawan.

Reference Books:-

1. Borude,R.R.(2005). Sanshodhan paddhatishastra .pune:pune Vidyarthi Grhua.
2. Desai, B& Abhyankar,S.C.(2007) prayogic manasashastra and sanshodhan paddhati. Pune: Narendra Prakashan.
3. Kothari, C.R.(1985).Research Methodology: Methods & Techniques. New Delhi:Wiley Eastern Ltd.

PSY C-104: PSYCHOLOGICAL STATISTICS -I

I- Applications of statistics in psychology.
II-Frequency distribution, graphical presentation.
III-Measures of variability.
IV- Concept and significance of Probability-Normal Distribution; Curve & its application.

V-Correlation; Pearsons' Product Moment method, Biserial and Point Biserial correlation, Phi and Contingency coefficient, Tetra choric.

PSY C-105: HEALTH PSYCHOLOGY:

CONTENTS

1. **Health Psychology**
   Nature, Scope and its interdisciplinary and socio-cultural. The relationship of health psychology with clinical psychology, Behavioral Medicine.

2. **Models of Health**
   Personality-Allport, Roger, Maslow, Biopsychosocial perspectives. Eastern approaches: Zen Buddhism, Concept of sthita projana (Bhagvad Gita), Behavioural Referents of the concepts of Anasakti. Health-related beliefs.

3. **Health Promotion and Disease Prevention**
   Behavioral Risk Factors (e.g, drug and alcohol use; unsafe sexual behaviour; smoking, diet, and sedentary life style), Development of health habits and /or reduction of unhealthy behavior.

4. **Stress, Personality and Social support as Psycho-Social Linkages of Ill-health**
   Cardio-Vascular Disorders; AIDS.HIV; Diabetes Mellitus; pain; cancer

5. **Conditions/ Resources Promoting and Maintaining Health**
   Biological, Socio-Cultural, psychological , Economic and, Spiritually-Oriented Interventions.

M.A - Semester-II

CORE COURSE

PSY C-007: Physiological Psychology

1.Organization and functions of the central nervous system: Spinal cord, hindbrain, midbrain and forebrain.

2.Methods of physiological psychology: Invasive physiological methods; methods of visualizing the living human brain; Recording human psycho physiological activity.

3.Neural conduction and transmission: Resting membrane potential; Action potential; synaptic transmission; neuromuscular transmission: Information processing.

4.Hormones and the brain: Endocrine communication and pheromone communication.

PSY C-008: Cognitive Psychology-II

I- **Problem solving , reasoning and thinking-**
- Process and determinants of problem solving.
- Theories of thought processes: Associations & Gestalt. Role of concepts in thinking.

II- **Emotions**
- Nature of development.
- Theories of emotions: psychological cognitive and Opponent process.
- Indicators of emotions, recognition of emotions.

III- **Creativity**
- Nature of measurement. Factors affecting creativity.

IV- **Motivation**
- Cognitive basis of motivation: Intrinsic motivation, Attribution, Competence.
- Measurement of motives : Issues and Techniques.

PSY C-009: Foundation of Behavioral Research-II

I- Nature and Types of social Research.
II- Difference between Experimental and Social Research.
III- Research tools or techniques- Observation, Case study method, Rating scale, Content analysis, Sociometry and Semantic differential.
IV- Sampling Techniques.
V- Report writing

Source Books:-

1.Broude,K.D.(1989). Experimental Design in Behavioral Research. New Delhi:Wily Estern Ltd.
2. A.K singh , Test Measurement and research Methods in Behavioral sciences , Bharti bhawan.
3.Robinson,P.W.(1976). Fundamentals of Experimental psychology. prentice-Hall.

PSY C-010: Psychological statistics -II

1. Parametric and non parametric statistics.
2. Significance difference Between Means. Standard error of Mean, Median, SD, and Correlation.
3. Analysis of Variance-One way, Two way classification.
4. Non parametric test-Chi-square test, Median test, Sign-test.

BOOKS RECOMMENDED:

1. Mangal,S.K.(2002). Statistics in Psychology and Education (2^{nd}).New:Delhi:Prentic-Hall.
2. Garrett-Statistics in Education and Psychology
3. Ferguson- Statistical Analysis in Psychology and Education.
4. Non Parametric Statistics.

PSY C-011: Behavioral Disorder

I- Introduction to psychopathology: The concept of normality and abnormality, Historical development of abnormal psychology.

II- Signs and symptoms of mental illness: Delusions Hallucinations, Obsessions, Compulsions etc.

III- Etiology of Behavioral Disorder.

IV-Psychological models of psychopathology: Psychodynamic, cognitive behavioral and existential.

BOOKS RECOMMENDED:-

1. Coleman,J.C.Abnormal Psychology & Modern. Life.
2.S.K.mangal .Aruan k. kapil.sarson. Abnormal psychology, PHI
3.Arun K. singh, Abnormal psychology,(Hindi & English)motilal Vnarasidas, Suleman Abnormal psychology,motilal Vnarasidas, Srivastava.D.N.Aadunik Asamanya manoviyigayan

M.A. SEMESTER-III

CORE COURSE

PSY C-013: PERSONALITY

I. Introduction:

i. Concept and Basic issues of Personality.

ii. Approaches to the study of personality-psychoanalytic approach

2. Determinants of personality-Biological, Psychological and Socio-cultural factors.

3. Personality Assessment – Subjective and projective techniques, self report, personality inventories.

SOURCE BOOKS:

1. Hall, C.S.Lindzey, G & compbell.J.B.(2004). Theories of personality (4th ed). New York, Jihn wiley & son's, Inc.

2.Barger, E. (2006). Personality theories (7th ed). New York: Houghton Mifflin Company

REFERENCE BOOKS:

1. Barger, J.M. (2004). Personality (6th ed). USA: Wadsworth/ Thompson Learning.

2. Hjelle,L.A.&Ziggler, D.J.(1992). Personality theories (3rd ed). New York:McGraw-Hill, Inc.

3. Mischel, W. (1976). Introduction to Personality. USA: Holt,Rnehart & Wiston.

PSY C-014: PSYCHOLOGICAL TESTING: APPLICATIONS

1. TESTING IN EDUCATIONAL SETTING

(I). General mental ability tests: Cattell's Culture-fair Test of Intelligence.

(II). Binet test, Raven, WISC,

(III). Differential Aptitude Test (DAT).

(IV). Personality and interest inventories.

2. TESTING IN CLINICAL SETTING:

(I) Testing based on the logical-content strategy- Woodworth personal Data sheet.

(II) Tests based on the Criteria –Group strategy-MMPI.

(III) Tests based on the Factor-Analytic strategy-16PF

(IV) Test based on the Theoretical strategy- EPPS, self concept inventories,MPI modernly personally Interlay.

(V) Projective and neuropsychological testing.

3. TESTING IN COUNSELING SETTING:

(I) General ability testing: Individual tests, group tests

(II) Multiple aptitude tests DAT, GATB.

(III) Strong Vocational Interest Blank (SVIB).

(IV) Anxiety and adjustment test

BOOKS RECOMMENDED:

1.Kaplan, R.M.& saccuzzo,D.P. (2007).psychological Testing: principles, Applications, and Issues. Australia: Thomson Wadswoerth.

2.Anastasi, A & Urbina, S. (1997). Psychological testing. N.D.pearson Education,

PSY C 15: SOCIAL PSYCHOLOGY

(A) Definition of Social Psychology social Psychology as Science

i. Special methods of Social Psychology-

ii. Experimental Method

iii. Partic pant Observation

iv. Sociometry

(B) Group Behavior

i. Formation, structure and types of Groups

ii. Group Cohesiveness

iii. Group Interaction

(c).**Attitude-**

(i). Concept formation and change

(ii). Measurement

(iii). Theories of attitude change –Balance Theory, Exchange theory

Cognitive diisonaive theory

BOOKS RECOMMENDED:

1.Berkowitz, L.and walster, E. (EDS).Advances in Experimental social psychology.

2.G.Lindzey and E.Avanson. the Hand Book of social

Psychology (3rd ed).

3.Cook. kretch and crusel bulleki . Sulman- Higher social psychology Motilal Banarasidas .

M. A. Semester-IV

Core Course

PSY C -016 Theories of personality

Unit-I

a. Murray's theory

b. Maslow's theory

c. Roger's self theory

Unit- II

a. Allport's theory

b. Cattell's Factor theory

c. Eysenck's dimensional theory of personality

Unit-III

a. Lewin's Field theory

b. Festinger's cognitive dissonance theory

c. Dollard &Miller's stimulus response theory.

SOURCE BOOKS:

1.Hall, C.S.Lindzey, G & compbell.J.B.(2004). Theories of personality (4th ed). New York, Jihn wiley & son's, Inc.

2.Barger, E. (2006). Personality theories (7th ed). New York: Houghton Mifflin Company.A.K. Singh Psychology of personality, Motilal Bnarsidas.

REFERENCE BOOKS:

1.Barger, J.M. (2004). Personality (6th ed). USA: Wadsworth/ Thompson Learning.

2. Hjelle, L.A. & Ziggler, D.J.(1992). Personality theories (3rd ed).New York:McGraw-Hill, Inc.

3. Mischel, W. (1976). Introduction to Personality. USA: Holt,Rnehart & Wiston

PSY C-017: TEST CONSTRUCTION

1. Principles of Test construction, Item Analysis, Norms and their uses, Reliability and Validity.

2. Test of General intellectual development. Stanford Binnet scale of intelligence, Weschler's scales. Individual & Group tests, performance test, non language test.

BOOKS RECOMMENDED:

1.Kaplan, R.M.& saccuzzo,D.P. (2007).psychological Testing:principles, Applications, and Issues. Australia: Thomson Wadswoerth.

2.Anastasi, A & Urbina, S. (1997). Psychological testing. N.D.pearson Education,

3.Gregory.R.J.(2005).psychological testing: History. Principles and applications. New Delhi: Pearson Education.

4. Freeman,F.S. 3rd ed. (1965).psychological testing .New Delhi oxford & IBH Publishing Co Pvt.Led.

5.Cronbach,L,J5th ed. (1990). Essential of psychological testing New york: Harper Collins Publishers.

6.Anastasi A,.(1988). Psychological Testing: New York:McMilla

PSY C- 018 - APPLIED SOCIAL PSYCHOLOGY

UNIT-I:

Social perception:

i. Meaning & Nature of social perception

ii. Perceptual Accentuation

iii. Role of Non Verbal cues in person perception

UNIT-II:

Pro-Social Behavior:

i. Determinants of Helping Behavior

ii. Theories of pro-social Behavior

a. Social Exchange Theory.

b. Social Norm Theory.

c. Reinforcement Theory

UNIT-III: Psycho-Social Issues and Indian Society

Poverty, Gender issues, social Institutions, population issues, dowry, sex discrimination, Social movements.

BOOKS RECOMMENDED:

1. Berkowitz, L. and walster, E. (EDS).Advances in Experimental social psychology.
2. G.Lindzey and E.Avanson. the Hand Book of social Psychology (3rd ed).
3.Cook. M.(Ed.)issues in person Perception.
4. Suleman. Social Psychology motilal Banarasidas.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – RURAL TECHNOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

M.Sc. RURAL TECHNOLOGY
(Revised Syllabus w.e.f. the academic session 2023-2024)

Course Code	Course Title	Credit (Marks)					
	Semester I	**Total**	**Theory**	**Tutorial**	**Practical**	**Sessional**	**Credit**
SOA/RT/C001	Integrated Watershed Management	100	2(60)	-	1(20)	20(10+10)	03
SOA/RT/C002	Nursery Techniques & Management	100	2(60)	-	1(20)	20 (10+10)	03
SOA/RT/C003	Project Planning in Extension Education	100	2(60)	1(20)	-	20 (10+10)	03
SOA/RT/C004	Fundamentals of Extension Education	100	2(60)	1(20)		20 (10+10)	03
SOA/RT/C005	Research Methods in Behavioral Science	100	2(60)		1(20)	20 (10+10)	03
SOA/RT/C006	Introduction to Apiculture	100	2(60)		1(20)	20 (10+10)	03
	Total	**600**	**12**	**02**	**04**		**18**
Semester II							
SOA/RT/C007	Soil Science and Agricultural Chemistry	100	2(60)	-	1(20)	20(10+10)	03
SOA/RT/C008	Diffusion & Adoption of Innovations	100	2(60)	-	1(20)	20 (10+10)	03
SOA/RT/C009	Development perspectives of extension education	100	2(60)		1(20)	20 (10+10)	03
SOA/RT/C010	Innovative Technologies for Rural Development	100	2(60)	-	1(20)	20 (10+10)	03
SOA/RT/C011	Participatory Methods For Technology Development and Transfer	100	2(60)		1(20)	20 (10+10)	03
SOA/RT/C012	Mushroom Cultivation Technique	100	2(60)	-	1(20)	20 (10+10)	03
Self-Study: Any One of the following							
SOA/RT/SS001	Rural Tourism	100	2(60)	1(20)	-	20 (10+10)	03
SOA/RT/SS002	Environmental Impact Assessment	100	2(60)	1(20)		20 (10+10)	03
	Total	**600**	**12**		**06**		**18**
Semester III							
SOA/RT/C013	Entrepreneurship Development and Management in Extension	100	2(60)	-	1(20)	20(10+10)	03
SOA/RT/C014	Training for Human Resource Development	100	2(60)	1(20)	-	20 (10+10)	03
SOA/RT/C015	Rural Waste Management	100	2(60)	1(20)	-	20 (10+10)	03
Elective Courses: Any three of the following							
SOA/RT/E001	Environment & Biodiversity Conservation	100	2(60)	1(20)	-	20 (10+10)	03
SOA/RT/E002	Rural Marketing and Management	100	2(60)	1(20)		20(10+10)	03
SOA/RT/E003	Fundamentals of Remote Sensing and GIS	100	2(60)		1(20)	20 (10+10)	03
SOA/RT/E004	Medicinal & Aromatic Plants(MAPs)	100	2(60)		1(20)	20 (10+10)	03
		600	**12**	**04**	**02**		**18**
Semester IV							
SOA/RT/C016	Master Seminar	100	1(60)	0(20)	-	0(20)	01
SOA/RT/C017	Master Thesis	100	12(60)	0(20)	-	0(20)	12
Elective Courses: Any three of the following							
SOA/RT/E005	Gender sensitization for development	100	2(60)	-	1(20)	20 (10+10)	03
SOA/RT/E006	Post-harvest Techniques of Fruit and Vegetable	100	2(60)	-	1(20)	20 (10+10)	03
SOA/RT/E007	Information And Communication Technology	100	2(60)	1(20)		20 (10+10)	03
SOA/RT/E008	Basic Imaging Technology	100	2(60)	1(20)		20 (10+10)	03
		500	**19**	**01**	**02**		**22**
		2300	**56**	**6**	**14**		**76**

Summary of Credit

Semester	Core Credit	Elective Credit	Self Study	Total Credit
I	18(600)			18(600)
II	18(600)			18(600)
III	09(300)	09(300)	3(100)	18(600)
IV	13(200)	09(300)	3(100)	22(500)
Total	**58(1700)**	**18 (600)**	**3(100)**	**76(2300)**

#There will be 02 internal assessments consisting of 10 marks each for each theory paper/ course. However, it can be internal assessment depending on course teacher.

- **In some paper, Instead of practical there will be Term paper/ Seminar in which students will be asked to prepare a paper on a particular topic and present the same in seminar.**

- **Maximum marks for each course: 100 [40 (20 sessional + 20 Practical/Term paper) + 60 End Term Test]**

Important Point from Academic Ordinances

- In order to qualify for a Two-Year Master's degree a student must acquire a minimum of 76 credits including a minimum of 58 credits in Core and 18 credits in Electives course.

- Maximum 6 credits self study course (one minimum 3 Credits course shall be mandatory but not to be included while calculating the grades).

The Distribution of marks for Dissertation/ Project report & Viva-voce will be as below

Master Thesis / Dissertation	60 Marks
Periodical Presentation	20 Marks
Viva-voce	20 Marks
Total	**100 Marks**

Master Thesis / Dissertation shall be evaluated jointly by Internal and the External Examiner.

DEPARTMENT OF RURAL TECHNOLOGY

H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand, India-246 174

Course Curriculum for M. Sc. Rural Technology, 2023-2024

Course offered

Core Courses

Course No.	Course Title	Credits
SOA/RT/C001	Integrated Watershed Management	03
SOA/RT/C002	Nursery Techniques & Management	03
SOA/RT/C003	Project Planning in Extension Education	03
SOA/RT/C004	Fundamentals of Extension Education	03
SOA/RT/C005	Research Methods in Behavioral Science	03
SOA/RT/C006	Introduction to Apiculture	03
SOA/RT/C007	Soil Science and Agricultural Chemistry	03
SOA/RT/C008	Diffusion & Adoption of Innovations	03
SOA/RT/C009	Development perspectives of extension education	03
SOA/RT/C010	Innovative Technologies for Rural Development	03
SOA/RT/C011	Participatory Methods For Technology Development and Transfer	03
SOA/RT/C012	Mushroom Cultivation Technique	03
SOA/RT/C013	Entrepreneurship Development and Management in Extension	03
SOA/RT/C014	Training for Human Resource Development	03
SOA/RT/C015	Rural Waste Management	03
SOA/RT/C016	Master Seminar	01
SOA/RT/C017	Master Thesis	12
	Total	**58**

Elective Courses

Course No.	Course Title	Credits
SOA/RT/E001	Environment & Biodiversity Conservation	03
SOA/RT/E002	Rural Marketing and Management	03
SOA/RT/E003	Fundamentals of Remote Sensing and GIS	03
SOA/RT/E004	Medicinal & Aromatic Plants(MAPs)	03
SOA/RT/E005	Gender sensitization for development	03
SOA/RT/E006	Post-harvest Techniques of Fruit and Vegetable	03
SOA/RT/E007	Information And Communication Technology	03
SOA/RT/E008	Basic Imaging Technology	03
	Total	**24**

Self-Study Courses

Course No.	Course Title	Credits
SOA/RT/SS001	Rural Tourism	03
SOA/RT/SS002	Environmental Impact Assessment	03

DEPARTMENT OF RURAL TECHNOLOGY

SCHOOL OF AGRICULTURE & ALLIED SCIENCE
HNB GARHWAL UNIVERSITY (A CENTRAL) UNIVERSITY
SRINAGAR GARHWAL, UTTARAKHAND

Revised Syllabus of PG Programme
M.Sc. Rural Technology

M.Sc. I SEMESTER

M.Sc. I Semester		
Course Code: SOA/RT/C001		**Credit-(2+1)**
Course Title: INTEGRATED WATERSHED MANAGEMENT		

Course outcomes:

- The main aim of the course are to preserve and conserve the ecology, restore and develop degraded natural resources by arresting soil loss, improving soil health, soil-moisture regime augmentation, promote water harvesting, recharging ground water, enhance crop production and promote livelihood and gainful employment opportunities for sustainable livelihood.
- The course is conceptualized to provide competency in understanding the impact of landuse changes on various hydrological cycle parameters and soil erosion and choosing suitable soil and water conservation techniques to control it.
- The course is designed as an elective to help capacity building of the candidates to undertake research work or professional assignment in the sub-fields of watershed management, which plays a key role in sustainable development.

Theory

Watershed Management: Definition, size, concept of watershed, effect of watershed on the community, watershed characteristics, objectives of watershed management, selection of watershed, watershed management plan, monitoring and evaluation in watersheds, participatory rural appraisal watershed program (PRA), watershed map, Format for watershed management Plan

Hydrology of Watershed: Precipitation, forms of precipitation, Rainfall pattern in India, Rain fall parameter, Rainfall measurement, Selection of raingauge sites, estimation of runoff, measurement of stream discharge.

Geo-hydrology of Watershed: Availability of ground water, Distribution of subsurface water, soil moisture, aquifer, water table, springs, Ground water recharge, recharges structure, Water harvesting.

Topographic surveying: Elementary surveying equipment, setting out straight lines, setting out contour and graded contour lines and slopes.

Erosion control measures for non-agricultural lands: Soil conservation on wastelands, contour and staggered trenching, gully control structures, Check dams

Erosion control measures for agricultural lands: Contour cultivation, contour banding, planning of contour bunds, maintenance of bunds, Graded bunds, advantages and disadvantages, bench terracing.

Practical:

Measurement of stream discharge. Water quality analysis (WQA). Techniques of water harvesting tank. Rainfall measurement, Surveying - Plane Table survey (Radiation and Inter section). Preparation of a watershed development plan (agronomic, physical treatment, social etc.)

Suggested Readings

- Integrated Watershed Management: Rajesh Rajora, Rawat Publications, Satyam Apts., Sector-3, JawaharNagar,Jaipur- 302004 Indai.
- Watershed management, Guidelines for Indian conditions: E.M. Tideman, Omega Scientific Publishers, B-17, 2nd Floor, Lajpat Nagar Part 2, New Delhi-110024.
- Watershed Management: M.K. Maitra
- Engineering & General Geology: Parbin Singh
- जलग्रहणप्रबन्धनः बी0 सी0 जाट, पोइन्टरपब्लिषर्स, व्यासबिल्डिंग, एस0 एम0 एस0 हाईवे, जयपुर–302003

M.Sc. I Semester		
Course Code: SOA/RT/C002		**Credit-(2+1)**
Course Title: NURSERY TECHNIQUES & MANAGEMENT		

Course outcomes:

- The aim of the course is to provide knowledge about nursery management its importance and scope of propagation of horticultural nursery management.
- To impart basic knowledge and develop skills about propagating different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation in commercially viable way.
- To provide basic knowledge about tools, equipments and growing structures used in nursery for plant production.
- To impart knowledge on establishment of commercial plant tissue culture unit.
- Student learnt about role of nurseries in horticulture development – demand and supply analysis of nursery plants.
- Provide knowledge of Selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship and bud wood certification.

Theory

Nursery: Introduction to nursery, Importance and Classification of Nurseries. Establishment of Commercial Nursery Nursery-site selection, lay out, records, Nursery structures.

Nursery management: Progeny orchard, Problems in nursery management and its control, Important Nursery operations - bed Culture, Manure and fertilizers, Irrigation, Protection, Potting, repotting, Lifting, Grading, Storage, Packing and Transportation of nursery plants.

Nursery Propagation: Seed propagation, Germination of seeds, Seed dormancy and viability, Seed testing, Vegetative propagation- cuttings layering, Grafting and budding,

Propagation by specialized by stem and roots, stolons, runners, offsets, bulbs, corms, rooted crowns, Micro-propagation.

Practical:

Study of media preparation for growing of plants in nursery beds, pots and in poly houses, preparation of nursery beds and sowing of seeds, rising of seedlings. Practice of vegetative means of propagations of cuttings layering, Grafting and budding. Practice of construction of propagation structures, study of media and PGR. Visit to Commercial nurseries.

Suggested Readings

- Hartmann HT & Kester DE. 1989. Plant Propagation – Principles and Practices. Prentice Hall of India.
- Bose TK, Mitra SK & Sadhu MK. 1991. Propagation of Tropical and Subtropical Horticultural Crops. NayaProkash.
- Peter KV. (Ed.). 2008. Basics of Horticulture. New India Publ. Agency. Singh SP. 1989 Mist Propagation. Metropolitan Book Co.
- Rajan S & Baby LM. 2007. Propagation of Horticultural Crops. New India Publ. Agency. Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.
- Plant propagation, M. K. Sadhu, New Age International Publishers.

M.Sc. I Semester		
Course Code: SOA/RT/C003		**Credit-(2+1)**
Course Title: PROJECT PLANNING IN EXTENSION EDUCATION		

Course outcomes:

By the End of the course student will be able to

- Develop & Standardize Attitude scale using different techniques of attitude scale construction.
- Develop skills of using Projected & Semi Projected & Semi Projected Techniques, Computer Package analysis and PRO Tools in Extension Research.

Theory

Introduction- definitions – classifications – project risk – scope. Project management – definitions – overview – project plan – management principles applied to project management–project management life cycles

Project planning – scope – problem statement – project goals – Objectives–success criteria – assumptions – risks – obstacles – approval process –projects and strategic planning. Project implementation – project resource requirements – types of resources–men – materials. Project - GOPP/Log Frame analysis

Project monitoring – evaluation – control – project network technique –planning for monitoring and evaluation – project audits – project management information system – 55 project scheduling – PERT & CPM – performance Appraisal- project communication – post project reviews

Closing the project – types of project termination – strategic implications – project in trouble – termination strategies – evaluation of termination possibilities – termination procedures Practical Study of an ongoing extension project. Development of an plan

through GOPP/Log frame Work- Application of PERT & CPM in a hypothetical situation- Application of performance appraisal technique on an ongoing extension project.

Practical: Instead of practical, there will be term paper

Suggested Readings

- Goel. B.B (1987): Project Management- A Development Perspective, Deep Deep Publications, New Delhi.
- Nair. B.M (1985): Project Management- Scheduling and Monitoring.
- Maylor Harvey (2000): Project Management, Pitman Publishing.
- Rao. P.C.K: Project Management and Control, Sultan Chand and Sons Publisher, New Delhi.
- Project Management:S. Choudhury,Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110008.
- Projects Planning, Analysis, Selection, Financing, Implementation and Review: Prasanna Chandra,Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110008.

M.Sc. I Semester		
Course Code: SOA/RT/C004		**Credit-(2+1)**
Course Title: FUNDAMENTALS OF EXTENSION EDUCATION		

Course outcomes:

- The course is intended to orient the students with the concept of Distance Education, Characteristics of Distance Education, Evolution, Methods of Distance Education, Different Approaches in Planning Distance Education, Educational Technology in Distance Education, Management of Resources for distance education, Strategies for maximizing the reach and programme evaluation and quality assessment.
- The course is intended to orient the students with the concept of extension education and its importance in Agriculture development
- Besides, the students will be learning about the new innovations being brought into the Agricultural Extension in India.

Theory

Analysis of definitions, principles and philosophy of Extension Education. Extension Education as a discipline and profession, objectives and role in development; Historical and emerging perspective of Agricultural Extension in India; Integrated functioning of teaching, research and extension in ICAR and SAUs systems; Participatory extension and participatory research - concepts, modalities and implications; Extension System in India and its linkage with National Agricultural Research Systems. Gender issues in rural development & its implications to Extension Education.

Practical: Instead of practical, there will be term paper

Suggested Readings

- Cernea, M.M.; Russell, J.E.A., and Coulter, J.K. (Eds) (1983). Agricultural Extension by Training and Visit: The Asian Experience. The World Bank, Washington D.C.

- Directorate of Extension (1964). Extension Education in Community Development. Directorate of Extension, Ministry of Agriculture, Government of India,
- Dahama, O. P. and Bhamagar, O. P. (1987). Education and Communication for Development. Oxford and IBH Publishing Co. New Delhi.
- Mosher, A.T. (1978). An introduction to Agricultural Extension. ADC, New York.
- Roling, N. (1988). Extension Science. Information systems in Agricultural Development. Cambridge University Press. New York.

M.Sc. I Semester		
Course Code: SOA/RT/C005		**Credit-(2+1)**
Course Title: RESEARCH METHODS IN BEHAVIOURAL SCIENCE		

Course outcomes:

- This course is designed with a view to provide knowledge and skills in methods of behavioral sciences research.
- Student will learn the Statistical Package for Social Sciences (SPSS) for choosing appropriate statistics for data analysis.
- By the end of the course student will be able to develop skills of theory building and scientific application of theoretical concept in Social Sciences by applying appropriate statistical tests.

Theory

Research – Meaning, importance, characteristics. Behavioural sciences research – Meaning, concept and problems in behavioural sciences research. Types and methods of Research – Fundamental, Applied and Action research, Exploratory, Descriptive, Diagnostic, Evaluation, Experimental, Analytical, Historical, Survey and Case Study. Review of literature – Need, Search Procedure, Sources of literature, Planning the review work. Research problem – Selection and Formulation of research problem and guiding principles in the choice of research problem, Factors and criteria in selection of research problem, statement of research problem and development of theoretical orientation of the research problem.

Objectives– Meaning, types and criteria for judging the Objectivess. Concept and Construct – Meaning, role of concepts in research and Conceptual frame work development in research. Variable – Meaning, types and their role in research. Definition – Meaning, characteristics of 48 workable definitions, types and their role in research. Hypothesis – Meaning, importance and functions of hypothesis in research, Types of hypothesis, linkages, sources, problems in formulation and criteria for judging a workable hypothesis. Measurement – Meaning, postulates and levels of measurement, Use of appropriate statistics at different levels of measurement, criteria for judging the measuring instrument and importance of measurement in research. Validity – Meaning and methods of testing. Reliability – Meaning and methods of testing. Sampling – Universe, Sample and Sampling-Meaning, basis for sampling, advantages and limitations, size and factors affecting the size of the sample and sampling errors – Methods of elimination and minimizing, Maximincon Principle, Sampling – Types of sampling and sampling procedures.

Research Designs – Meaning, purpose and criteria for research design, Types, advantages and limitations of each design. Experimental design – Advantages and limitations. Data Collection devices - Interview – Meaning, purpose, types, techniques of interviewing and advantages and limitations. Enquiry forms and Schedules – Meaning, types of questions used, steps in construction and advantages and limitations in its use. Questionnaires – Meaning, difference between schedule and questionnaire, types of questions to be used, pre – testing of the questionnaires or schedules and advantages and limitations. Check lists – Meaning, steps in construction, advantages and limitations in its use. Rating scales – Meaning, types, limits in construction, advantages and limitations in its use. Observation – Meaning, types, tips in observation, advantages and limitations in its use. Case studies – Meaning, types, steps in conducting, advantages and limitations in its use. Social survey – Meaning, Objectives, types and steps in conducting, advantages and limitations.

Data processing – Meaning, coding, preparation of master code sheet, analysis and tabulation of data, Statistical Package for Social Sciences (SPSS) choosing appropriate statistics for data analysis based on the level of measurement of variables. Report writing – Meaning, guidelines to be followed in scientific report writing, References in reporting.

Practical Selection and formulation of research problem - Formulation of Objectives and hypothesis Selection of variables based on Objectives-Developing the conceptual framework of research. Operationally defining the selected variables-Development of data collection devices.- Testing the validity and reliability of the data collection instruments.- Pre-testing of the data collection instrument-Techniques of interviewing and collection of data using the data collection instruments-Data processing, hands on experiences on SPSS, coding, tabulation and analysis. Formulation of secondary tables based on Objectives of research. Writing report, Writing of thesis and research articles-Presentation of reports.

Suggested Readings

- Chandrakandan K, Venkatapirabu J, Sekar V &Anand Kumar V. 2000. Tests and Measurements in Social Research. APH Publ.
- Kerlinger FN. 1973. Foundations of Behavioural Research. Holt Rhinehart.
- Kothari CR.1984. Research Methodology, Methods and Techniques.Chaitanya Publ. House.
- Mulay S &Sabaratnam VE.1983. Research Methods in Extension Education.Manasavan.
- Ray GL & SagarMondal. 1999. Research methods in Social Sciences and Extension Education. NayaProkash.

M.Sc. I Semester		
Course Code: SOA/RT/C006		**Credit-(2+1)**
Course Title: INTRODUCTION TO APICULTURE		

Course outcomes:

- The course is prepared with the objective of introducing students to the world of honey bees and modern beekeeping. This course starts with importance of apiculture with brief history and information on equipment required, handling of honey bee colonies, seasonal managements and economics has been provided in concise form.

- The course content has been developed to provide student an easy to understanding the needs of the bee colonies during different seasons and providing them space, food and protection from enemies and tips for handling of bee colonies, feeding methods, honey extraction etc.

Theory

Introduction to Apiculture: Definition of apiculture, Importance and future prospects of apiculture, History of apiculture industries in India and world.

Origin and Classification of Bee: Origin, Classification and its silent feature, Species of honeybee and their castes.

Equipments and Appliances: Bee Hive, Comb, other appliances for bee keeping.

Life cycle: Developmental stages of Honey Bees (Egg, Larva, Pupa and Adult) and division of labour, Honey bee senses, Recourse needs of the colony, Artificial feeding of honeybees.

Anatomy of Honey Bees: External anatomy and internal anatomy of bee, Importance of bees in human life.

Properties of Honey: Physical and chemical properties of honey, Honey bee products and their values. **Extraction of Honey:** Extraction handling, processing and storage of honey, Granulation and fermentation of honey, Hydroxy- methyl-furfural (HMF) value.

Honey Processing Unit: Design of honey processing unit.

Diseases Management: Enemies of honeybees, Diseases in apiculture

Practical:

Study the techniques of bee keeping and identification of related equipments, colony formulation, identification of Caste, feeding, honey extraction, migration.

Suggested Readings:

- A handbook of Beekeeping: Dharm Singh/ DevendraPratap Singh, Agrobios, India.
- Beekeeping: . E. F. Phillips, Agro bios, India.

M.SC. II SEMESTER

M.Sc. II Semester		
Course Code: SOA/RT/C007		**Credit-(2+1)**
Course Title: SOIL SCIENCE & AGRICULTURAL CHEMISTRY		

Course outcomes:

- Students will gain knowledge on concepts and principles of Soil Science
- Comprehensive knowledge on rocks and minerals, their composition and the types of soils formed from different parent materials.
- Understand the role of soil forming factors and processes in soil formation
- Understand various soil physical, chemical and biological properties and their impact on plant growth.
- The knowledge gained in this course will be useful in understanding the behavior of soils in crop production and management

Theory

Introduction: Theory Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil;

Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth,

Soil reaction-ph, soil acidity and alkalinity, buffering, effect of phon nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects;

Soil pollution-behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content. Determination of soil texture by Buckman and Brady Methods. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour by Munsell Soil Colour chart. Estimation of organic matter content of soil

Suggested Readings:

- Engineering & General Geology:**Parbin Singh,** S.K. Kataria& Sons 4424/6, Guru Nanak Market, NaiSarak, Delhi-110006
- Textbook of Soil Science: **R.K. Mehra,** Agriculture Indian Council of Agricultural Research, KrishiAnusandhanBhavan, Pusa, New Delhi-110012.
- Principles and Practice of Soil Science**: Robert E. White,** Wiley India Pvt. Ltd. New Delhi.
- Watershed management, Guidelines for Indian conditions: **E.M. Tideman,** Omega Scientific Publishers, B-17, 2nd Floor, Lajpat Nagar Part 2, New Delhi-110024.
- The Nature and Properties of Soil: Brady, N.C. 1990, McMillan, Eurasia.

M.Sc. II Semester		
Course Code: SOA/RT/C008		**Credit-(2+1)**
Course Title: DIFFUSION AND ADOPTION OF INNOVATIONS		

Course outcomes:

- The students will learn how the agricultural innovations spread among the farmers in the society by getting into the insights of diffusion concept and adoption process, stages of adoption and innovation decision process, adopted categories and their characteristics, opinion leaders and their characteristics, attributes of innovations, and factors influencing adoption.
- In addition, the students would be learning various concepts related to diffusion and adoption of innovations.

Theory

Diffusion – concept and meaning, elements; traditions of research on diffusion; the generation of innovations; innovation-development process; tracing the innovation-development process, converting research into practice.

The adoption process- concept and stages, dynamic nature of stages, covert and overt processes at stages, the innovation-decision process – a critical appraisal of the new formulation.

Adopter categories – Innovativeness and adopter categories, adopter categories as ideal types, characteristics of adopter categories; Perceived attributes of Innovation and their rate of adoption, factors influencing rate of adoption.

Diffusion effect and concept of over adoption, opinion leadership- measurement and characteristics of opinion leaders, monomorphic and polymorphic opinion leadership, multistep flow of innovation; concepts of homophily and heterophily and their influence on flow of innovations; Types of innovation-decisions –Optional, Collective and Authority and contingent innovation decisions; Consequences of Innovation-Decisions – Desirable or Undesirable, direct or indirect, anticipated or unanticipated consequences; Decision making – meaning, theories, process, steps, factors influencing decision – making.

Practical:

Case studies in individual and community adoption process, content analysis of adoption studies, Identification of adopter categories on a selected technology, study of attributes of current farm technologies, Identification of opinion leaders, Sources of information at different stages of adoption on a selected technology, study of factors increasing or retarding the rate of adoption, presentation of reports on adoption and diffusion of innovations.

Suggested Readings:

- Dasgupta. 1989. Diffusion Agricultural Innovations in Village India. Wiley Eastern.
- Jalihal KA &Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publ. Co.
- Ray GL. 2005. Extension Communication and Management. Kalyani Publ.
- Reddy AA. 1987. Extension Education. Sree Lakshmi Press, Bapatla.
- Rogers EM. 2003. Diffusion of Innovations. 5th Ed. The Free Press, New York.

M.Sc. II Semester		
Course Code: SOA/RT/C009		**Credit-(2+1)**
Course Title: DEVELOPMENT PERSPECTIVES OF EXTENSION EDUCATION		

Course outcomes:

- The course is intended to orient the students with the concept of extension education and its importance in Agriculture development and also to expose the students with various rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis.
- Besides, the students will be learning about the new innovations being brought into the Agricultural Extension in India.

Theory

Extension Education – Meaning, Objectives, concepts, principles and philosophy, critical analysis of definitions – Extension Education as a Profession – Adult Education and Distance Education.

Pioneering Extension efforts and their implications in Indian Agricultural Extension – Analysis of Extension systems of ICAR and SAU – State Departments Extension system and NGOs – Role of

Poverty Alleviation Programmes – SGSY, SGRY, PMGSY, DPAP, DDP,CAPART – Employment Generation Programmes – NREGP, Women Development Programmes – ICDS, MSY, RMK, Problems in Rural Development.

Current Approaches in Extension: Decentralised Decision Making, Bottom-up Planning, Farming System Approach, Farming Situation Based Extension, Market– Led – Extension, Farm Field School, ATIC, Kisan Call Centres, NAIP.

Practical:

Visit to Gram Panchayat to study on-going Rural Development Programmes, Visit to KVK, NGO and Extension centers of State Agricultural University and State Departments, Bottom up planning, Report preparation and presentations.

Suggested Readings:

- Jalihal KA &Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publ. Co.
- Ray GL. 2005. Extension Communication and Management. Kalyani Publ.
- Reddy AA. 1987. Extension Education. Sree Lakshmi Press, Bapatla.
- Rogers EM. 2003. Diffusion of Innovations. 5th Ed. The Free Press, New York.

M.Sc. II Semester		
Course Code: SOA/RT/C010		**Credit-(2+1)**
Course Title: INNOVATIVE TECHNOLOGIES FOR RURAL DEVELOPMENT		

Course outcomes:

- The main aim of the study of this course is to Improving the quality of life of the rural population by introducing new technologies to farmers. Student learnt about different earthworm species its morphology, anatomy and use of earthworms, vermicomposting materials, requirement of vermiculture and vermicomposting
- Course provide knowledge of vermiculture and effect of vermiwash in agricultural crops. Student also learnt about biocomposting and methods of different types of composting harvesting and marketing of compost and the basics of organic farming and certification organic products.

Theory

Vermi Technology: Earthworm classification, Species, External and internal features of verms, Use of earthworms, vermicomposting materials, requirement of vermiculture and vermicomposting, Factors affecting earth worm's growth, Types of vermicomposting, methods of vermicomposting, Harvesting and storage of vermicompost, advantages of vermicompost, Use and benefits of Vermicompost, Effect of vermicompost on plants, chemical composition of vermicompost, vermiwash (worm-tea), Chemical composition of vermiwash, Use and advantages of vermiwash.

Biocomposting: methods of biocomposting, decomposition process, difference between biocompost and Farm yard manure (FYM), Materials used in biocompost, advantages of biocompost. Precaution needed for compost preparation.

NADEP Compost: Preparation of NADEP compost, construction and design of NADEP compost tank, Material use for preparation of NADEP compost, Substrate use for the production of compost.

Organic Farming: Definition, its components, importance and certification.

Practical:

Study the pit construction, different types of worms used for vermicompost, pit installation, compost preparation, removal of compost from the pit and reinstallation, Preparation of Nadep compost.

Suggested Readings

- Vermiculture and Organic Farming, T. V. Sathe, Daya Publishing House, New Delhi.
- A Hand book of Organic Farming: Arun K Sharma Agro bios Inida, New Delhi.

M.Sc. II Semester		
Course Code: SOA/RT/C011		**Credit-(2+1)**
Course Title: PARTICIPATORY METHODS FOR TECHNOLOGY DEVELOPMENT AND TRANSFER		

Course outcomes:

- This course is intended to orient the students with the key concepts, principles process of different participatory approaches for technology development and transfer and also to expose the students with various participatory tools and techniques like space related, time related, and relation oriented methods.
- Besides the students will be learning the preparation of action plans participatory monitoring and evaluation.

Theory

Participatory extension – Importance, key features, principles and process of participatory approaches; Different participatory approaches (RRA, PRA, PLA, AEA, PALM, PAR, PAME, ESRE, FPR) and successful models.

Participatory tools and techniques. Space Related Methods: village map (social &resource), mobility services and opportunities map and transect; Time related methods: time line, trend analysis, seasonal diagram. Daily activity schedule, dream map; Relation oriented methods: cause and effect diagram (problem tree), impact – diagram, wellbeing ranking method, Venn diagram, matrix ranking, livelihood analysis.

Preparation of action plans, concept and action plan preparation; Participatory technology development and dissemination; Participatory planning and management, phases and steps in planning and implementation aspects; Process monitoring, participatory evaluation.

Practical

Exercises on space related methods, time related method and relation oriented methods; Documentation of PTD and dissemination; Preparation of action plan; Participatory monitoring and evaluation of developmental programmes.

Suggested Readings

- **Adhikary. 2006**. Participatory Planning and Project Management in Extension Science. Agrotech Publ. Academy.
- **Mukharjee N. 2002.** Participatory Learning and Action. Concept Publ. Co.
- **Singh BK. 2008.** PRA/PLA and Participatory Training. Adhyayan Publ. & Distr.
- **Somesh Kumar. 2002**. Methods for Community Participation. Vistaar Publ.

M.Sc. II Semester		
Course Code: SOA/RT/C012		**Credit-(2+1)**
Course Title: MUSHROOM CULTIVATION TECHNIQUE		

Course outcomes:

- The foremost aim of this course is to promote self-employment.
- The course components comprises of theory and practical components covering important topics such as spawn production, cultivation of button mushroom, oyster mushroom, paddy straw mushroom, milky mushroom and other medicinal mushrooms of economic importance and management of insect pest and diseases of mushroom.
- The course provides knowledge of value addition, entrepreneurial skills and health and safety at workplace etc.

Theory

Introduction to Mushroom, Mushroom Cultivation – History of Mushroom in India and Abroad, Types of edible Mushroom species, Nutritional value of Mushrooms, Medicinal value of mushrooms.

Mushroom Production Technique – Button Mushroom (*Agaricus*), Oyester Mushroom (*Pleurotua)*, Paddy Straw Mushroom (*Volvariella*).

Spawn Production Techniques: Preparation of culture, Mother Spawn Production, Multiplication of spawn.

Post Harvest Handling and Preservation of Mushroom: Harvesting and Packaging, Storage of mushroom, Marketing problems in mushrooms, Future prospects of Mushroom in India.

Disease and pest management.

Practical:

Identification of different mushroom species, mushroom production, Preparation of medium for mushroom cultivation, spawn mixing, packaging, mushroom recopies.

Suggested Readings

- Mushroom: Cultivation and Use ,Suman and Sharma, Agrobios India.
- Mushroom Growing, S. C. Day, Agrobios India.
- Mushroom: Production and Processing Technology, Pathak Yadav Gour, Agrobios India.
- Mushroom and their Cultivation Technique, R. C. Ram, Aavishkar Publishers, Distributors, Jaipur India.

SELF STUDY

M.Sc. II Semester		
Course Code: SOA/RT/SS001		**Credit-(2+1)**
Course Title: RURAL TOURISM		

Course outcomes:

- The course provides knowledge about the potential customer of rural tourism.
- To orient the students about the challenges and opportunities in rural tourism from both tourist and host concerns and also know about the essential elements for the development of rural tourism.

Theory

Introduction, Tourism, types of tourism, tourism in world, in India, in Uttarkahand, tourism in past, present trends and foresight models of tourism, tourism & sustainable development, sustainable tourism, social tourism, rural tourism. Market share of tourism in world market, world tourism day & motto, Rural tourism & India.

Rural Tourism in India, its scope & importance, rural society of India, cultural aspects of India & tourism, Models of sustainable tourism in India, Rural Tourism components & types of rural tourism.

Economics of tourism, GDP share of tourism in India. Opportunities for development of rural tourism, Challenges in development of rural tourism, benefits & hazards of rural tourism, rural tourism & employment generation in rural India.

Development of rural tourism, selection of theme, selection of site, planning of rural tourism theme, execution of rural tourism theme, promotion & marketing of rural tourism theme, management of resources, security & service, guests feedback.

Practical: Instead of practical, there will be term paper/ assignment.

Suggested Readings

- Rural Tourism, by R. Prudhi
- Rural Tourism and Tribal Development1 December 2006 by S.B. Verma and S.K. Jiloka
- Rural Tourism: New Concepts, New Research, New Practice19 September 2017 by Bernard Lane and Elisabeth Kastenholz
- International rural tourism development: an Asia-Pacific perspective1 July 2017 by World Tourism Organization

M.Sc. II Semester		
Course Code: SOA/RT/SS002		**Credit-(2+1)**
Course Title: Environmental Impact Assessment		

Course outcomes:

- This course is designed to introduce students to environmental impact assessment and to provide theoretical and practical education in this field.
- The focus is on the rationale and methodology of integrated environmental impact assessment (EIA), including consideration of the relevant bio-physical, social, cultural, economic and human health aspects of development proposals, programs and policies.

Theory

Introduction: principles and purpose of IEE and EIA and its significance for the society, Cost and benefits of EIA. EIA involvement during project life cycle. EIA management, principles and management of EIA, main stages in EIA techniques, checklists, scooping, prediction, mitigation and alternatives auditing. EIA techniques, checklists, matrices, network method, remote sensing and GIS. Public consultation in EIA and SEA(Strategic Environmental Assessment).

Practical: Instead of practical, there will be term paper/ assignment

Suggested Readings

- Ecology Environment and Resource Conservation : J.S. Singh, S.P. Singh, S.R. Gupt, Anamaya Publishers, F-154/2, Lado Sarai, New Delhi-110030, India.
- Strategic Environmental Assessment, A Source Book and reference guide to International Experience: Barry Dalal, Clayton &Barrry Sadler, Earthscan U.K
- Environment Impact Assessment: Peter Morris &RikiTherivel.

M.Sc. III Semester

M.Sc. III Semester		
Course Code: SOA/RT/C013		**Credit-(2+1)**
Course Title: ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT IN EXTENSION		

Course outcomes:

- The first part of the course is intended to provide overall picture of planning and development of enterprises for extending sustainable livelihoods for rural people.
- The second part of the course is structured to help the students to gain knowledge and skills in different concepts and techniques of management in extension organizations.

Theory

Entrepreneurship – Concept, characteristics, Approaches, Theories, Need for enterprises development. Agri – entrepreneurship – Concept, characteristics, Nature and importance for sustainable Livelihoods. Traits of entrepreneurs – Risk taking, Leadership, Decision making, Planning, Organizing, Coordinating and Marketing, Types of Entrepreneurs. Stages of establishing enterprise – Identification of sound enterprise, steps to be considered in setting up an enterprise, feasibility report, product selection, risk and market analysis, legal requirements. Project Management and Appraisal – Market, Technical, Financial, Social Appraisal of Projects.

Micro enterprises – Profitable Agri enterprises in India – Agro Processing, KVIC industries. Micro financing – meaning, Sources of Finance, Banks, Small scale industries development organizations. Marketing for enterprises – Concept, planning for marketing, target marketing, Competition, market survey and strategies, Product sales and promotion. Gender issues in entrepreneurship development – Understanding gender and subordination of women, Gender as a development tool, Policy approaches for women entrepreneurship development. Success and Failure stories for enterprises – Issues relating to success and failure of enterprises – Personal, Production, Finance, Social, Marketing.

Management – Meaning, concept, nature and importance, Approaches to management, Levels of management, Qualities and skills of a manager. Extension Management –

Meaning, Concept, Importance, Principles of management, Classification of Functions of Management. Planning – Concept, Nature, Importance, Types, Making planning effective. Change Management – factors, process and procedures. Decision making – Concept, Types of decisions, Styles and techniques of decision making, Steps in DM Process, Guidelines for making effective decisions. Organizing – Meaning of Organization, Concept, Principles, Organizational Structure, Span of Management, Departmentalization, Authority and responsibility, Delegation and decentralization, line and staff relations.

Coordination – Concept, Need, Types, Techniques of Coordination. Interpersonal relations in the organization. Staffing – Need and importance, Manpower planning, Recruitment, Selection, Placement and Orientation, Training and Development – Performance appraisal – Meaning, Concept, Methods. Direction – Concept, Principles, Requirements of effective direction, Giving orders, Techniques of direction. Leadership – Concept, Characteristics, Functions, Approaches to leadership, Leadership styles. Organizational Communication – Concept, Process, Types, Net Works, Barriers to Communication. Managing work motivation – Concept, Motivation and Performance, Approaches to motivation. Supervision – Meaning, Responsibilities, Qualities and functions of supervision, Essentials of effective supervision. Managerial Control – Nature, Process, Types, Techniques of Control, Budgeting, Observation, PERT and CPM, MIS.

Practical

Field visit to Successful enterprises-Study of Characteristics of Successful entrepreneurs Development of Project Proposal -Case Studies of Success / Failure enterprises-Exercise on Market Survey-Field visit to Financial institutions- Simulated exercise to understand management process-Field visit to extension organizations to understand the functions of management -Group exercise on development of short term and long term plan-Simulated exercise on techniques of decision making-Designing organizational structure -Group activity on leadership development skills.

Suggested Readings

- Akhouri, M.M.P., Misra, S.P. and Sengupta, Rita (1989). Trainers Manual on Developing Entrepreneurial motivation, NIESBUD, New Delhi
- Betty Gordan B (1979). Entrepreneurship, Playing to Win, Taraporewala, Bombay
- Entrepreneurship Development Institute of India (1987). Developing New Entrepreneurs EDII, Ahmedabad, NISIET Library: 338.93/EDI/87/25104
- Mancuso, Josheph (1974). The Entrepreneurs Handbook Vol.1 & 2 Artech House Inc. USA
- Patel V.G. (1987) Entrepreneurship Development Programme in India and its relevance to Developing Countries, Entrepreneurship Development Institute of India, Ahmedabad, NISIET Library: 338.93 (540)/PAT/87/25103
- Rao, T.V. (1974) Development of an Entrepreneur: A Behavioristic Model, Technical paper no. 51, (Mimeographed), Ahmedabad, Indian Institute of Management.
- Vasanta Desai. 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House.

M.Sc. III Semester		
Course Code: SOA/RT/C014		**Credit-(2+1)**
Course Title: TRAINING FOR HUMAN RESOURCE DEVELOPMENT		

Course outcomes:

- To orient the students about key concepts importance, scope & conceptual frame work, growth & development of Human Resource Development, Subsystems of Human Resource Development for extension organization and process of HRD.

Theory

Human Resource Development – Definition, Meaning, Importance, Scope and Need for HRD; Conceptual frame work, inter disciplinary approach, function systems and case studies in HRD; HRD Interventions– Different Experiences; Selection, Development & Growth- Selection, Recruitment, Induction Staff Training and Development, Career planning; Social and Organizational Culture: Indian environment perspective on cultural process and social structure, society in transition; Organizational and Managerial values and ethics, organizational commitment ; Motivation productivity - job description – analysis and evaluation; Performance Appraisal.

Human Resource management: Collective bargaining, Negotiation skills; Human Resource Accounting (HRA): What is HRA? Why HRA? Information Management for HRA and Measurement in HRA; Intra personal processes: Collective behaviour, learning, and perception ; Stress and coping mechanisms; Inter-Personal Process, Helping Process – communication and Feedback and interpersonal styles; Group & Inter group process: group information and group processes; Organizational communication, Team building Process and functioning, Conflict management, Collaboration and Competition; HRD & Supervisors: Task Analysis; Capacity Building – Counseling and Mentoring; Role of a Professional Manager: Task of Professional Manager – Responsibility of Professional Manager; Managerial skills and Soft Stills required for Extension workers; Decision Making: Decision Making models, Management by Objectives; Behavioural Dynamics :Leadership styles – Group dynamics.

Training – Meaning, determining training need and development strategies – Training types, models, methods and evaluation; Facilities for training – Trainers training – techniques for trainees participation; Research studies in training extension personnel; Main issues in HRD: HRD culture and climate – organizing for HRD – emerging trends and Prospective. Practical Visit to different training organizations to review on going activities & facilities; Analysis of Training methods followed by training institutions for farmers and extension workers Studies on evaluation of training programmes; Study of HRD in organization in terms of performance, organizational development, employees welfare and improving quality of work life and Human resource information, Presentation of reports.

Practical: Instead of practical, there will be term paper

Suggested Readings

- Agochiya D. 2002. Every Trainer's Handbook. Sage Publ.
- David Gross. 1997. Human Resource Management - The Basics. TR Publ.
- Knoontz Harold &Weihhrich Heinz 1990. Essentials of Management. 5th Ed. McGraw-Hill.

- Lynton RP &Pareek U. 1993. Training for Development. DB. Taraporewale Sons & Co.
- Punna Rao P &Sudarshan Reddy M. 2001. Human Resource Development Mechanisms for Extension Organization. Kalyani Publ.
- Rao TV. 2003. Readings in Human Resource Development. Oxford Publ. Co.
- Silberman Mel. 1995. Active Training. Press Johnston Publ. Co., New Delhi.
- Subba Rao P. 2005. Management & Organizational Behaviour. Himalaya Publ. House.
- Sundaram RM, Gupta V, George SS. 2006. Case Studies in Human Resource Management. ICFAI, Hyderabad.
- Tripati& Reddy. 2004. Principles of Management. Tata McGraw-Hill.
- Wayne MR & Robert MN. 2005. Human Resource Management. International Ed. Pearson Prentice Hall.

M.Sc. III Semester		
Course Code: SOA/RT/C015		**Credit-(2+1)**
Course Title: RURAL WASTE MANAGEMENT		

Course outcomes:

- To know the problems related to the waste management and find out their mode of appurtenances. S
- To initiate the awareness toward the cleanliness and waste disposal in rural area.
- The small group of student can promote the rural people by teaching them about the waste disposal.

Theory

Introduction of Rural waste, Type of waste, Necessity of systematic collection and disposal of waste, Types of sewerage systems.

Sewage Treatment concept, Meaning and principle of primary and secondary treatment, constructional details of screening chamber, grit chamber, clarifier, trickling filters, General composition of sewage, importance & method of determination of B.O.D. and C.O.D.

Disposal of night soil, Village latrines- collection and disposal of garbage and refuse. Construction of low cost latrines in rural areas. Septic tanks, cess pools/soak pit, privy pit and bore hole latrines,

Waste water management, Drainage, topography, storm water, natural passage, development of drains. Technological options at household level management, leach pit, soakage pit, soakway channel, plantation with intercepting chamber.

Solid waste management, Prospects and problems of solid waste management in rural areas, approach and steps for effective management of solid waste through composting, biogas technology and landfills.

Practical: Instead of practical, there will be term paper

Suggested Readings:

- Rangwala S.C, Water Supply & Sanitary Engineering, Charotar Publishing House (P) Ltd.,

- Anand.Gurcharan Singh, Water Supply & Sanitary Engineering, Standard Publishers Distributors, Delhi.
- Garg, S.K., Water Supply Engineering, Khanna Publishers, Delhi.
- Gupta, D.V. Water Supply & Sanitary Engineering, Asian Publishers,
- P.N. Water Supply Engineering, Standard Book House, Delhi

ELECTIVE COURSE:

M.Sc. III Semester		
Course Code: SOA/RT//E001		**Credit-(2+1)**
Course Title: ENVIRONMENT AND BIODIVERSITY CONSERVATION		

Course outcomes:

- The aim of the course is that the students understand biodiversity in the context of ecosystem dynamics, ecosystem functioning and provision of ecosystem services.
- Students will know how to assess biodiversity with different methodologies and they will be able to conduct a critical analysis of measures to manage biodiversity.
- Students will know how to preserve the diversity of species, sustainable utilization of species and ecosystem and maintain life-supporting systems and essential ecological processes.

Theory

Climatology: Weather and climate, Control of Climate, The Climate System , Climate Anamoly, Variability and change, Koppen's classification of Climate, climate of India, clouds and precipitation, Possible Global climate Change, Greenhouse effect, Greenhouse gases, stratospheric ozone, Strategies for protecting stratospheric ozone.

Pollution: definition, causes, effects and control measures of Air pollution, water pollution, soil pollution, Noise pollution, Pollution case studies.

Biodiversity: Definition, levels of biodiversity, uses of biodiversity, distribution of biodiversity, ecological concept, hot-spots of biodiversity, threats of biodiversity, conservation of biodiversity, India's biodiversity and its conservation, endangered threatened and rare species, IUCN red list categories

Sustainable development and ecological economics, causes of un-sustainability, national and international programme on sustainable development, sustainability indicators, environmental sustainability index, sustainability development in India.

Practical: Instead of practical, there will be term paper.

Suggested Readings:

- Ecology Environment and Resource Conservation :J.S. Singh, S.P. Singh, S.R. Gupt,Anamaya Publishers, F-154/2, Lado Sarai, New Delhi-110030, India.
- Climatology An Atmospheric Science : John E. Oliver, John J. Hidore,Dorling Kindersley (India) Pvt. Ltd.
- Climate Change and Global Warming: AvinashTyagi,Rajat Publications 4675/21, Ansari Road, Daryaganj New Delhi- 110002 (India)
- Cold Climate Hydrometeorology: D.S. Upadhyay,Wiley Eastern Ltd., 4835/24, Ansari Road, Daryaganj, New Delhi- 110002 (India).

M.Sc. III Semester		
Course Code: SOA/RT//E002		**Credit-(2+1)**
Course Title: RURAL MARKETING AND MANAGEMENT		

Course outcomes:

- To provide an overview of rural markets and emerging perspectives of rural marketing.
- To debate the emerging managerial initiatives and relevant frameworks in rural marketing.
- To share the experiences of institutions engaged in rural marketing in the form of case studies.
- Identify the challenges and opportunities in the field of rural marketing for the budding managers and also expose the students to the rural market environment and the emerging challenges in the globalization of the economies.
- Acquaint the students with the appropriate concepts and techniques in the area of rural marketing.

Theory

Rural Marketing: Definition, Nature, Scope and importance distinction between marketing, selling distribution and evolution of market components and classification of market, Five Ps, Marketing goals, marketing practices, challenges in Indian Rural Marketing.

Marketing Analysis: Marketing environment, macro and micro component and their impact, marketing organization, marketing components and their impact, marketing research, meaning, nature and scope, objectives, marketing research procedure.

Co –operatives: Meaning and Definition of Co-operative movement in India, Basic principles of Co-operative and other lead Bank Agriculture credit societies and its function

Co-operative Marketing: Meaning, definition, Importance, objectives, advantages, need, structure and organization of marketing societies, its financing patterns, critical evaluation of co-operative marketing

Financing: Introduction of rural financing, finance requirements for production and marketing function, source of finance, national level credit Agency-NABARD, Function of NABARD, Schemes and Patterns of NABARD.

Practical: Instead of practical, there will be term paper/ assignment

Suggested Readings:

- Rural Marketing: R.V. Badi, N.V. Badi, Himalaya Publishing House, Ramdoor, Dr. Bhalerao Marg, Girgaon, Mumbai-400004.
- Indian Economy: Misra, Puri, Himalaya Publishing House, Ramdoor, Dr. Bhalerao Marg, Girgaon, Mumbai-400004.
- Rural Marketing (Environment, Problems and Strategies): T.P. Gopalaswamy, Vikas Publishing House Pvt. Ltd, A-22, Sector-4, Noida-201301 (UP).
- Case in Rural Marketing an Integrated Approach: CSG Krishnamacharyulu, LalithaRamakrishnan,Dorling Kindersley (India), Pvt. Ltd.,

M.Sc. III Semester		
Course Code: SOA/RT//E003		**Credit-(2+1)**
Course Title: FUNDAMENTALS OF REMOTE SENSING AND GIS		

Course outcomes:

- To know about Remote Sensing and its uses in various sectors like agriculture, forest, wild life and rural area planning.
- To get knowledge of study area through remote sensing Software.
- Analysis and interpretation of data of study area at different time Interval can be done for research purpose.

Theory

Remote Sensing: Fundamental & concept of remote sensing, Electromagnetic Energy, Energy interaction with Earth surface features, Spectral response of natural earth surface features. Sensor systems used in remote sensing**:** Passive system, Active system, spectral enhancement techniques – NDVI, NDWI

Aerial Photography: Types of Aerial photographs, how aerial photographs are taken. Errors in flying, Geometry of Aerial photographs, aerial camera, and aerial film negative, Stereoscopes, How to order fresh photography.

Global Positioning System: Introduction, space segment, ground control segment, user segment, errors in GPS, applications of GPS.

Principles of Geographic Information System (GIS): Definition, GIS applications, Components of GIS, geographically referenced data, spatial data, attribute data, GIS operations, Types of data structure, Raster and Vector formats, Advantages and disadvantages of various data structure.

Spatial Objects: Points, lines, polygons, relationships between spatial objects, adjacency, connectivity, containment, digital elevation models (DEM)

Data Input: Method of data capture, digitization and scanning methods, data output.

Practical:

Practical on photogrametry, Visual interpretation of aerial photos on different scale, tracing of details from stereo pair, Georeferencing, GPS field study.

Suggested Readings:

- An Introduction to Geographical Information Systems: Ian Heywood, Sarah Conrnelius, Steve Carver, Srinivasa Raju, Dorling Kindersley (India) Pvt. Ltd.
- Concepts and Techniques of Geographic Information Systems: C.P.Lo. Albert, K.E. Yeung, PHI Learning Pvt. Ltd. New Delhi-110001.
- Geographical Introduction Science: Narayan Panigrahi, Universities Press (India) Pvt. Ltd.
- Remote Sensing in Geology: SM. Ramasamy, Rawat Publications, Jaipur and New Delhi.
- Remote Sensing and Image Interpretation: Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman, Wiley India, Pvt. Ltd. Daryaganj New Delhi.
- Geographic Information Systems and Science: Paul A. Longley, Michael F. Good child, David J. Maguire, David W. Rhind, John Wiley & Sons, Ltd.

M.Sc. III Semester		
Course Code: SOA/RT//E004		**Credit-(2+1)**
Course Title: MEDICINAL AND AROMATIC PLANTS (MAPs)		

Course outcomes:

- The aim of the course is to provide knowledge of cultivation and collection of medicinal plants its importance and identifies different medicinal and Aromatic plants available in different parts of the country.
- After completion of the course students will be able to perform nursery management, domestication and harvesting practice of MAPs and can carry out processing of MAPs for value addition.
- Student learn about Improvement and conservation of medicinal plants, breeding technique for medicinal plant improvement, domestication, rear and endangered medicinal plants.

Theory

Introduction of Medicinal and Aromatic Plants: Importance and needs of cultivation of Medicinal and Aromatic plants, Nutritional value, Scope, Development and future prospect , Area and production, Export potential of medicinal and Aromatic plants, medicinal plants found in Uttarakhand.

Origin, distribution, morphological features, climatic and soil requirements, classification, propagation and nursery techniques, transplanting, after care, Harvesting and post-harvest processing, and uses of the following medicinal and aromatic plants.

Medicinal Plants: Amla, Shankhpuspi, Brahmi, Chirayita, Arjuna, Kutki, Harad, Tulsi, Ashwagandha, Aloe-Vera, Sarpgandha, Isubgol, Kuth, Jatamanshi Garlic, Ginger Turmeric, Black pepper, Coriander, Fenugreek, Clove and other species related to local condition.

Aromatic Plants: Lemon grass, Lavender grass, Citronella grass, Geranium, Ocimum, Mentha, Eucalyptus and other species related to local conditions of Uttarakhand.

Improvement and conservation of medicinal plants, breeding technique for medicinal plant improvement, domestification, rear and endangered medicinal plants.

Practical:

Preparation and layout of nursery and field area, preparation of root and shoot cuttings, Methods of seed sowing, Irrigation techniques, Identification of valuable Medicinal Plants, Related indigenous knowledge, Nursery raising techniques, Planting and care, Harvesting, Storage and Preservation of MAPs, Habitat study of MAPs, Herbarium preparation, Cultivation techniques

Suggested Readings:

- A Handbook of Medicinal Plants: A Complete Source Book: Prajapati/ Purohit/ Sharms/Kumar,Agrobios India.
- Herbal and Medicinal Plants of India: Dr. D. K. Bhatt/ Dr. Aparna Raj/ Kiran Bhatt, Shree Publishers and Distributors, New Delhi.
- Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants**:** N. Kumar/ JBM Md.Abdul Khader/ P. Rangaswami/ I. Irulappan, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

SEMESTER IV

M.Sc. IV Semester		
Course Code: SOA/RT/C016		**Credit-(1+0)**
Course Title: MASTER SEMINAR		

Course outcomes:

- Department will organize in house seminars about pre-discussion of the master thesis topics and Assignments topic.
- Formulate main research question and related questions, and discuss them.
- Understand the logic and implications of the choices they are making when it comes to research methodology and methods

M.Sc. IV Semester		
Course Code: SOA/RT/C017		**Credit-(12+0)**
Course Title: MASTER THESIS		

Course outcomes:

- To build up the efficiency of students regarding research.
- To study the data collection technique on the local research areas. It will help to learn about the idea of dissertation, thesis writings, selection of problems and thesis writing. It will help to presentation of papers. Provide idea of basic research.
- Students will presentation their work. Students can write their Dissertation and paper for Publication. Improve the language and thinking of the students.

Elective Course

M.Sc. IV Semester		
Course Code: SOA/RT/ E005		**Credit-(2+1)**
Course Title: GENDER SENSITIZATION FOR DEVELOPMENT		

Course outcomes:

- In this course the students will learn about an overview of the concept of gender and gender balance on development and develop skills of identifying gender roles, rights, responsibilities and relationships on development.
- Besides the students will also learn the attitudinal change to internalize gender equity concerns as fundamental human rights and also enhance the capability for identifying and analyzing gender issues in agriculture and allied sectors.

Theory

Gender concepts, issues and challenges in development; Gender roles, gender balance, status, need and scope; Gender analysis tools and techniques.

National policy for empowerment of women since independence; Developmental programmes for women; Gender mainstreaming in agriculture and allied sectors –need and relevance; Gender budgeting – A tool for empowering women.

Women empowerment –Dimensions; Women empowerment through SHG approach; Women entrepreneurship and its role in economic development; Public Private Partnership for the economic empowerment of women; Building rural

institution for women empowerment; Women human rights ; Action plans for gender mainstreaming.

Practical

Visits to rural institutions of women for studying in the rural institutions engaged in Women empowerment; Visits to entrepreneurial unit of women for studying the ways and means of establishing entrepreneurship units for Women and their development and also SWOT analysis of the Unit; Visit to Center for women development - NIRD to study the different activities related to projects and research on gender; Visit to gender cell, Office of the Commissioner and Director of Agriculture, Hyderabad, to study the mainstreaming of gender concerns and gender budget of the department.

Suggested Readings

- Grover I & Grover D. 2002. Empowerment of Women. Agrotech Publ. Academy.
- Porter F, Smyth I &Sweetman C.1999. Gender Works: Oxfarm Experience in Policy and Practice. Oxfarm Publ.
- Raj MK. 1998. Gender Population and Development. Oxford Univ. Press.
- Sahoo RK &Tripathy SN. 2006. SHG and Women Empowerment. Anmol Publ.
- Sinha K. 2000. Empowerment of Women in South Asia. Association of Management Development Institution in South Asia, Hyderabad.
- Thakur Joshi S. 1999. Women and Development. Mittal Publ.
- Vishwanathan M. 1994. Women in Agriculture & RD. Rupa Books.

M.Sc. IV Semester		
Course Code: SOA/RT/ E006		**Credit-(2+1)**
Course Title: POSTHARVEST TECHNOLOGY OF FRUITS &VEGETABLES		

Course outcomes:

- This course is an advanced course wherein, various aspects of the "farm to table" theme will be covered.
- Main objectives of the course are to make the students aware about post harvest technology and management of fruits and vegetables.
- The course is designed to give students an understanding on various changes occurring in fruits and vegetables during the pre-and post-harvest stages.
- The students will learn more on physiology and biochemical changes in fruits and vegetables, handling, transportation and preservation/storage of the fresh harvest with emphasis laid on safety and quality evaluation.
- The course will be of immense help to students to have a better understanding of the harvesting systems (traditional and modern), postharvest biology as well as the physiology importance of quality, safety and marketability of the fresh horticultural produce, all of which are directly dependent on the consumers' attitude.

Theory

Introduction: Importance and scope and of fruit and vegetables preservation industry in India, Principles and methods of preservation.

Causes of Post-Harvest Losses: control of post-harvest losses- proper cultural operations, maturity indices of fruits and vegetables, pre-storage treatments, transportation, storage, environmental control, ionizing radiation, post-harvest chemical treatments.

Value Addition: General methods of making Jam, Jelly, marmalades, fruit juices, Pickles, Sauce and chutney, Canning and Bottling, Food spoilage.

Drying/ Dehydration of Fruit and Vegetables: Natural or home drying, commercial dehydration.

Freezing of Fruit and Vegetables: freezing process, methods of freezing.

Marketing: Principles and guidelines for establishment of processing unit. Rural entrepreneurship development for preservation of fruit, vegetables and their products. Quality management for fresh marketing, Marketing of fruits and vegetables and their products, Quality control in food processing- HACCP. List of machineries used in processing industries.

Practical:

Identification of equipments used in preservation, preparation of jam, jelly, squash, juice, chutney, sauce, pickles, estimation of acidity , vitamins C , sugar, T.S.S., and juice content, visit to processing factories.

Suggested Readings

- Fruit and Vegetable Preservation, Principles and Practices: R. P. Srivastava/ Sanjeev Kumar, International Book Distributing Co.
- Post Harvest Management and Processing of fruit and Vegetables- Instant notes: Satish Kumar Sharma, New India Publishing Agency, PitamPura, New Delhi.
- Practical Manual Series-2: Post Harvest technology of Horticultural Crops: S. K. Sharma/ M. C. Nautiyal, New India Publishing Agency, PritamPura, New Delhi

M.Sc. IV Semester		
Course Code: SOA/RT/ E007		**Credit-(2+1)**
Course Title: INFORMATION AND COMMUNICATION TECHNOLOGY		

Course outcomes:

- The course also exposes the students to various Digitized video material in multimedia and also enable to design visuals for print, TV and knowhow about scanning of visuals.
- In this course, students will learn about the concept, meaning and process of communication and various methods and modern media of communication.

Theory

Communication process – concept, elements and their characteristics – Models and theories of communication - Communication skills – fidelity of communication, communication competence and empathy, communication effectiveness and credibility, feedback in communication, social networks and

development communication – Barriers in communication, Message – Meaning, dimensions of a message, characteristics of a good message, Message treatment and effectiveness, distortion of message.

Methods of communication – Meaning and functions, classification, Forms of communication – Oral and written communication, Non-verbal communication,

interpersonal communication, organizational communication, Key communicators – Meaning, characteristics and their role in development.

Media in communication- Role of mass media in dissemination of farm technology, Effect of media mix for rural people, Modern communication media – Electronic video, Tele text, Tele conference, Computer associated instruction, Computer technology and its implications.

Agricultural Journalism as a means of mass communication, Its form and role in rural development, Basics of writing – News stories, feature articles, magazine articles, farm bulletins and folders. Techniques of collection of materials for news stories and feature articles; Rewriting Art of clear writing, Readability and comprehension of testing procedures; Photo journalism, communicating with pictures, Radio and TV journalism, Techniques of writing scripts for Radio and TV.

Practical: Instead of practical, there will be term paper/ assignment

Suggested Readings

- Communication and Instructional Technology. Agrotech Publ. Academy.
- Jana BL &Mitra KP. 2005. Farm Journalism. Agrotech Publ. Academy.
- Ray GL. 2006. Extension Communication and Management. Kalyani Publ. Rayud
- Van Den Ban AW & Hawkins HS. 1998. Agricultural Extension .2nd Ed. CBS.
- Viswanathan M. 1994. Women in Agriculture and Rural Development .Printwell Publ.
- Jitendra Chauhan, 2012. PrasarSikshaAvemSuchna Tantra, Eisha Publication, Agra
- O.P. Dahama,97. Extension and Rural Welfare, Ram Prasad & Sons, Agra

M.Sc. IV Semester		
Course Code: SOA/RT/ E008		**Credit-(2+1)**
Course Title: BASIC IMAGING TECHNOLOGY		

Course outcomes:

- In this course, students will learn the information management and journalistic writing of various information materials and also study their readability.

Theory

Photo Journalism Concept, Scope and Importance, Theory and principles of photography; role of photography in extension; types of camera and their use; essential of a camera; taking indoor and outdoor pictures;

Type of films; darkroom and its requirements; choice of papers; developing agents and their preparation Principles, Selection and Editing of photographs, writing photo features and captions.

Video Production Technology - Concepts, Types of Cameras & Parts, Different formats, Techniques of Planning, Production and Editing, Types of Shots. Audio & Video mixing. Desk Top Publishing

Practical

Designing of layout and Preparation of Agricultural Information Materials, Method of holding and Exposing a Still camera. Writing captions for photographs. Writing Photo

features for photographs. Studying various parts of video camera and Handling of video camera. Audio & Video mixing. Desk Top Publishing

Suggested Readings

- Dahama OP &Bhatnagar OP. 2005. Education and Communication for Development. Oxford & IBH. Grover I, Kaushik S, Yadav L & Varma SK. 2002. Communication and Instructional Technology. Agrotech Publ. Academy.
- Jana BL &Mitra KP. 2005. Farm Journalism. Agrotech Publ. Academy.
- Ray GL. 2006. Extension Communication and Management. Kalyani Publ. Rayud

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – SANSKRIT

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

प्रवेश परीक्षा (पी0 एच0 डी0) पाठ्यक्रमः
संस्कृत–साहित्यम्

पूर्णाङ्काः–100

वर्गः–1

Unit-1

वैदिकवर्गः–

(क) ऋग्वेदः– अग्निसूक्तम् 1.1, विष्णुसूक्तम् 1.154, इन्द्रसूक्तम् 2.12, अक्षसूक्तम् 10.34, पुरुषसूक्तम् 10.90, प्रजापतिसूक्तम् 10.121 ।

संवादसूक्तानि– पुरुरवा–उर्वशीसंवादः (ऋग्वेद 10.95), सरमा–पणिसंवाद (ऋग्वेद 10.108), विश्वामित्र–नदीसंवाद (ऋग्वेद 3.33), इन्द्र–मरुत्संवाद (ऋग्वेद 10.165)

(ख) अथर्ववेदः– द्वादशकाण्डम् पृथिवीसूक्तम् 1.1–20 ।

(ग) निरुक्तम् –1–2 अध्यायौ।

वर्गः–2

Unit-2

वैदिकसाहित्यस्येतिहासः–

वेदोत्पत्तिः, वेदानां प्रतिपाद्यविषयाः, वेदानां भाष्यकारः, संहिताब्राह्मणारण्यकोपनिषदां, वेदाङ्गानाञ्च संक्षिप्तः परिचयः।

वर्गः–3

Unit-3

(क) लौकिकसंस्कृतसाहित्यस्य संक्षिप्त इतिहास, काव्यानि च।

अधोलिखितकवीनां तत्काव्यकृतीनाञ्च संक्षिप्तः परिचयः–

वाल्मीकिः, व्यासः, भासः, शूद्रकः, कालिदासः, अश्वघोषः, विशाखदत्तः, भट्टिः, भारविः, माघः, दण्डी, सुबन्धुः, बाणः, हर्षदेवः, भट्टनारायणः, भवभूतिः, श्रीहर्षः, जयदेवः, कल्हणः, विल्हणः, पण्डितराजजगन्नाथः, अम्बिकादत्तव्यासः, भर्तृहरिः।

(ख) अधोलिखितानां विशेषाध्ययनम् –

कुमारसम्भवम् (प्रथमःसर्गः), किरातार्जुनीयम् (प्रथमःसर्गः), अभिज्ञानशाकुन्तलम्, उत्तररामचरितम्, मेघदूतम्, शुकनासोपदेशः।

वर्गः–4

Unit-4

काव्यशास्त्रम्

(i) साहित्यदर्पणम् (प्रथम द्वितीय, तृतीय परिच्छेदाः)

(ii) काव्यप्रकाश (1, 2, 8, 9, 10, उल्लासाः)

(iii) ध्वन्यालोकः–प्रथमोद्योतः।

(iv) दशरूपकम्, रसगङ्गाधर (प्रथम आननम्) ।

(v) काव्यशास्त्रस्य सामान्यपरिचयः।

(vi) वृत्तरत्नाकरः।

वर्गः–5

Unit-5

दर्शनशास्त्रम्

सांख्यकारिका, तर्कभाषा (प्रामाण्यवादपर्यन्तम्), वेदान्तसारः,
सर्वदर्शनसङ्ग्रह चार्वाकः, जैनदर्शनम्, बौद्धदर्शनम्।

वर्गः–6

Unit-6

दर्शनशास्त्रस्येतिहासः

भारतीयास्तिक– नास्तिकदर्शनानां सामान्यपरिचयः।

वर्गः–7

Unit-7

व्याकरणम्

(क) वरदराजविरचिता लघुसिद्धान्त कौमुदी
संज्ञाप्रकरणम्, संन्धिप्रकरणम्, कृदन्तप्रकरणम्, समासप्रकरणम्।
(ख) भट्टोजिदीक्षितविरचिता व्याकरणसिद्धान्तकौमुदी – कारकप्रकरणम्।

वर्गः–8

Unit-8

भाषाविज्ञानम्

भाषायाः लक्षणम्, भाषायाः प्रकृतिः, भाषाविज्ञानस्य लक्षणम्, भाषापरिवर्तनस्य कारिणानि विश्वभाषाणां वर्गीकरणम्– आकृतिमूलकवर्गीकरणम्, पारिवारिकवर्गीकरणञ्च, भारोपीयपरिवारस्थानां भाषाणां संक्षिप्त परिचयः, आर्यभाषापरिवारविवरणम्, अर्थविज्ञानम्, ध्वनिविज्ञानम्, रूपविज्ञानम्।

वर्गः–9

Unit-9

धर्मशास्त्रम्

(क) धर्मशास्त्रस्य सामान्यपरिचयः
विशेषाध्ययनम्– मनुस्मृतिः, याज्ञवल्क्यस्मृतिः, नारदस्मृतिः, पराशरस्मृतिः।

वर्गः–10

Unit-10

शुद्धाशुद्धविवेचनम्।

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – SOCIAL WORK

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

SYLLABUS: Social Work

Contents :

Unit I-Nature and Development of Social Work.

Unit II- Society, Human Behavior and Communities.

Unit III- Social Work with Individuals and Groups.

Unit IV-Social Work with Communities and Social Action.

Unit V-Research in Social Work : Quantitative and Qualitative Approaches.

Unit VI-Administration, Welfare and Development Services.

Unit VII -Social Policy, Planning and Social Development.

Unit VIII-Indian Constitution, Social Justice, Human Rights and Social Work Practice.

Unit IX- Areas of Social Work Practice I.

Unit X-Areas of Social Work Practice II.

Unit I

Nature and Development of Social Work

- **Social Work** : Definition, Scope, Principles, Nature, Goals and Process
- **Historical Development**:Development of Professional Social Work across the world (U.K., U.S.A., and India)
- **Social Reform and Professional Social Work**:Contribution of Social Reformers in 19th and 20th Century in the development of Professional Social Work in India.
- **Social Work as a Profession in India**: Values, Competencies and Code of Ethics for the Social Work Practioners.
- **Theories**:Theories for Social Work Practice.
- **Changing Context of Social Work Practice** : Emerging Perspectives, Trends and Challenges of Social Work for Practice.
- **Social Work Practice in various settings**:(Family, Child and Youth welfare, Industry, Older Persons, Persons with Disabilities, Environment, Women and Welfare, Healthcare and Disaster Management.)

Unit II

Society, Human Behavior and Communities

- **Sociological Concepts** : Social Structure, Social Institutions and Social Groups, Socialization, Social Control and Social Change.
- **Approaches to the study of Society**: Functionalist, Conflict/Dialectical , Structuralism and Post Modernism.
- **Social System and Stratification**: Major Social Systems (Family and Religion), Social Stratification : Marxist, Functionalist and Weberian approach.
- **Human Behavior** : Normal and Abnormal Behaviour Determinants and Life span perspective of Human Development, Development Tasks and Hazards during Pre Natal Period, Infancy, Babyhood, Childhood, Puberty, Adolescence and Adulthood.
- **Theories of Personality** : Psycho Analytic Theory of Personality, Behavioral theories and Humanistic theories.
- **Social Psychology**: Social Perception, Attitude formation, Change and Measurement, Communication and Theories of Collective Behavior.

- **Type of Communities**: Rural ,Urban, Tribal and Virtual Communities and various Vulnerable Groups/ sections viz. Women , Child , Aged, Dalits etc; Caste and Class – Their Characteristics.

Unit III

Social Work with Individuals and Groups

- **Basic Social Case Work Concepts** : Social Roles, Social Functioning, Need Assessment, Adaptation, Social environment, Person-in-Environment Fit, Principles and Components.
- **Approaches to Social Case Work Practice :** Diagnostic and Functional Approach, Problem Solving, Task Centered and Radical Approach.
- **Process and Techniques of Social Case Work**:Phases of Case Work Intervention, Tecniques of Case Work Intervention, Principles of Interviewing and Case Work Recording.
- **Social Group Work** : Definition, Characteristics, Functions and Group Structure, Classification of Groups and making of Social Groups, Issues of Identity, Diversity and Marginalization.
- **Social Group Work Process and Group Dynamics** : Principles, Determinants, Indicators and Outcomes, Decision making and Problem Solving Process, Theories of Leadership, Roles and Responsibilities of Group Leaders.
- **Group Development** : Stages of Group Work, Techniques and Skills in Group Work, Group Climate, Communication in Groups, Use of Programme Media and Group Work Recording, Monitoring and Evaluation.
- **Practice Sites of Social Case Work and Social Group Work** : Client Groups and various settings (Children, Correctional, Health, Women, Persons with Disabilities, Older Persons, Oppressed Groups, Religious Minorities, Persons who are Gay & Lesbian and other Socially and Economically Disadvantaged Groups)

Unit IV

Social Work with Communities and Social Action

- **Community Organization** – Concept , Definition , Scope and Historical Perspective in India, UK, and USA, The Role of Community-Based Organizations, Human Capital & Social Capital.
- **Process of Community Organization**: Steps in Community Organization , Methods , Principles, Skills, Assumptions, Record Maintaince, Involving NGOs in Community Organization.
- **Approaches in Community Organization Practice** – Models , Strategies, The role of CommunityBased Organizations, Leadership Development and Leaders, Building Partnerships and coalitions.
- **Social Action and Social Movements**: Concept, History, Social Action as a Method of Social Work.
- **Models of Social Action:** Conscientisation model of Paulo Freire,Role of ideology, Saul Alinsky as a radical community organizer, Liberation Theology.
- **Social Movements:** Origin, Nature, Types of Movements,Theories of Movement and new Social Movements
- **Social Movements, Social Action and Social Change**: Movement Analysis : Ideology, Structure, Leadership, Process and Outcomes, Analysis of ideology and approach of (Gandhi, Martin Luther King Jr. and Frantz Fanon)

Unit V

Research in Social Work : Quantitative and Qualitative Approaches

Section A : Quantitative Research

- **Basics of Social Science Research** : Meaning of Research, Social Science and Social Work Research : Meaning, Nature and Scope.
- **Steps in Social Science Research** : Identifications and Formulations of Research Problem, Literature Review, Objectives and Hypothesis Formulation, Research Design, Sample Design, Sources, Methods and Tools of Data Collection, Processing and Analysis of Data and Writing Research Reports including Presentations and Styles of References, Citing and Paraphrasing.

- **Basic Statistical concepts** : Process of statistical Enquiry and dealing with Descriptive and Inferential Statistical Methods, Parametric and Non-parametric Tests.

Section B : Qualitative Research

- **Qualitative Research** : Meaning, Basic tenets of Qualitative Research, Difference between Quantitative and Qualitative Approach to Research in social Work.
- **Designing Qualitative Research**: Steps, Methods of Qualitative Research (Field study, Case Study, Focus Group Discussions, Narratives, Observation and Theoretic Research)
- **Managing Qualitative Data** : Procedures and Techniques of Analyzing Qualitative Data and Report Writing.

Section C :

- **Mixed Method Research** : Components of Mixed Methods, Procedures of Combing Quantitative and Qualitative research.

Unit VI

Administration, Welfare and Development Services

- **Social Welfare Administration** : Meaning, History, Principles, Nature and Type of Organizations.
- **Types of Admisntration** :Distinction between Social Welfare Administration, Public administration and Social Security administrations.
- **Registration of Welfare Agencies:** Laws relating to Societies, Trust and Non – Profit organizations, Challenges
- **Structure of Social Welfare Administration** : Service Providers, Administrative structures (Government and Non - Government), Organization and Management of Institutional Welfare Services.
- **Components of Administration** : Planning, Coordination, Staff Recruitment, Training and Development, Recording and Documentation, Budgeting, Monitoring and Evaluation, Networking and Maintaining Pubic Relations.

- **Strategies and Mechanisms ofAdministration**: Role of Social Workers in Decision Making Process, Communication, Role Description and Functioning, Sustainability of Programmes.
- **Fund raising and Resource Mobilization**: Grant-in-aid (Principles and Procedures), Resource Mobilization, Financial Administration and Social Marketing – Process and Models.

Unit VII

Social Policy, Planning and Social Development

- **Social Policy** : Concept, Goals, Scope , Context and Models of Social Policy and applicability in Indian context.
- **Historical Development**: Evolution and Historical perspective of various Policies, Implementation of Social Policies especially for Marginalized and Vulnerable sections of the society.
- **Process of Policy Formulation** : Determinants and Steps, Approaches to Social Policy formulation , Impact of changing Political Scenerio in a country.
- **Social Planning**; Concept, Objectives, Scope, Models, Interrelationship between Social and Economic Planning, Social Planning in India.
- **Five Year Plans**: Changes in Social Planning with Five Years Plans in India, Social Planning and Social Change , Factors leading to development of planning in India. Roles and functions of Niti Aayog.
- **Social Development**:Positive and Negative Dimensions of Social Development; Concept, Models and Theories, Historical and Social Context of Development in India,
- **Sustainable Development**: Concept, Strategies, Critical issues , Salient Features of Social Development. Approaches to Social Development; Similarities and Differences.Strategic Development Goals, Human Development Index and Indicators for Policies and Programmes.

Unit VIII

Indian Constitution, Social Justice, Human Rights and Social Work Practice

- **Indian Constitution**: Characteristics, Features, Preamble, Directive Principles of State Policy and Articles.
- **Social Justice** : Concept, Definition, Historical Development, Dimensions, Manifestations and Social Justice as a Core value of Social Work Profession.
- **Social Justice and Leadership**: Community Building, Personal and Community Empowerment, Social Justice and Technology, Promoting a Plan and Vision for Change, Reflections and Connection, Social Reconstructions, Paradigms, Policies, Privileges, Implications of Social Justice for Policy Formulation.
- **Instrument of Social Justice** : Constitutional Base and Indian Legal System, Legal and Public Advocacy, Role of Civil Society as a Pressure group, Statutory bodies.
- **History of Human Rights**: Concept and Historical Context of Human Rights, Human Rights Declarations, Treaties and Conventions, Human Rights and Protection Systems, Human Rights in the Indian Context.
- **Human Rights and Social Work** : Code of Ethics of Social work and Protection of Human Rights, Human Rights perspective in Social Work Practice, Ethnic sensitive practice, Feminist Practice, Social Work with Diverse Groups.
- **Violation of Human Rights and Social work practice**: Social Work with the Victims of Human Rights Violations and Human Rights Activism. Role of UNHCR, National Human Rights Commission and International Human Rights Agencies.

Unit IX

Areas of Social Work Practice I

(Health Care Social Work Practice, Social Work with Older Persons and Persons with Disabilities,Gender, Labour Welfare, Industrial Relations, Personnel Management and Human Resource Management)

- **Medical Social Work and Psychiatric Social Work**: Concept, Evolution, Roles, Functions / Responsibilities of Medical Social Workers and Psychiatric Social Workers.
- **Mental Health and Disease**: Normal and abnormal behaviour, Epidemiology, Etiology, Types, Clinical Manifestation and Management of Schizophrenia, Mood Disorders, Neurotic Disorders, stress related Disorders, Somatoform Disorders, Child and Adolescent Mental Health Problems, Legislations related to Mental Health.
- **Theories of Aging and Vulnerability**:Psychological and Sociological Theories of Aging, Psychological, Social, Physical needs and problems of Older Persons. Rights of Older Persons against Neglect, Abuse, Violence and Abandonment and Social Work Interventions.
- **Persons with Disabilities:**Models of Disability, Disability Movement – Historical Perspective, National and International Milestones from Welfare to Right based Approach, Legislative Measures and Social Work Interventions.
- **Gender and Development**:Expressions of Gender Disparity in Education, Health, Property, Employment and Livelihood, Decision Making, Feminization of Poverty and Manifestations of Gender based Violence. Constitutional & Legislative Safeguards and Social work Interventions.
- **Labour Welfare & Human Resource Management (HRM):** Historical background of Industrial Development as a sub-system of society, Concept of Labour Welfare, Nature, Objectives, Principles, Theories, Principles of labour welfare, Labour Legislations, Human Reosurce management : Concept, Scope, Evolution, Theories, Models, Sub-systems, Human Resources Development (HRD) - Performance Management System, Types, Six Sigma, ISO, Total Quality Management, Corporate Social Responsibility(CSR) - Concept, Issues, Practices, Models, Components, Approaches and Corporate Governance.
- **Personnel Management and Industrial Relations:** Concept, Defintiion , Objectives, Scope., Functions, Determinants and Reflectors of Industrial Relations, Models of Industrial Relations, Globlazition and Industry, International Labour Organization(ILO) Role, Functions; Collective Bargaining, Job Analysis, Manpower Planning, Organization Behaviour and Organization Development Interventions.

Unit – X

Areas of Social Work Practice II

(Social Defence and Correctional Services, Social Work with Familiaes and Children, Environment and Social Work, Social Work and Disaster Management)

- **Social Defence**: Concept, Philosophy and Changing Dimensions, Children in Need of Care and Protection, Juveniles in Conflict with law, Street and Working Children and Young Offenders, Probation and Parole. Emerging issues in Social Defence.
- **Legislations and Criminal Justice System**: Juvenile Justice (Care and Protection of Children) Act, 2000, Immoral Traffic prevention Act 1986, Probation of Offenders Act, 1958, Beggary Prevention Act, Narcotic Drugs and Psychotropic Substance Act 1986, Prison Act, and Criminal Justice System.
- **Social Work with Families**: Functions, Developmental Stages and Family patterns, Family Dynamics and Theoretical Models of Family Functioning (Circumflex model, Mc Master Model and Structural Model) and Social Work Interventions.
- **Child Development**: Concept, Philosophy and Historical context, State of Children in India - Demographic Profile, Education, and Protection
- **Policies & Programmes for Children**: Constitutional Provisions, National Policy on Children, International perspective and UN convention an rights of children, Programmes and Legislative Measures related to Female Feticide, Adoption, Foster Care, Guardianship and Child Marriage and Social Work Interventions.
- **Environment and Social Work:** Causes and Consequences, Differential impact on Women, Poor, Marginalised Groups and Indigenous Populations. Environment in the Human Rights Perspective. Environmental Movements and social work

interventions in the management, protection and promotion of the environment.

- **Social Work and Disaster Management**: Disaster related concept and Definitions: Hazard, Risk, Vulnerability and Disaster, different forms of natural & manmade disasters. Impact of Disaster and Disaster Management Initiatives, Pre and Post Disaster Interventions.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – SOCIOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Hemvati Nandan Bahuguna Garhwal (A Central) University
Syllabus of Ph.D. Entrance Examination
SOCIOLOGY

Sociological Concepts: The Historical Background of Sociology: Definition, Scope, and Nature of Sociology.
Basic Concepts - Society, Community, Institution, Association and Culture, Status, Status set, Status sequence. Role, Multiple roles, Role set, and Role Conflict,
Social Group - Meaning and Types: Primary-Secondary, Formal-Informal, Ingroup-Outgroup, Reference Group, Social Institutions - Marriage, Family and Religion, Socialization-Socialization, Anticipatory socialization, Agencies of socialization, Theories of socialization,
Social Stratification- Social differentiation, Hierarchy, Forms of stratification: Caste, Class, Gender, Ethnicity, Theories of Social Stratification,
Social Change and Social Mobility—concepts and Types: Evolution, Diffusion, Progress, Revolution; Theories: Dialectical and Cyclical; Social Mobility concept and types.

Classical Sociological Theory: The socio-historical and intellectual background of Sociology; August Comte (Positivism, social evolution); Karl Marx (historical and dialectical materialism, class conflict); Emile Durkheim (Social Fact, methodology, social solidarity, social change, religion, and society); Max Weber (Social Action, authority, class, status, and power, religion, economy)

Modern Sociological Theory: Conflict Theory and Neo-Marxism (Lewis Coser, Ralf Dahrendorf, Antonio Gramsci, Louis Althusser, Habermas) Functionalism and Neo-Functionalism (Talcott Parsons, Robert Merton, Jefferey Alexander) Interpretative Sociology (G.H. Mead, Harold Garfinkel, Erving Goffman, Alfred Schutz, Peter Berger, Luckmann)

Social Research Method: Meaning and nature (social phenomena, scientific inquiry, objectivity, and subjectivity, fact, and value); Quantitative methods (survey, research design, hypothesis, sampling, techniques of data collection: observation, questionnaire, and interview); Qualitative methods (participant observation, case study, content analysis, oral history, life history); Statistical tools (measures of central tendency, measures of dispersion, correlation, test of significance — reliability, and validity).

Sociology of India: Approaches to studying Indian Society (Indology, Civilizational, Functional, Marxist, Subaltern); Indological/Textual-G.S. Ghurye; Louis Dumont. Civilizational: N.K. Bose and Surjeet Sinha. Structural-Functional-M.N. Srinivas; S.C. Dube, Synthesis of Textual and Field views. Irawati Karve; Andre Beteille. Marxian-D.P. Mukherji, A.R. Desai, Subaltern-Ranjit Guha, David Hardiman, Recent trends in Indian Sociology

Contemporary Social Issues: Poverty, Inequality of caste and gender, Regional, ethnic, and religious disharmonies, family disharmony (Domestic violence, Dowry, Divorce, Intergenerational conflict). Contemporary Developmental Issues - Poverty, Regional disparity, slums, Displacement, ecological degradation and environmental pollution, Health problems, Issues On Deviance - Deviance and its forms, Crime and delinquency, White collar crime and corruption, Changing profile of crime and criminals, Drug addiction, Suicide,

Sociology of Development: Conceptual perspectives on Development: Economic Growth, Human Development, Social Development, Sustainable development: Ecological and Social. Social Structure and Development: Social Structure as a Facilitator/Inhibitor. Culture and Development: Culture as an aid/ impediment.

Women and Society: Social Construction of Gender: Gender vs. Biology, Approaches to the Study of Women: Marxian and Feminist, The Changing Status of Women in India: Pre-Colonial, Colonial and Post-Colonial, Women's movements in 19th and 20th Centuries, The Status of Health and Education among Women in India, Development of Women: Economic and Political Participation of Women.

Rural Sociology: Definition, Scope, and Importance, Rural-Urban Continuum, Little Community, Peasant Society and folk Culture, dominant caste, Rural faction, Little and Great Tradition, Social Institution: Joint Family, Caste and Jajmani System, Community development programs and Panchayati Raj.

Sociology of environment: The Rise, Decline and Resurgence of Sociology of Environment, Interrelation among Ecology, Environment and Society, Environment Conservation and Sustainable Development, Environment Impact Analysis, Human Rights concerning Environment, Social movements regarding Environment and Ecology, Role of Non-Governmental and Voluntary Organization (NGOs & VOs) in Environment Protection.

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SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – STATISTICS

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

SEMESTER POST - GRADUATE COURSE

IN

STATISTICS

Deparatment of Statistics, H.N.B.Garhwal Central University, Srinagar (Garhwal)

M.A. / M.Sc. course in Statistics is meant for two years spread in four semesters. Each of the theory and practical paper consists of 100 marks. Four theory papers and two practicals will be undertaken in each semester.

Eligibility: B.A. /B.Sc. with Mathematics. Preference to those who have Statistics as a subject at B.A. /B.Sc. level.

(Revised in 2018)

Distribution of different courses and credits in various semesters:

First Semester

Course Code	Title of the Paper	Credit
ST-101	Real Analysis and Complex Analysis	**3**
ST-102	Matrices	**3**
ST-103	Measure Theory and Probability	**3**
ST-104	Distribution Theory	**3**
SP-105	Practical I	**3**
SP-106	Practical II	**3**
	Total	**18**

Second Semester

Course Code	Title of the Paper	Credit
ST-201	Statistical Inference	**3**
ST-202	Survey Sampling	**3**
ST-203	Design and Analysis of Experiment	**3**
ST-204	Linear Algebra	**3**
SP-205	Practical I	**3**
SP-206	Practical II	**3**
	Total	**18**

Third Semester

Course Code	Title of the Paper	Credit
ST-301	Multivariate Analysis and Curve Fitting	**3**
Elective/Optional Papers	**Any three papers out of the paper Nos. ST-302 to ST-309**	**3 X 3= 9**
ST-302	Advanced Operations Research I	
ST-303	Statistical process and Quality control	
ST-304	Reliability theory	
ST-305	Research methodology and project work - I	

ST-306	Statistical decision theory	
ST-307	Statistical Computing	
ST-308	Nonparametric and Semiparametric methods	
ST-309	Linear Models and Regression Analysis	
ST-310	Time series analysis	
SP-311	Practical I	**3**
SP-312	Practical II	**3**
	Total	**18**

Fourth Semester

Course Code	**Title of the Paper**	**Credit**
ST-401	Economic Statistics and Demography	**3**
Elective/Optional Papers	**Any three papers out of the paper Nos. ST-402 to ST-407**	**3 X 3= 9**
ST-402	Advanced Operations Research II	
ST-403	Bio Statistics	
ST-404	Stochastic Process	
ST-405	Official Statistics	
ST-406	Bayesian Inference	
ST-407	Econometrics	
ST-408	Environment Statistics	
ST-409	Project Work	
SP-410	Practical I	**3**
SP-411	Practical II	**3**
	Total	**18**
	Grand Total	**72**

First Semester

Course No. ST-101 **Title: Real Analysis and Complex Analysis**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Monotone functions and functions of bounded variation. Absolute continuity of functions, standard properties. Uniform convergence of sequence of functions and series of functions. Cauchy's criterion and Weirstrass M-test. Condititions for termwise differentiation and termwise integration (statements only). Power series and radius of convergence.

Riemann-Stieltjes integration. Statement of the standard properties and problems based on them. Multiple integrals and their evaluation by repeated integration. Change of variable in multiple integration. Beta and gamma functions. Differentiation under integral sign. Leibnitz rule. Dirichlet integral, Liouville's extension.

Maxima-minima of functions of several variables, Constrained maxima-minima of functions.

Analytic function, Cauchy-Riemann equations. Statement of Cauchy theorem and of Cauchy integral formula with applications,Taylor's series. Singularities, Laurent series. Residue and contour integration.

Fourier and Laplace transforms.

Books Recommended:

1. Apostol, T.M. (1975). Mathematical Analysis, Addison- Wesley.
2. Bartle, R.G. (1976). Elements of Real Analysis, John Wiley & Sons.
3. Berbarian, S.K. (1998). Fundamentals of Real Analysis, Springer-Verlag.
4. Conway, J.B. (1978). Functions of one Complex Variable, Springer-Verlag.
5. Priestley, H.A. (1985). Complex Analysis, Clarenton Press Oxford.
6. Rudin, W. (1985). Principles of Mathematical Analysis, McGraw Hill.

Course No. ST-102 **Title: Matrices**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Different type of matrices, algebra of matrices, row and column spaces of a matrix, elementary matrices, determinant, singular and non-singular matrices, adjoint of matrix, rank and inverse of matrix, portioned matrices and Kroneker product.

Canonical form, Hermit canonical form, diagonal form, triangular form, Jordan form, quadratic form, generalized inverse, Moore-Penrose generalized inverse, idempotent matrices.

Characteristic roots and vectors, algebraic multiplicity of characteristic roots, Caley-Hamilton theorem, spectral decomposition of real symmetric matrix.

Positive, semi positive , negative and semi negative definite matrices, similar matrices

Derivative of determinant.

Books Recommended:

1. Biswas, S, (1984): Topics in Algebra of matrices, Academic Publications.
2. Shanti Narain: A text books of matrices, S. Chand and Company (Pvt) Ltd.
3. Frank Ayres , JR: Schaum's outline series Theory and problems.

Course No. ST-103 **Title: Measure Theory and Probability**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Measure and integration: Classes of sets, field, sigma fields, minimal sigma fields, Borel sigma fields, Limsup and liminf of a sets, Measure, Probability measure, properties of a measure, Lebesgue and Lebesgue- Steljes measures, measurable functions.

Probability : Baye's theorem. Random variable. Marginal and conditional distributions, Expectation. Tehebycheffs inequality and improvements on it, convergence in probability. The weak law of large numbers Bernoulli's theorem. Convergence in distribution continuity theorem. Khinchin's theorem. Strong law of large numbers Kologorov's theorem, Borel zero-one law, Borel-Cantelli lemma.

Central limit theorem-Lindberg Levy's and liapouneff forms.

Books Recommended:

1. Goon Gupta and Das Gupta: An outline of Statistical theory, World Press Calcutta, Vol. 1.

2. Rohtagi, V.K. and Saleh A.K. (2005): Probability Theory, John Wiley.
3. B.R. Bhat(1985): Modern Probability Theory.
4. Basu, A.K. (2001): Probability and Measure theory, Narosa Pub.

Course No. ST-104 **Title: Distribution Theory**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Univariate Discrete distributions; properties and applications of Uniform Discrete, Binomial, Poisson, Hypergeometric, Geometric Negative Binomial distribution and Multinomial distribution.

Univariate continuous Distribution; statement, derivation of properties and applications of Normal, Beta, Gamma, Cauchy, Exponential

Sampling distribution from Binomial, Poisson, Exponential and Normal populations, Bivariate distributions; bivariate normal. Distribution of functions of random variables.

Large sample tests. Derivation and properties of chi-square, t and F distribution and their inter relationship. Test of significance based on chi-square, t and F distribution.

Order statistics, their distributions and properties, joint and marginal distributions of order statistics, extreme values and their asymptotic distributions (statement only) with applications.

Books Recommended:

1. Rao, C.R. (1973): Linear Statistical Inference and its Application, Wiley Eastern.
2. Kendall, M.G., Stuart, A: The Advanced Theory of Statistics: Distribution Theory. Vol. 1.
3. Johnson and Kotz: Continuous Univariate Distribution, Vol. 1 and Vol. 2, Wiley.
4. Dudwvicz, E.J. and Mishra, S.N. (1988): Modern Mathematics Statistics, Wiley. International students edition.

Course No. SP-105 **Title: Practical I**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on ST-102 and ST-103.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Course No. SP-106 **Title: Practical II**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on ST-104.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Second Semester

Course No. ST-201 **Title: Statistical Inference**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Problem of point estimation: Unbiasedness, Consistency, Sufficiency, Efficiency, Complete statistics, Complete Sufficient statistics. Factorization theorem, Exponential family of distributions and its properties, Minimum-variance unbiased estimators, Rao Blackwell theorem. Lehmann Schefe's theorm, Cramer-Rao Inequality.

Method of estimation- Method of Maximum Likelihood and its properties.

Interval estimation, Interval Estimation: Confidence Region, shortest confidence intervals, General method of finding confidence interval. Method of obtaining confidence intervals based on small and large samples, Relationship with the testing of hypothesis.

Testing of hypothesis: Basic concept, Simple and composite hypothesis, Two types of error, power of the test , Neyman-Pearson lemma and its generalization, Types A, A1 critical regions, Construction of most powerful test, Uniformly most powerful tests, Uniformly most powerful Unbiased test using N P lemma, likelihood ratio test and its properties.

General decision problem: Basic concept of loss function, risk function, Minimax and Bays rule.

Books Recommended:

1. Lehmann, E.L.(1986): Theory of Point Estimation, Student Edition.
2. Zacks, S. (1971): Theory of Statistical Inference, Wiley, New York.
3. Rao, C.R. (1973): Linear Statistical Inference and its applications, 2nd edition, John wiley and sons.
4. Kale, B.K. (1999): A First course on Parametric Inference, Narosa Publishing House.
5. Goon, A.M., M.K. Gupta, & B. Das Gupta: Outline of Statistics, Vol-II.

Course No. ST-202 **Title: Survey Sampling**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Basic Principles: Census and sample surveys, advantages and disadvantages of sample surveys. Basic principles in sampling, survey enquiries, choice of sampling units, problems of sample size, Bias in selection and estimation, simple random sampling, sampling from finite populations with and without replacement, sampling of attributes, unbiased estimates of population total, mean and estimation of their variances.

Stratified Sampling: Reason for stratification, choice of strata, choice of sampling unit, stratified random sampling, estimation of population mean and its variance, choice of sample sizes in different strata, variances of estimates with different allocation, effects of deviation from optimum allocation, estimation of the gain in precision due to stratification, cost function, construction of strata.

Systematic Sampling: Estimation of sample mean and its variance, comparison of systematic sampling with simple random and stratified sampling.

Ratio and Regression Estimation: Ratio and regression methods of estimation, variances of the estimates, optimum property of ratio estimates, comparison among ratio and regression and simple and biased estimates.

Cluster Sampling: Estimates of mean and its variance for equal and unequal clusters, efficiency in terms of intra-class correlation, optimum unit of sampling, sampling with replacement, estimation of mean and variance.

Double Sampling: Multistage sampling with special reference to two stage design, Non-sampling errors, problems of non response, errors of measurements, Interpenetrating sub sampling. Randomized response techniques. Pilot survey.

PPS Sampling schemes, sampling techniques with varying probabilities for simple random sampling. Herwits Thompson Estimators, Mid Zuno Sen Sampling Scheme.

Books Recommended:

1. Cochran W.G.: Sampling Techniques, Wiley Eastern Ltd., New Delhi.
2. Des Raj and Chandhok (1998): Sampling Theory, Narosa Publishing House.
3. Mukhopadhayay Parimal: Theory and Methods of Survey Sampling-Prentice Hall of India Ltd.
4. Kish L: Survey Sampling.

Course No. ST-203 **Title: Design and Analysis of Experiment**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Analysis of Variance for one-way, two-way with one/m observation per cell for fixed, mixed and random effects models, Tuckey's test for non- additivity. General theory of analysis of experimental designs; completely randomized design, Randomized block design and Latin square design, Missing plot techniques in RBD and LSD.

Analysis of covariance for CRD and RBD. Split plot and strip plot designs. Complete and Partial confounding. General factorial experiments: Definition, Estimation of factor's effect. Analysis of the factorial experiments using CRD and RBD.

Balanced Incomplete Block Designs: Balanced Incomplete Block Design with and without recovery of inter information.

Books Recommended:

1. Goon A.M., Gupta, M.K. and Das Gupta, B.: Outline of Statistics Vol.-2.
2. Das and Giri: Design and analysis of experiment.
3. Cochran, W.G. and Cox, G.M. (1959): Experimental Designs, Asia Publishing House, Singapore.
4. Mann H.B.: Analysis and Design of Experiments, Dover Publications Inc. New York.

Course No. ST-204 **Title: Linear Algebra**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Vector Space, subspace, linear dependence and independence, maximal linearly independent subset, basis and dimension of vector space, finite dimensional vector spaces, Example of vector spaces over real and complex variable.

Linear transformation, algebra of linear transformation, null space and ranges, rank and nullity of linear transformation, Rank nullity theorem, Eigenvalues and eigenvectors for Linear Transformations, matrix representation of linear transformation.

Vector spaces with an inner product, Gram-Schmidt orthogonalization process, orthonormal projection of a vector.

Books Recommended:

1. Biswas, S, (1984): Topics in Algebra of matrices, Academic Publications.
2. Shanti Narain: A text books of matrices, S. Chand and Company (Pvt) Ltd.
3. Stephen H. Friedberg, Arnold J. Insel Lawrence E. Spence: Liner Algebra, Pearson Education Limited.
4. Kenneth Hoffman and Ray Kunje:Linear Algebra, Prentice-Hall Inc.

Course No. SP-205 **Title: Practical I**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on ST-202.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Course No. SP-206 **Title: Practical II**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on ST-203.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Third Semester

Course No. ST-301 **Title: Multivariate Analysis and Curve Fitting**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Multivariate normal distribution and its properties. Random sampling from multivariate normal distribution. Maximum likelihood estimators of parameters, distribution of sample mean vector.

Wishart matrix- its distribution and properties, distribution of sample generalized variance, null and non-null distribution of multiple correlation coefficient.

Hotelling's T^2 and its sampling distribution, application in test on mean vector for one and more multivariate normal population.

Classification and discrimination procedures for discrimination between two multivariate normal populations-sample discriminant function, test associated with discriminant functions, probabilities of misclassification and their estimation, classification into more than two multivariate normal populations, Fisher Behren Problem.

Mahalonobis D^2 Statistics and its application, Principal component, Canonical variables and canonical correlations: definition, use, estimation and computation.

Books Recommended:

1. Anderson, T.W. (1983): An Introduction to Multivariate Statistical Analysis, 2nd Ed., Wiley.
2. N.S. Giri: Multivariate Statistical Analysis.
3. Johnson, R. and Wychern(1992): Applied Multivariate Statistical Analysis, Prentice Hall, 3rd Edition.
4. Sharma, S. (1996): Applied Multivariate Techniques, Wiley.

Elective/Optional papers: Any Three papers out of the Following:

Course No. ST-302 **Title: Advanced Operations Research I**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Definition and scope of Operational research; phases in Operations Research; models and their solutions.

Review of linear programming problems (LPP); revised simplex method; duality theorem. Two-person games; pure and mixed strategies; existence of solution and uniqueness of value in zero-sum games; finding solution in 2x2, 2xm and mxn games; reduction of game problem to a linear programming problem.

Allocation Problems: transportation problem (TP); degeneracy in TP; unbalanced TP, Assignment Problem.

Dynamic Programming: Bellman's principle of optimality; general formulation of dynamic programming; computational methods and applications of dynamic programming.

Queuing Models: Steady-state solutions of (M/M/1) and (M/M/C) models with associated distributions of queue length and waiting time; M/G/1.

Non-Linear Programming: Kuhn-Tucker conditions; Wolfe's and Beale's algorithms for solving quadratic programming problems.

Inventory Control- Economic lot Size, Formulae of Harris for known demand and its extension allowing shortage, Random demand: Discrete and Continuous case.

Books Recommended:

1. Sharma, S.D.: Operation Research, Pragati Prakashan, Meerut.
2. Taha, H.A. (1982): Operations Research: An Introduction; MacMillan Publishing Company, New York.
3. Kanti Swaroop, Gupta, P.K. and Singh, M.M. (1985): Operations Research; Sultan Chand and Sons.
4. Hadley, G and Whitin, T.M. (1963): Analysis of Inventory System; Prentice Hall.

Course No. ST-303 **Title: Statistical Process and Quality Control**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Basic concept of process monitoring and control, process capability and process optimization.

General theory and review of control charts for attribute and variable data; O.C. and A.R.L. of control charts; control by gauging; Moving average and exponentially weighted

moving average charts; Cu-sum charts using V-masks and decision intervals; Economic design of X-bar chart.

Acceptance sampling plans for attribute inspection; single, double and sequential sampling plans and their properties; Plans for inspection by variables for one-sided and two-sided specifications; Mil Std and IS plans; continuous sampling plans of Doge type abd Wald-Wolfiwitz type and their properties. Bayesian sampling plans.

Capability indices Cp, Cpk and Cpm; estimation, confidence intervals and tests of hypotheses relating to capability indices for Normally distributed characteristics.

Use of Design of Experiments in SPC; factorial experiments, fractional factorial designs, construction of such designs and analysis of data.

Multivariate quality control; use of control ellipsoid and of utility function.

Books Recommended:

1. Montgomery, D.C. (1985): Introduction to Statistical Quality Control; Wiley.
2. Wetherill, G.B. and Brown, D.W.: Statistical Process Control: Theory and Practice; Chapman and Hall.
3. Phadke, M.S.(1989): Quality Engineering Through Robust Design, Prentice Hall.
4. Ott, E.R. (1975): Process Quality Control; McGraw Hill.

Course No. ST-304 **Title: Reliability theory**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Reliability concepts and measures; components and systems; coherent systems; Reliability of coherent system; cuts and paths; modular decomposition; bounds on system reliability; structural and reliability importance of components.

Life distribution; reliability function, hazard rate; common life distribution- exponential, Weibull, gamma, normal, etc.; Estimation of parameters and tests in these models.

Notion of aging; IFR; IFRA; NBU; DMRL and NBUE classes and their duals; Io of memory property of the exponential distribution; closures of these classes under formation of coherent system; convolution and mixture.

Basic ideas of accelerated life testing.

Univariate shock models and life distribution arising out of them; bivariate shock models; common bivariate exponential distributions and their properties. Reliability estsimation based on failure times in variously censored life tests and in tests with replacement of failed items; stress-strength reliability and its estimation.

Books Recommended:

1. Zacks, S.: Reliability Theory, Springer.
2. Barlow, R.E. and Proschan, F. (1985): Statistical Theory of Reliability and Life Testing; Holt, Rinehart and Winston.
3. Nelson, W. (1982): Applied life Data Analysis; John Wiley.
4. Lawless, J.F. (1982): Statistical Models and Methods of Life Time Data; John Wiley.

Course No. ST-305 **Title: Research Methodology and Project Work – I**

Credit: 3

Maximum Marks: 100
(a) Semester Examination: 60
(b) Preparation of project proposal, discussion and presentation: 40

Meaning of Research – Objective of Research – Approach to research – significance of research – type of research – research in Social Sciences – facts, theories and concepts in Social Science research – research design – features of a good research design.

Research problem – Identifying the research problem – formulation of research problem-concept of hypothesis – role and formulation of hypothesis – scientific method of research – nature of scientific research – stages of scientific method.

Logic and scientific method – Deductive and inductive methods – the Case study method-merits and demerits of Case study methods – survey methods – merits and demerits of survey methods – types of survey – selecting the survey method – sample surveys – different types – merits and demerits.

Schedule and questionnaire – Principle underlying the construction of questionnaire-measurement and scaling techniques – processing and analysis of data.

Interpretation and report writing – Steps – bibliography, quality of a good research report.

Books Recommended:

1. Kothari, C.R. (1985): Research Methodology: Methods and Techniques, Wiley Eastern.
2. Dominowski, R.L. (1980): Research Methods, Prentice Hall Inc., New Jersey.
3. Mishra, R.P. (1980): Research Methodology, Handbook Concept Publishing Company, New Delhi.
4. IIPS (1996): Research Methodology, IIPS, Mumbai.

Course No. ST-306 **Title: Statistical decision theory**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Decision problem and 2-person game, utility theory, loss functions, expected loss, decision rules(non-randomized and randomized), decision principles (conditional Bayes, frequentist), inference problems as decision problems optimal decision rules, concepts of admissibility and completeness, Bayes rules, admissibility of Bayes rules, Supporting and separating hyperplane theorems.

Minimax theorem for finite parameter space, minimax estimators of Normal and Poisson means, admissibility of minimax rules, Invariant decision rules-location parameter problems, invariance and minimaxity, admissibility of invariant rules.

Complete class theorem, complete and essentially complete classes in simple estimation and testing situations, estimation of a distribution function, Multivariate normal distribution, Exponential family of distributions.

Sufficient statistics, essentially complete classes of rules based on sufficient statistics, complete sufficient statistics, sequential decision rules, Bayes and minimax sequential decision rules, invariant sequential decision problems, sequential tests of a simple hypothesis against a simple alterative, SPRT and stopping rule principle.

Books Recommended:

1. Berger, J.O. (1985): Statistical Decision Theory and Bayesian Analysis, 2nd Edition. Springer Verlag.
2. Rohatgi, V.K. (1988): An Introduction to Probability and Mathematical Statistics, Wiley Eastern, New Delhi.
3. Rao, C.R. (1973): Linear Statistical Inference and its Applications, Wiley Eastern.
4. Ferguson, T.S.(1967): Mathematical Statistics-A Decision Theoretic Approach, Academic Pres.

Course No. ST-307 **Title: Statistical computing**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Computer organization, problem analysis, Algorithm development, Flow chart, Introduction to Fortran 77, Data type, operators and expressions, Assignment statement, Arithmetic and logical operation, List directed and Format-directed Input / Output statement**.**

Windows: Use of windows, its operations and applications. MS word: operations of MS word and applications.

MS excel: Use of MS excel, its operations, solution of statistical problems using MS excel.

MATLAB/MINITAB: Use of MATLAB/MINITAB, computation of statistical problem using MATLAB/MINITAB.

A statistical package such as SPSS or R.

Books Recommended:

1. B. Ryan and B.L. Joiner (2001): Minitab handbook, 4th edition, Duxbury.
2. R.A. Thisted (1988): Elements of statistical computing, Chapman and hall.
3. Ram Kumar: Introduction to Fortran-77.
4. V.Raja Ramen: Fortran-77.

Course No. ST-308 **Title: Nonparametric and Semiparametric methods**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Empirical distribution function, Glivenko Cantelli Theorem, Kolmogorov Goodness of fit test.

One sample U-statistics, Kernel and symmetric kernel, Two sample U-statistics, Asymptotic distribution of U-statistics. UMVUE property of U-statistics, Asymptotic distribution of linear function of order statistics.

Rank tests, Locally most powerful rank tests, Linear rank statistics and their distributional properties under null hypothesis, Pitman's asymptotic relative efficiency.

One sample location problem, sign test and signed rank test, two sample Kolmogorov Smirnov tests. Two sample location and scale problems. Wilcoxon-Mann-Whitney test, normal score test, ARE of various tests based on linear rank statistics. Kruskal-Wallis K sample test.

Cox's Proportional Hazard Model, rank test (partial likelihood) for regression coefficients. Concepts of jackknifing method of Quenouille for reducing bias, Bootstrap methods, Confidence intervals.

Books recommended:

1. Davison, A.C. and Hinkley, D.V. (1997): Bootstrap methods and their application, Cambridge University Press.
2. Gibbons, J.D. (1985): Nonparametric statistical inference, 2nd ed., Marcel Dekker, Inc.
3. Randles, R.H. and Wolfe, D.A. (1979): Introduction to the theory of nonparametric statistics, John Wiley & Sons, Inc.
4. Puri, M.L. and Sen, P.K. (1971): Nonparametric methods in multivariate analysis, John Wiley & Sons, Inc.

Course No. ST-309 **Title: Linear Models and Regression Analysis**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Standard Gauss-Markov models: Estimability of parameters, Best linear unbiased estimator (BLUE), method of least square and Gauss-Markov theorem, Variance and Covariance of BLUE.

Introducing of one way random effects linear models and estimation of Variance components.

Maximum likelihood, MINQUE and restricted maximum likelihood estimators of variance components, best linear unbiased predicators (BLUP).

Bi-variate and multiple linear regression, polynomial regression, use of orthogonal polynomial. Linear and non-linear regression models.

Books Recommended:

1. Rao, C.R. and Kleffe, J. (1988). Estimation of variance component and applications, North Holland.
2. Chatterjee, S. and Prince, B. (1991): Regression Analysis by example, John Wiley, New York.
3. Draper, N.R. and Smith H. (1998): Applied Regression Analysis, 3rd Ed. Wiley.
4. Cook, R.D. and Weisherg, S. (1982): Residuals and Inference in Regression, Chapman and Hall.

Course No. ST-310 **Title: Time series analysis**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Time-Series as discrete parameter stochastic process. Auto covariance and autocorrelation function and their properties. Exploratory time series analysis, Holt and winters smoothing. Forecasting based on smoothing, adaptive smoothing.

Detailed study of the stationary processes; (1) moving average(MA), (2) auto regressive(AR), (3) ARMA and (4) AR integrated MA(ARIMA) models. Box-Jenkin models.

Discussion(without proof) of estimation of mean, auto covariance and autocorrelation function under large sample theory. Choice of AR and MA periods. Estimation of ARIMA model parameters, Forecasting.

Spectral analysis of weakly stationary process. Periodogram and correlogram analysis. Computations based on Fourier transform.

Spectral decomposition of weakly AR process and representation as a one- sided MA process- necessary and sufficient condition. Implication in prediction problems.

Books recommended:

1. Anderson, T.W. (1971): The Statistical Analysis of Time Series, John Wiley, New York.
2. Box, G.E.P. and Jenkins, G.M. (1976): Time Series Analysis-Forecasting and Control, Holden-day, San Francisco.
3. Kendall, Sir Maurice and Ord, J.K. (1990): Time Series, Edward Arnold, London.
4. Findley, D.F. (Ed.) (1981): Applied Time Series II, Academic Press.

Course No. SP-311 **Title: Practical I**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on ST-301.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Course No. SP-312 **Title: Practical II**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on selected elective papers.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Fourth Semester

Course No. ST-401 **Title: Economic Statistics and Demography**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Time Series Analysis: Objects, Decomposition, Tests of Randomness, Trend component, polynomial, logistic, Gompertz, Log-normal trend functions, smoothing of moving average, Spencer's formulae and effects, Slutsky-yule effect, variate difference method, Measurement of seasonal and cyclic functions, peridogram and Harmonic analysis, Autocorrelation and Correlogram analysis.

Demand Analysis: Distribution of Income, Income and Demand elasticities. Methods for estimating elasticities using family budget data and time series data, Engel's Curve and Engel's law, Pareto's Analysis.

Demography: Source of Demographic data, Limitations and uses of demographic data, vital rates and ratios, Definition, construction and uses, life tables, complete and abridged construction of life table from vital statistics, uses of life tables. Logistic and other population growth curves. Measure of fertility gross and net reproduction rates, stationary and stable population theory. Uses of Lotka's stable population theory in estimation of demographic parameters, methods of inter-censal and post-censal estimation.

Books Recommended:

1. Lodge, II. F & Roming: Sampling Inspection Plans and Tables, John Wiley
2. Goon Gupta and Das Gupta: Fundamental of Statistics, Vol-II, The World Press, Pvt. Ltd.
3. Biswas, S: Stochastic processes in demography and applications
4. Johnsonton J: Economic Models, John Wiley and Sons, New York.

Elective/Optional papers: Any Three papers out of the Following:

Course No. ST-402 **Title: Advanced Operations Research II**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Integer Programming: Branch and bound algorithm and cutting plane algorithm. Multi-criterion and goal programming.

Stochastic Programming; quantile rules.

Two-stage programming; use of fractional programming.

Sequencing and scheduling problems: 2 machines n-job and 3-machines n-job problems with identical machine sequence for all jobs; 2-job n-machine problem with different routing; branch and bound method for solving travelling-salesman problems.

Sensitivity analysis. Parametric programming.

Project management: CPM and PERT; probability of project completion; PERT-crashing.

Replacement problems: block and age replacement policies; dynamic programming approach for maintenance problems; replacement of items with long life.

Transient solution of M/M/1 queue; bulk queues(bulk arrival and bulk service); finite queues; queues in tandem; GI/G/1 queue and its solutions; simulation of queues.

Books Recommended:

1. Taha, H.A. (1982): Operations Research: An Introduction; MacMillan Publishing Company, New York.
2. Shamblin, J.E. and Stevens, G.T. (1974): Operations Research: A Fundamental Approach; McGraw Hill.
3. Kanti Swaroop, Gupta, P.K. and Singh, M.M. (1985): Operations Research; Sultan Chand and Sons.
4. Kleinrock, L. (1975): Queuing Systems, Vol. I; John Wiley.
5. Starr, M.K. and Miller, D.W. (1962): Inventory Control-Theory and Practice; Prentice Hall.

Course No. ST-403 **Title: Bio Statistics**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Type of biological assays: direct assays, indirect assays, parallel line assays. Incomplete block designs for bio assays.

Response surfaces: Linear Response surface designs, second order response surface designs, variance of estimated response.

Introduction to clinical trials: the need of clinical trials, bias and random error in clinical studies, overview of phase 1-4 trials. Analysis of categorical outcomes from phase I-III Trials, analysis of survival data from clinical trials.

Analysis of One DNA sequence: Shotgun Sequencing, Modeling signals in DNA.

Analysis of multiple DNA or Protein Sequences: Alignment Algorithms for Two sequences, Protein sequences and Substitution Matrices.

Books Recommended:

1. Z. Govindarajulu(2000): Statistical technique in Bioassay, S. Kargar.
2. 2. Das, M.N. and Giri, N. (1975): Design and Analysis of experiments, New age international.
3. S. Piantadosi (1997): Clinical trials. A methodological perspective. Wiley & sons.
4. J.L. Fleiss (1989): The design and analysis of clinical experiments, Wiley & sons.

Course No. ST-404 **Title: Stochastic Process**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Probability generating function, Binomial, Poisson, Geometric and Negative Binomial. Convolution. General Stochastic Process, Definition, classification and examples. Compound distribution.

Branching process, Properties of Generating function, Probability of extinction, Distribution of total progeny. Random walk, first passage time, Gambler's ruin problem, duration of game.

Markov chains, higher transition probabilities. Classifications of states and chain, determination of higher transition probabilities. Stability of Markov system, limiting behavior.

Poisson process and related distribution. Generalization of Poisson process. Birth process, Yule-Furry process, Generalized Birth death processes, Linear Birth death processes.

Books Recommended:

1. Medhi, J. (1982): Stochastic process, New age international, New Delhi.
2. Bhat, B.R.: Stochastic models, Analysis and applications
3. Ross, S.M.: Stochastic process, New age international, New Delhi.
4. Bailey, N.T.J.: Elements of Stochastic process.

Course No. ST-405 **Title: Official Statistics**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Introduction to Indian and International Statistical systems. Present Official Statistical System in India, role, functions and activates of central and state organization. Organization of large scale sample surveys methods of collection of official statistics, Role of National Sample Survey Organization.

General and special data dissemination systems, population growth in developed and developing countries. Evaluation of performance of family welfare programs projection of labor force and manpower. Scope and content of population of census of India.

System of collection of agriculture Statistics, Crop forecasting and estimation. Support prices buffer stock, impact of irrigation projects.

Statistics related to industries, balance of payment, cost of living, educational and other Social Statistics.

Books Recommended:

1. Basic Statistics relating to Indian Economy (CSO) 1990.
2. Statistical system in India (CSO) 1975.
3. Guide to Official Statistics (CSO) 1999.
4. Principles and accommodation of National Populations Census. UNESCO.

Course No. ST-406 **Title: Bayesian Inference**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Subjective probability, its existence and interpretation. Prior distribution, subjective determination of prior distribution. Improper priors, non-informative (default) priors, invariant priors. Conjugate prior families, construction of conjugate families using sufficient statistics of fixed dimension, mixtures of conjugate priors, hierarchical priors and partial exchangeability. Parametric Empirical Bayes.

Bayesian inference: Bayes sufficiency, summary through posterior, predictive inference.

Bayesian decision theory: Bayes solutions for practical decision problems. Point estimation, credible sets, testing of hypotheses. Comparison with classical procedures. Admissibility and minimaxity of Bayes and generalized Bayes procedures.

Ideas on Bayesian robustness. Asymptotic expansion for the posterior density. Bayesian calculation, Monte-Carlo Integration and Markov chain. Monte Carlo techniques (Without proof).

Books Recommended:

1. Berger, J.O.: Statistical Decision Theory and Bayesian analysis, Springer Verlag.
2. Robert, C.P. and Casella, G.: Monte Carlo Statistical Methods, Springer Verlag.
3. Leonard, T. and Hsu, J.S.J.: Bayesian Methods, Cambridge University Press.
4. Box, G.P. and Tiao, G.C.: Bayesian Inference in Statistical Analysis, Addison-Wesley.

Course No. ST-407 **Title: Econometrics**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Nature of econometrics, The general linear model (GLM) and its extensions, Use of dummy variables and seasonal adjustment, Generalized least squares (GLS) estimation and prediction, Heteroscedastic disturbances, Pure and mixed estimation, Grouping of observations and of equations.

Auto correlation, its consequences and tests, Theil BLUS procedure: estimation and prediction, Multicollinearity problem, its implications and tools for handling the problem, Ridge regression.

Linear regression with stochastic regressors, Instrumental variable estimation, Errors in variables, Autoregressive linear regression, Distributed lag models, Simultaneous linear equations model, Examples, Identification problem, Restrictions on structural parameters - rank and order conditions, Restrictions on variances and covariances.

Estimation in simultaneous equations model, Recursive systems, 2 SLS Estimators. Limited information estimators, k - class estimators. 3 SLS estimation, Full information maximum likelihood method.

Books Recommended:

1. Johnston, J. (1984): Econometrics methods, Third Edition, McGraw Hill.
2. Apte, P.G. (1990): Text books of Econometrics, Tata McGraw Hill.
3. Damodar N. Gujrati(2004): Basic Econometrics, Fourth edition, McGraw Hill.
4. Cramer, J.S. (1971): Empirical Econometrics, North Holland.

Course No. ST-408 **Title: Environment Statistics**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Ecological diversity: species abundance curve, Indices of diversity (Simpson's Index, Shannon-Wiener index). Diversity as average rarity. Harvesting renewable biological resources-Maximum sustainable yield, tragedy of the commons, Air and water pollution.

Books Recommended:

1. Bodkin, Daniel D.(1995): Environmental Science-Earth as a living planet, John Wiley & Sons, New York
2. Clack, C.W.(1976): Mathematical Bioeconomics: Optimal management of renewable resources, John Wiley and Sons, New York
3. Pielow, E.C. (1997): An introduction to Mathematical ecology, John Wiley and Sons, New York
4. Gore, Anil and Paranhoe, S.A. (2000): A course on Mathematical and Statistical Ecology, Kluwer.

Course No. ST-409 **Title: Project Work**

Credit: 3 **Maximum Marks: 100**

The Project Work will spread over the whole semester. A project may be undertaken by a group of students. However, the project report shall be submitted by each member of the group separately. A project report shall clearly state the problem addressed, the methodology adopted, the assumption and the hypotheses formulated, any previous reference to the study undertaken, statistical analyses performed and the broad conclusion drawn. There shall be an external examiner and an internal examiner (preferably the supervisor of the student) for the evaluation of the project work. Out of the total 100 marks assigned to the project, 60 marks will be assigned on the evaluation of the project work separately by both the examiner and 40 marks will be assigned jointly by the examiners on the oral presentation and viva-voce.

Course No. SP-410 **Title: Practical I**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on ST-401.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Course No. SP-411 **Title: Practical II**

Credit: 3 **Maximum Marks: 100**

Syllabus: Practicals based on selected elective papers.

(Practical paper will be of 100 marks out of which 20 marks will be assigned on sessionals / tutorial / class tests / seminars in class / group discussions and 80 marks will be assigned on the end semester examination out of which 60 marks will be on the performance in practical examination and 10 marks will be assigned each on practical record book and viva-voce).

Minor Electives for students of other programmes

First Semester

Course No. STM-101 **Title: Statistical Methods**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Descriptive Statistics: Measures of central tendency, dispersion, skewness and kurtosis for the sudy of nature of data.

Idea of correlation and regression for two and three variables; correlation coefficient, correlation ratio, multiple and partial correlations.

Important statistical distribution: Binomial, Poisson, Hypergeometric, Negative binomial, Normal, Uniform, Exponential and Multinomial distributions.

Statistical Inference: Concept of point estimation, interval estimation and testing.

Books recommended:

1. Bhat, B.R., Srivenkatarmana, T. and Rao Madhava, K.S. (1996): Statistics: A Biginner's Text, Vol I & II, New Age International (P) Ltd.
2. Snedecors, G.W. and Cochran, W.G. (1967): Statistical Methods, Iowa state University Press.
3. Goon, A.M., Gupta, K. and Dasgupta, B. (1991): Fundamentals of Statistics, Vol I, World Press, Calcutta.
4. Freund, J.E. (2001): Mathematical Statistics, Prentice Hall of India.
5. Mukhopadhyay, P. (1996): Mathematical Statistics, New Central Book Agency.

Second Semester

Course No. STM-201 **Title: Sampling theory, design of experiments and data analysis using softwares**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

Basic concept of sampling from a finite population; sampling versus complete enumeration; simple random sampling, sample size determination, stratified random sampling, systematic sampling, cluster sampling and multi-stage sampling (all sampling schemes without proof of expressions).

Analysis of variance technique: One way and two way classified data.

Design of experiment: Randomization, replication, local control; Completely randomized design, Randomized block design and Latin square design; factorial experiments.

Data analysis: Use of SPSS and SYSTAT softwares for data analysis, Use of parametric and non – parametric tests and the interpretation of the results.

Books recommended:

1. Cochran, W.G. (1977): Sampling Techniques, 3rd Edition, Wiley.
2. DesRaj (2000): Sample Survey Theory, Narosa Publishing House.
3. Das, M.N. and Giri, N (1986): Design and Analysis of Experiments, Springer Verlag.
4. Rohatgi, V.K. (1988): An Introduction to Probability and Mathematical Statistics, Wiley Eastern, New Delhi.
5. Gibbona, J.S. (1985): Non- Parametric Statistical Inference, 2nd Edition, Marcel Dekkar, Inc.

Third Semester

Course No. STM-301 **Title: Data analysis using regression models**

Credit: 3 **Maximum Marks: 100**
(a) Semester Examination: 60
(b) Semester/Internal Assessment: 40

(The course will involve a substantial amount of computing and the emphasis will be on applications and interpretations, rather than equations and derivations. Illustration will be done using R language)

Basic of linear regression with one predictor and multiple predictors, interactions, statistical inference, graphical display of data and fitted models.

Linear regression before and after fitting the model: linear transformations, centering and standardizing, logarithmic and other transformations.

Logistic regression with single predictor, interpreting the regression coefficients, logistic regression with interactions.

Generalized linear modes: Poisson regression, logistic- binomial models, regression (normally distributed latent data), ordered and unordered categorical regression, robust regression.

Simulation of probability models and statistical inferences, simulation for checking models fits.

Books recommended:

1. Weisberg, S. (1985): Applied Linear Regression, 2nd Edition.
2. Draper, N.R. and Smith, O. (2001): Applied Regression Analysis, Wiley.
3. Rawlings, John, O. (2001): Applied Regression Analysis, Springer Verlag.

* Students of Statistics shall offer Minor Electives from other programmes.

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SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – TOURISM

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

Centre for Mountain Tourism and Hospitality Studies

Ordinances and Syllabus on Credit based Two Year Full time Master of Business Administration in Tourism and Travel Management Degree Programme

(MBA in Tourism and Travel Management)

1. **Two Year Full Time M.B.A. (Tourism and Travel Management) Programme**:

   There shall be one full time Master's Degree Programme in **(Tourism and Travel Management)** M.B.A.(TTM). The duration of the Programme shall be two years (Two full Academic Years of Four Semesters of six month each). Accordingly each year is divided in two semester- First and Third Semesters from July to December and Second and Fourth Semesters from January to June. There shall be actual teaching for a minimum of Ninety (90) Days in each Semester. The Examination for First and Third Semesters shall ordinarily be held in the month of December and for Second and Fourth Semester in the month of May or on such dates as convenient to the University.

2. **Intake:** Total number of seats:

   There shall be a maximum of Forty four (44) seats for each year or such number of seats as may be approved by the University. The reservation of the seats for various categories of students shall be as per the norms prescribed by the Central Government from time to time.

3. **Course fee**: The fee for the course and other charges and norms for refund of fee shall be as prescribed by the University from time to time**.**

4. **Eligibility for Admission to the Programme**:

   No student shall be eligible for admission to Two Year Full Time M.B.A. in **(Tourism and Travel Management)** unless he/she has successfully completed a three year Under Graduate Degree with prescribed number of Credits through the Examinations conducted by a University/Autonomous Institution or possesses such qualifications as recognized by the University. Further a candidate holding three year Bachelor Degree in any discipline from a recognized University without credit system shall also be eligible. The maximum age of a candidate for taking admission in the programme and the gap between the last Degree/Diploma courses shall be as per the norms prescribed by the university from time to time.

4. **Selection Procedure**: The Candidates seeking admission to Two Year Full Time M.B.A. in Tourism will have to appear in a written test followed by Group Discussion and Personal Interview or as per the norms prescribed by the University. The written test may be conducted by the University or by such agency as may be authorized by the University. The Board for Group Discussion and Personal Interview shall be such as constituted by the University. The final merit for admission shall be prepared based on the score of written test, marks obtained in the Group Discussion and Personal Interview. The eligible candidates appearing in final merit list in inter-se merit shall be eligible for taking admission after completing the procedural formalities including payment of prescribed fees and other charges. Should some seats remain vacant on failure of the candidates to take admission in the Programme, those in the subsequent order of merit list (waitlisted candidates) shall be eligible for admission.

5. **Semesters**

   (a) An academic year shall consist of two semesters:
   Odd Semester (1 and III Semesters): generally July to November
   Even Semester (II and IV Semesters): generally December to April
   The academic calendar for each semester shall be notified well before the commencement of the semester by the Dean, School of Management.

   (b) A semester shall normally extend over a period of 15 weeks. Each week shall have 30 hours of instruction including lab/field work as applicable.

6. **Credits**

   a. Credit defines the quantum of contents / syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus credits shall be assigned on the basis of the number of lectures / tutorials / laboratory work/project work and other forms of learning required to complete the course contents in a 15 week schedule:

   b. 1 Credit = 1 hour of lecture/instruction per week (1 Credit course = 15 hours of lectures per semester) Instruction can by in the form of lectures / tutorials / laboratory work / fieldwork or other forms. In determining the number of hours of instruction required for a course involving field-work, 3 hours of field work shall be considered equivalent to 1 hour of lecture.

7. Roll Numbers and Enrollment Numbers

The Dean of School of Management shall allot a roll number to the students after payment realization, thorough scrutiny and verification of the required documents for a particular course. After the completion of the admission procedure the enrolment number for the students shall be allotted by the University at the entry point which shall remain same for the entire period of study in the University.

8. Course Numbering

MBA (Tourism) shall be identified by the following code.

SOM/MBAT

Course Structure

The MBA in Tourism Programme will be divided into four semesters and the study modules are as follows:-

Syllabus of Master of Business Administration in Tourism (MBA in Tourism)
Course Structure

FIRST SEMESTER (All papers are compulsory-Total Credit -18)

Course No.	Title of course	Credit			
		L	T	P	C
SOM/MBAT/C-01	Principles and Practices of Management	03	0	0	03
SOM/MBAT/C-02	Marketing: Concepts & Principles	03	0	0	03
SOM/MBAT/C-03	Business Environment	02	0	0	02
SOM/MBAT/C-04	Tourism: Concepts and Principles	03	0	0	03
SOM/MBAT/C-05	Tourist Resources of India	03	0	0	03
SOM/MBAT/C-06	Computer Apllication in Tourism & Hospitality industry	02	0	0	02
SOM/MBAT/C-07	Field Tour and Viva-Voce	0	0	02	02
Total		18			

SECOND SEMESTER (All papers are compulsory-Total Credit -18)

Course No.	Title of course	Credit			
		L	T	P	C
SOM/MBAT/C-08	Introduction to Travel Agency and Tour Operation Business	03	0	0	03
SOM/MBAT/C-09	Organizational Behaviour	03	0	0	03
SOM/MBAT/C-10	International Air Fare, Ticketing and Air Cargo Operation	03	0	0	03
SOM/MBAT/C-11	Introduction to Basic Accounts & Financial Management	03	0	0	03
SOM/MBAT/C-12	Hospitality Industry Management	02	0	0	02
SOM/MBAT/C-13	Human Resource Management	02	0	0	02
SOM/MBAT/C-14	Field Tour Report and Viva-Voce	0	0	02	02
	Total	**18**			
SOM/MBAT/S-01	Self-Study Course on Convention and Event Management	03	0	0	03

THIRD SEMESTER (Total Credit -18 (9 Core & 9 Elective)

Course No.	Title of course	Credit			
		L	T	P	C
SOM/MBAT/C-15	Research Methodology	03	0	0	03
SOM/MBAT/C-16	Foreign Language (French)	03	0	0	03
SOM/MBAT/C-17	Tourism Policy and Planning	03	0	0	03
(Any one Group as Elective Major and Any One Paper From the Other Group as Elective Minor)					
	Marketing Management Group				
SOM/MBAT/E-1 A	Tourism and Hospitality Marketing	03	0	0	03
SOM/MBAT/E-2 A	Consumer Behaviour	03	0	0	03
	Financial Management Group				
SOM/MBAT/E-1 B	Advanced Financial Management	03	0	0	03
SOM/MBAT/E-2 B	Working Capital Management	03	0	0	03

	Human Resource Management Group				
SOM/MBAT/E-1 C	Legal Environment & Industrial Relationship	03	0	0	03
SOM/MBAT/E-2 C	Performance Appraisal & Counseling	03	0	0	03
	Total		**18**		
SOM/MBAT/S-02	Self-Study Course on Ecotourism: Principles & Practices	03	0	0	03

FOURTH SEMESTER (Total Credit -18 (9 Core & 9 Elective)

Course No.	**Title of course**	**Credit**			
		L	**T**	**P**	**C**
SOM/MBAT/C-18	Inbound and Outbound Tour Operation	03	0	0	03
SOM/MBAT/C-19	Training Report and Viva-Voce	0	0	03	03
SOM/MBAT/C-20	Project report / Dissertation and Viva-Voce	0	01	02	03
(Any one Group as Elective Major and Any One Paper From the Other Group as Elective Minor)					
	Marketing Management Group				
SOM/MBAT/E-1D	Advertising, Publicity & Public Relation in Tourism & Hospitality Business	03	0	0	03
SOM/MBAT/E-2D	Airlines Marketing	03	0	0	03
	Financial Management Group				
SOM/MBAT/E-1E	Global Financial Market	03	0	0	03
SOM/MBAT/E-2E	Security Analysis & Portfolio Management	03	0	0	03
	Human Resource Management Group				
SOM/MBAT/E-1F	Wages and Salary Administration	03	0	0	03
SOM/MBAT/E-2F	Corporate Restructuring and Human Dimension	03	0	0	03
	Total	**18**			
	Grand Total	**72**			
SOM/MBAT/S-03	Self-Study Course on Adventure Tourism Management	03	0	0	03

In the code number mentioned above the words denotes as SOM- School of Management, C-Core subject, E-Elective subject, SS-Self Study. L- Lectures, T-Tutorials, P-Practical

Course with Credits	Semester-I	Semester-II	Semester-III	Semester-IV	Total
Core	18	18	09	09	54
Elective	Nill	Nill	09	09	18
Self Study course	-	03	03	03	03

First Semester

Title: Principles and Practice of management

Subject Code: SOM/MBAT/C-01 **Contact Hours: 45 Hours**

Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The objective is to provide an understanding of basic concepts, principles and practices of management. The aim is to include the ability to apply multifunctional approach to Organizational objectives.

Course Contents

Unit - I

The Basic Management Theory and Practice: Nature and Importance Management, Concept of Management, Management as Science or Art, Management as profession.

Development of Management Thought: Classical Management Theory: Contribution of Taylor & Fayol: Human behaviour approach, Hawthorne studies, Chester Bernard and social system theory, Recent contribution and Overview of shifts in focus in Management thought.

Management function and skills: Management Role, Functions, Various levels of Management; Overview of functional areas of Management.

Management and society: The external Environment, Social Responsibility and Ethics

Unit II:

Planning: The Nature of Planning, Steps in planning and planning process. Fundamentals of planning; mission and objectives, Major kinds of strategies and policies and Technique of decision making.

Unit-III:

Organizing: Concept of Organization and organization Theories, Formal and Informal organization. Authority and responsibility, Delegation, Centralization and Decentralization; Span of Management, Authority relationships, Line and Staff relationship, Designing of organizations structure.

Unit-IV:

Staffing and Directing: Fundamental of Staffing; Issues in Managing Human Resources, Human factors.

Motivations Theories of Motivations: McGregor's Theory, Hierarchy of needs theory and Herzberg Theory, **Leadership:** Definition, Ingredients of leadership, leadership Pattern styles.

Communication: Process of communication, Communication in organization, Barriers in communication, Effective communication.

Unit V:

Controlling: The Basic Control process, Control Techniques: Budget, Use of Information Technology, Profit and loss control, Control though ROI, Direct control, Preventive control, Managements Audit.

Suggested Readings

1. Drucker, F. Peter: Management-Tasks, Responsibilities & Practices
2. Koontz 'O' Donnel whihrich: Elements of Management
3. Drucker, F. Peter: The Practice of management
4. Drucker, F. Peter: The Practice of Management
5. Terry and Frnklin: Principles of Management
6. Stoner: Principle of Management
7. William H. Newman and E. Kirby Wassen: The Process of Management
8. Rao, V.S.P and Rao S: Management Concepts, konark Publishers.
9. Prasad L.M., Chan S.: Principles & Practice of Management.
10. Agarwal R.D.: Organization & Management, Tata McGraw Hill.

Title: Marketing: Concept & Principles

Subject Code: SOM/MABT/C-02 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: To understand and appreciate the concept of marketing in theory and practice, evaluate the environment of marketing and develop a feasible marketing plan and to understand and appreciate the concept of marketing strategy formulation and implementation

Course Contents

Unit I

Introduction to Marketing, Marketing process and Concepts: from traditional concepts to modern, Indian marketing environment, the marketing mix.

Unit II

Strategic Marketing Planning: Market Segmentation-Bases for segmenting consumer markets, Levels of market segmentation, Market Targeting, Analyzing Buyer Behaviour: Factors affecting consumer behavior, Buyer decision process, Related Case studies.

Unit III

Product and Pricing: Product characteristics and classification, characteristics of services, Product life cycle, Product mix, new product development, Product and brand relationship, brand attributes, branding strategies, product differentiation and positioning. Factors influencing pricing, Pricing methods, to consider when setting prices. Related Case studies.

Unit IV

Integrated marketing communication, Distribution and Promotion: Role of marketing communication, marketing communication mix, advertising, sales promotions, public relation, personal selling, direct marketing. Related Case studies.

Physical distribution and marketing logistics, marketing channels, creating and managing dealer network, retailing, wholesaling, direct marketing, internet marketing.

Unit V

Trends in Marketing: Internal marketing, Socially responsible marketing. Total marketing effort. Marketing information system, marketing research, marketing control, rural marketing in India, Global marketing strategies for Indian firms. Related Case studies.

Suggested Readings

1. Kotler, Philip & Armstrong, Gray, “Principles of Marketing”, Prentice Hall of India, New Delhi
2. Kotler, Philip, “Marketing Management: Analysis, Planning, Implementation and Control”, Prentice Hall of India, New Delhi
3. Kotler, Philip; Keller, Kevin; Koshi, Abraham and Jha, Mithileshwar, “Marketing Management, A South Asian Perspective”, Pearson education.
4. Neelamegham, S., “Marketing in India - Cases & Readings”, Vikas Publishing House, New Delhi
5. RamaSwamy, V.S and Namakumari, S, “Marketing Management - Planning Implementation & Control', Macmillan Books, New Delhi
6. RamaSwamy V.S and Namakumari, S, “Marketing Management”, Macmillan Books, New Delhi
7. Kumar, Arun and Meenakshi, N, “Marketing Management”, Vikas Publishing House, New Delhi.
8. Srinivasan, “Case studies in Marketing”, Prentice Hall of India, New Delhi.
9. Stanton, William J, “Fundamentals of Marketing”, McGrawHill, New York
10. Enis, B.M, “Marketing Classics: A Selection of Influential Articles”, McGrawHill, New York.

Title: Business Environment

Subject Code: SOM/MBAT/C-03 **Contact Hours: 30 Hours**
Work Load: 02 Hours Per week **Credit Points: 02**

Objective: The object is to educate the students on the role of business in modern society. Emphasis is placed on the significant relationship, which exists between business and the social, legal, political, economic, financial and fiscal environment in India. Also analyze the competitive business environment.

Course Contents

Unit I

Introduction: Business environment, Economic environment of business, non-economic environment of business, Environment and Management. Nature of Economic System: Free Market Economy, Social Economy, Mixed Economy, Privatization.

Economic Policies: The theory of economic policy, fiscal policy, monetary policy, physical policy.

Unit II

Indian Economy: The Indian corporate sector, The Public Sector, The Joint Sector, The Co-Operative Sector, Small Scale Industry, The Infrastructure Sector, The Social Sector, The Capital Market, Government Machinery for Industrial Economy.

Unit III

Economic Policy Statements and Problems: Industrial policies of the past, the industrial policy 1990, the industrial policy reforms in the nineties, foreign trade policies and related measures, some aspects of Indian fiscal management, some aspects of Indian monastery management.

Unit IV

Economic Legislation: Monopolies and Restrictive Trade Proactive (MRTP) Act, Company laws, SEBI regulations on corporate restrictions, FEMA.

Unit V

International Economic Environment: New world economic order, Economic Transition in India-Liberalization, Privatization and Globalization global position of India, India and WTO, India and economic sanctions, India's balance of payment outlook, national companies global reach.

Suggested Readings

1. AdhikariM - Economic Environment of Business
2. Agarwal A N - Emerging Dimensions of Indian Management
3. Cherunilam Francis - Business Environment
4. Datta R. and Sundhran KPM - Indian Economy

Title-Tourism: Concepts and Principle

Subject Code: SOM/MBAT/C-04 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The objective is to provide an understanding of basic concepts, principles of tourism.

Course Contents

Unit I: Introduction to Tourism:
Concepts and Issues, Historical Development of Tourism, Technical Definition of tourism and tourists, Understanding the Tourist, Types of Tourist, Travel and Tourism Intermediaries, Transport and Tourism, Tourist Attractions, Tourism Accommodation. Tourism System, Factors Effecting Tourism Systems, Tourism Demand, Tourism Supply Issues, Tourist Motivation.

Unit II: Managing Tourism Operations and Tourist Activities:-
Tourism and Entrepreneurship, Tourism and Information Technology, The Role of the Public and Private Sector in Tourism.
Economic Impacts, the Multiplier Effect, Social and Cultural Impacts, Environmental Impacts, The challenge of Sustainability, carrying capacity, alternative and green tourism philosophy

Unit: III:- Marketing Tourism:
Concepts and Issues, Marketing Tourism: Destination Management, Tourism Product, Difference between Tourism Product and Other Consumer Product.

Unit IV: Tourism Trends and Philosophies
Trends and Themes in the use of Tourist Resources, Urban Tourism, Rural Tourism, Coastal and Resort Tourism, Tourism in the less Developed World. Upcoming Tourism Opportunities, New Realities, New Horizon. Growth of International Tourism, Status concern of top 10 destinations in India and the World, Domestic, Inbound and Outbound Tourism in India

Unit V: Tourism Planning and Tourism Organization:
Conceptual Meaning of Tourism Planning, Types and Process of Tourism Planning. Structure and Role of WTO, PATA, IATO, TAAI, ASTA and Department of Tourism Govt. of India.

Suggested Books:

1. Tourism: A Modern Synthesis: Stephen J Page, Paul Brunt, Graham Busby and Jo Connell
2. Business of Tourism- Christopher J.,Hollway
3. Discovering Hospitality and Tourism- Jack D. Ninemeier and Joe Perdue, Pearson Education

Title: Tourist Resource of India

Subject Code: SOM/MBAT/C-05 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The module gives information of country's tourist places of national and international importance and it helps students to know the background elements of tourism industry of our country.

Course Contents:

Unit I

Introduction: Concepts, meaning and characteristics, typologies and nature, definition and differentiation and nature and scope of tourist places in India.

Unit II

Natural Resources: Wildlife Parks, Sanctuaries and Tiger reserves in India with case studies of Raja-ji-National Park, Jim Corbett Tiger Reserve, Har-Ki-Doon Sanctuary, Bharatpur Bird Sanctuary and Bhuyandar-Valley of Flowers.

Unit III

Natural Resources : Hill Stations and Coastal Tourism:

Study of Hill station attractions and their environs with case studies of Mussoorie, Nainital, Shimla, Darjeeling. Sustainable Tourism Development and Carrying capacity in Hill stations

Beaches and Islands : Resources and their use patterns. Case studies of Goa, Kovalam and Gopalpur Sea beaches.

Unit IV Socio-Cultural Resources

Buddhist and Islamic Resources: Bodh Gaya, Nalanda, Kushinagar, Sarnath, Sanchi and Ajanta. Islamic resources: Delhi, Agra and Fatepur Sikri.,

Important fairs and festivals with case studies of Kumbh Mela, Puskar Fair, Surajkund Craft Mela and Puri Rath Yatra.

Unit V Socio- Cultural Resources

Hindu Resources: Khajuraho, Jaipur, Mahabalipuram, Tanjore, Hampi, Ellora, Elephanta and Konark. National Museum, New Delhi

Suggested Readings:

1. Mukarjee, R.K. The Culture and Art of India, George Alleene Unwin Ltd., London, 1959.
2. Oki Morihiro - Fairs and Festivals, World Friendship Association, Toyko, 1988.
3. The Treasures of Indian Museumes, Marg Publication, Mumbai.
4. Archaeological Survey of India publication on archaeological places of India.
5. Mitra, Devla - Buddhist Aruhitecture, Calcutta.

Title: Computer Application in Tourism & Hospitality Industry

Subject Code: SOM/MBAT/C-06 **Contact Hours: 30 Hours**
Work Load: 02 Hours Per week **Credit Points: 02**

Objective: The module is prescribed in the course to impart practical knowledge on computer application and train the students on office automation.

Course Contents

Unit I: Introduction to Computer Terminology and Hardware: The use of an Operating System. Various Programming Languages, A descriptive survey of some of the important Application: Communication, Office Systems, Information Storage and Retrieval and Artificial Intelligence.

Unit II: Operating System, Window and its Application: Typical Micro Computer Storage, Software Packages such as Word Processor, Spreadsheet and MS Office.

Unit III: Management Information Systems, Office automation, E-mail and Electronic Highway, Internet.

Unit IV: Computer Networking and its Application in Tourism: CRS for Rail Transport, Hotel Bookings, Airlines: Different packages used: Amadeus, Apollo-Galileo, Sabre etc.

Unit V: Introduction to a Statistical Package (SPSS), Presentation Graphic Tools. Multi-media Technology.

Suggested Readings:

1. London, K.C & London, J.P, Management System Information Systems - a Contemporary Perspective, Mcmillan, 1988.
2. Lucey, T. Management Information Systems, DP Publications.
3. Clark, A. Small Business Computer Systems, Hodder & Stoughton, 1987
4. Parkinson, L.K & Parkinson ST, Using the Micro-Computer in Marketing, McGraw Hill, 1987.
5. Braham, B. Computer System in Hotel & Catering Industry, Cassell, 1988
6. Basandra S.K., 'Computer Today', New Delhi : Galgotia Publications.
7. Mehta Subhash, 'Wordstar-7', New Delhi : Comdex Computer Publishing, Pustak Mahal.
8. Taxali, R.K., 'Lotus 1-2-3 Made Simple', New Delhi : Tata McGraw Hill.

Title: Field Tour & Viva-voce

Subject Code: SOM/MBAT/C-07 **Contact Hours: 30 Hours**
Work Load: 02 Hours Per week **Credit Points: 02**

Objectives: This module is prescribed to make students appraised on tourists' places in the Himalaya. There will be a field visit of six to ten days duration in a specific destination in Himalaya during the semester period duly approved by the Director. All students are required to submit the field study tour reports of their field visits in the department 15 days before the first semester Viva-voce examination. The Viva-voce shall be conducted on the basis of theory papers and field visits and marks shall be awarded both by Internal and External examiners. The aggregate of both the examiners shall be awarded to the candidates there upon.

SECOND SEMESTER

Title: Introduction to Travel Agency and Tour Operation Business

Subject Code:SOM/MBAT/C-08 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: In this module students will understand the conceptual meaning and differentiation between Travel agency and tour operation. Further, they can get Knowledge on formalities and documentation needed to set up tour and travel units.

Course Contents:

Unit I:
Travel Agency and Tour Operation business : Concept of Travel Agencies and tour Operators; History; Present status and future prospects of Travel Agency Business,. The Indian Travel Agents and Tour Operators- an overview. Travel Agency and Tour Operators: Linkages and arrangements with hotels, Airlines and Transport Agencies and other segments of Tourism Plants.

Unit II:
How to Set Up a Travel Agency? Various types of organizations: Proprietorship, Partnership, Private Limited and Limited. Procedure for approval of Travel Agents, Tour Operators by Department of Tourism, Government of India. IATA rules and regulations, Basis of approval of a Travel Agency. Study of various fiscal and nonfiscal incentives available to travel agencies and tour operators business.

Unit III:
Travel Terminology and Travel Trade Organization: Current and Popular Travel Trade Abbreviations and other terms for supporting sources. Travel Agency Manuals, ABC, TIM, and other relevant manuals. Travel organizations: Travel Agents Association of India (TAAI), Indian Association of Tour Operators (IATO), International Air Transport Association (IATA).

Unit IV:
Function of a Travel Agent and Tour Operator: Understanding the functions of a Travel Agent, travel information and counseling to the tourists, reservation, ticketing, documentation, handling business/corporate clients including Conference and Conventions, sources of income: commission,

service charges.

Market research and tour package formulation, assembling, processing and disseminating information on destinations, preparation of itineraries. Handling of tour file, sources of income for tour operation.

Unit V: Organization structure, Management and Products of leading Travel Agencies of India: Case Study of Kuoni. SOTC, Thomas Cook, Orbit; Le Passage, Make My Trip, ITDC& GMVN.

Suggested Readings:

1. Holloway, K.C., The Business of Tourism (1983), Mac Donbald and Evans, Plymounth.
2. Syratt Gwenda, Manual of Travel Agency Practice, Buutterworth Heinmann, London, 1995
3. Susan Webster, Travel Operating Procedures (Second Edition),- Van Nostrand Reinhold New York.
4. Fuller-Travel Agency Management, South-Vestern Publishing Co.
5. Chand Mohinder, Travel Agency Management, Anmol Publication Delhi.
6. Gupta S.K., International Airfare & Ticketing, UDH, Publlisher.

Title: Organizational Behaviour

Subject Code: SOM/MBAT/C-09 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: The module helps to understand the key dimensions, processes and influences upon human behavior at the level of individual and group in the context of work organizations.

Course Contents

Unit I

Introduction: Meaning and Forms of an Organization. Theories of Organization, An Overview of Organizational Behavior (OB), Contributing Disciplines to the OB field. Challenges and opportunities and trends for OB.

Unit II

Individual dimensions of OB:

Perception: Concept, The Perceptual process, Person perception: Making judgment about others and perceptual errors.

Learning: Concept and process; Learning in organization, Theories of learning, Learning through reinforcement.

Personality: Concept, Personality determinants, Personality traits, Personality and OB, Different personality dimensions.

Motivation: Concept, Motivation in the workplace, Theories of Motivation.

Unit III

Interactive Dimensions of OB: Interpersonal and Group Behavior: Analysis of Interpersonal behavior; Transactional analysis, Group dynamic: Groups at work: Nature, Classification, Structure.

Unit IV

Controlling and Directing the Behavior: **Leadership:-** Nature of leadership, Styles, Theories of leadership, Successful versus effective leadership styles in travel trade and hospitality organizations.

Organizational Climate: Concept, Participative Management, Employee Moral, **Communication**: Process, Principles of effective communication, Barriers in Communication.

Unit V

Organizational Effectiveness and organizations Structure: Organizational Change: Some determining factors, Process of change, Implementation, Planned organizational changes. Organizational effectiveness. Design of an organization structure and forms of Organization Structure.

Suggested Readings

1. Robbins, Stephens P, Organizational Behaviour, Pearson Education.
2. Prasad, L.M, Organizational Behaviour.
3. Luthans, Fred, Organizational Behaviour.
4. Hersey and Blanchard, Management of Organizational.
5. Kakabadse et al, Working in Organization, Penguin, 1987.
6. Vecchio, R.P, Organizational Behaviour, Dryden Press, 1998.
7. Invancevvich, J.M and Matteson. M.T, Organizational Behaviour and Management 3rd edition, Irwin/ISE, 1993.
8. Steven L. Mcshane & M.A. Von Glinow, Organization Behaviour, Tata MC Graw Hill.

Title: International Air Fare, Ticketing and Air Cargo Operation

Subject Code: SOM/MBAT/C-10 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: This Module is intended to prepare the students to make them well versed with the modalities the reservation and issuance of International air ticket.

Course Contents

Unit I

Aviation Geography: IATA areas, Sub Areas, Sub Regions. Time Calculation: GMT variation, Concept of Standard Time and Day light saving time, Calculator of Elapsed time, Flying Time and Ground Time and Minimum Connecting Time.

Unit II

Minimum Connecting Time, CRS, Comparative Study of Different CRS System. CRS Functions: City pair Availability, Flight Bookings, Levels of CRS Participation, Airline Tickets, CRS Regulating Issues. PNR, Fare Quotes, Pre-assigned Seats, Special Traveler Account Records, Queues.

Unit III

Introduction to Fare Calculation: 3 letter City Code and Airport Code, Airline Designated Code, Global Indicator. Familiarization with Air Tariff: Currency Regulation, NUC Conversion Factors, General Roles, Mileage Principles. Fare Construction with extra Mileage Allowance (EMA), Extra Mileage surcharge (EMS). Higher Intermediates Point (HIP).

Unit IV

Fare Calculation for One Way Journey, Back Haul Minimum Check (BHC), Mixed class Journeys, Fare Calculation of circle Trip, Circle Trip Minimum Check, Practices of Filling of Passenger Ticket (With issuance of Ticket with Itineraries One way (OW) Return (RT) on EMA, EMS, HIP, CTM, BHC, add-on and mixed class.

Unit V

Air Cargo Operation: Types of Air Cargo, Cargo needing Special Attention. Introduction to Dangerous Goods Regulation, Documentation for Cargo handlers, Air wage bill.

Suggestive Reading:

1. OAG
2. Air Tariff Book
3. World Wide Rules
4. IATA Ticketing Hand book
5. Airport Business - R. Boganis
6. All you wanted to know about Airlines Functions K. Sikdar
7. Gupta S. K. International Air Fare and Ticketing, UDH Publishers Delhi.

Title: Introduction to Basic Accounts & Financial Management

Subject Code: SOM/MBAT/C-11 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: The module will enable the students to understand principles of accounting in business operation and the basic objective is to teach students on principles of financial management and to brief inform them about the techniques of preparing financial information.

Course Contents

Unit-I:
Financial Accounting : Concepts and Conventions Double Entry System, Preparation of Journal, Ledger and Trial Balance ; Preparation of Final Accounts: Trading, Profit and Loss Account and Balance Sheet.

Unit-II: Nature of Financial Management and Financial Planning:
Financial Function, Meaning, Role, Scope and Importance of Financial Management, Financial Planning: Capitalization, Capital Structure and Capital Budgeting. Capital Structure and Managerial Policies, Trading on Equity, Financial Leverage.

Unit-III: Working Capital Management: Concepts, need, determinant of working capital, estimates of working capital, estimates of working capital and financing of current assets, management of cash, inventory management and accounts receivable.

Unit-IV: Management of Long Term & Short Term Funds:
Sources of Finance Long term and short Term , shares and debentures, Trade Credit, Unsecured loans, loans from Commercial Banks and other institutions, public deposits etc , Advantages and Disadvantages of different

sources of funds.

Unit V: **Dividend decision:** Dividend Policy-Meaning and determinant, Formulation of stable dividend policy and advantage factors influencing dividend policy.

Suggested Books:

1. Anthony and Reece, Management Accounting Principles: Text and Cases
2. Pandey, I.M. Management Accounting: A Planning and Control Approach, Vikas Publication.
3. David, D., The Art of Managing Finance, Mc Graw Hill.
4. Pandey, I .M. Financial Managemnt, Vikas Publication
5. Van Horne, Financial Managemnt and Policy, Prentice Hall
6. Pandey, I.M., and Bhatt, Ramesh, Cases in Financial Managemnt, TATA Macgraw Hill

Title: Hospitality Industry Management

Subject Code: SOM/MBAT/ C-12 **Contact Hours: 30 Hours**
Work Load: 02 Hours Per week **Credit Points: 02**

Objective: This module is prescribed to appraise students about the important departments of a classified hotel and to know various aspects related to accommodation industry.

Course Contents:

Unit I:- The Hospitality Industry : Introduction to Hospitality Industry: Classification of Hotels - Star Rating of Hotels - Classification on the basis of size, Location, Clientele, Duration of stay, level of Service - Classification on the basis of ownership - Alternative Accommodations - Hotel Tariff Plans - Types of Guest Rooms, forces affecting growth and change in the Hospitality Industry.

Unit II:- **Organization Structure:** Structure of Major Departments of a hotel-Front Office, Housekeeping, Food and Beverage Service Departments, Food Production, Engineering and Maintenance, Accounts, Human Resource, Security, Sales Marketing, Purchase etc.

Unit III:- Front Office Operations: Room Reservations, Registration - Allotment of rooms - Stay, Departure - Handling FIT GIT - Guest - Handling

guest mail - Message -Handling - Custody and control of keys -Guest paging - Safe deposit locker, left luggage ,handling, wake up call, Handling Guest Complaints.

Unit IV:- Housekeeping and **Food and Beverage Services:** The operational areas of the Housekeeping, Room Cleaning, Public area Cleaning, food services and food and beverage department, job description of personnels of Housekeeping and F&B Service department.

Unit V: - Management Contracts and Franchising: Advantages and disadvantages of management contracts, franchise operation procedure, advantages and disadvantages of franchise, franchise fee, franchise selection. Major Hotel Chains of India and of World.

Suggested Readings:

1. Hotel and Lodging Management an Introduction: by Alan T. Stutis & James F.Wortman, John Willy & sons
2. Management in the Hospitality industry by Tom Power and Clatan W.Barrows, John Willy & sons
3. G. Raghubalan & Smritee Ragubalan: Hotel Housekeeping operations and Management.
4. Jagmohan Negi, Hotels for Tourism Development, S. Chand, New Delhi.
5. Jatashankar R Tewari (2009), Hotel front office operations and Management, Oxford publication New Delhi.
6. Gray and Ligouri (2000), Hotel and Motel Management and Operations, PHI, New Delhi.
7. Sudheer Andrews (2009), Hotel Front Office Training Manual, Tata McGraw Hill, Bombay.

Title: Human Resource Management

Subject Code: SOM/MBAT/C-13 **Contact Hours: 30 Hours**
Work Load: 02 Hours Per week **Credit Points: 02**

Objectives: To develop an understanding of the human resource management with respect to various aspects of personnel management and industrial relations.

Course Contents

Unit I

Over view and model of personal/human resource management, nature,

scope and importance of human factor in managing modern organisation, personal/human resource activity, strategic human resource management.

Unit II

Human Resource Planning: Meaning and nature of human resource planning, need for human resource planning, planning process. Job analysis, methods of job analysis, job description,

Unit III

Recruitment, Sources of Recruitment, Process of Selection, placement and induction.

Unit IV

Training & Development: Need, objectives and methods of training, significance of training, management development Program principles and methods, transfer and promotion, performance appraisal.

Unit V

Wage and salary administration, wage policy concept, role and importance, developing a pay structure, determining individual rates of pay, benefits.

Suggested Readings

1. Heneman, Schooab - Personnel/Human Resource Management
2. Aswathppa, A - Human Resource & Personal Management
3. Yoder Dale - Personnel Management and Industrial Relations
4. Singh Chandra &Tunga - Personnel Management and Industrial Relations

Title: Field Tour Report and Viva-voce

Subject Code: SOM/MBAT/C-14 **Contact Hours: 30 Hours**
Work Load: 02 Hours Per week **Credit Points: 02**

There will be a field visit of six to ten days duration specific destination during the semester period duly approved by the Director. All students are required to submit the field study tour reports of their field visits in the department 15 days before the second semester Viva-voce examination. The Viva-voce shall be conducted on the basis of theory papers and field visits and marks shall be awarded both by Internal and External examiners. The aggregate of both the examiners shall be awarded to the candidates there upon.

Self-Study Course

Title: Conference Convention and Event Management

Subject Code: SOM/MBAT/S-01 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: This self-study course is identified for the students to gain basic knowledge on MICE segment, trade fairs, business conferences etc.

Course Contents

Unit I
Growth and Development: Introduction to conventions, incentives, exhibition and meetings (MICE)

Unit II
Selecting a Partner: Initial enquiries, communicating & determining needs, menu planning details, contracting with an outside caterer, press kits.

Unit III
Making Events Successful: Marketing, advertising, preparation of brochures, publicity, campaign and joint publicity and direct sale.

Unit IV
Emergency and Risk Management: General preparation fire safety in the hotel, medical emergencies, facilities procedures for medical emergencies, bomb threats, other contingencies, inspecting a hotel, accommodation, meeting and banquets space, other information.

Unit V
Budgeting Conference and Exhibition: Use of Budget Preparation, estimating, fixed and variable costs, cash flow sponsorship and subsidies, operation guide to submitting a successful bid, supporting documents for convention bid, role of Indian Convention Bureau.

Suggested Readings:

1. Coleman, Lee& Frankly, Powerhouse Conferences, Educational Institute of AH&MA, 1991.
2. Hoyle, Dort & Jones, Maning Conventions and Group Business, Educational Institute of AH & MA, 1995

SEMESTER III

Title: Research Methodology

Subject Code: SOM/MBAT/C-15 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: In this module students will understand the conceptual meaning of research methodology. Further, they can get Knowledge on research design, processing & analysis of data, report writing.

Course Contents

I. **Research Methodology, Research Design and Sampling Design:** An Introduction- Meaning and Objectives of Research; Types of Research; Significance of Research; Defining a Problem. Meaning of Research Design; Need for Research Design; Features of a Good Design; Different Research Designs. Steps in Sampling Design; Criteria for Selecting a Sampling Procedure; Characteristics of a Good Sample Design; Different Types of Sample Designs

II. **Methods of Processing and Analysis of Data:** Collection of Primary Data; Collection of Data through Questionnaires; Collection of Data through Schedules; Some Other Methods of Data Collection; Processing Operations; Some Problems in Processing; Elements/Types of Analysis; Statistics in Research; Measures of Central Tendency; Measures of Dispersion; Measures of Asymmetry (Skewness); Measures of Relationship.

III. **Testing of Hypotheses- I :** What is Hypothesis? Procedure for Hypothesis Testing; Tests of Hypotheses; Hypothesis Testing. Chi-square test as a Test for Comparing Variance; Steps Involved in Applying Chi-square Test;

IV. **Analysis of Variance and Multivariate Analysis Techniques:** Analysis of Variance (ANOVA): What is ANOVA? The Basic Principle of ANOVA; ANOVA Technique; Setting up Analysis of Variance Table; Short-cut Method for One-way ANOVA; Coding Method. Important Multivariate Techniques; Important Methods of Factor Analysis; Rotation in Factor Analysis; R-Type and Q-Type.

V. **Interpretation and Report Writing:** Technique of Interpretation:

Significance of Report Writing; Different Steps in Writing Report.

Suggested Readings

1. Kothari, SR, Research Methodology
2. N.D. Vohra, Quantitative Techniques in Managerial Decisions
3. Levin and Rubin, Statistics of Management
4. Yamane and Taro, Introduction to Statistical Methods
5. John Boot and F.D. Coxe, Statistical Analysis for Managerial Decision
6. Witt, S and Moutinho

Title: Foreign Language (French)

Subject Code: SOM/MBAT/C-16 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: This module intends to provide knowledge on the basic elements of French grammar, vocabulary and communication skill.

Course Contents

Unit I:

Grammar: Conjugation of verbs in present tense, Change of gender and numbers (masculine to feminine and singular to plurals and vice versa) knowledge of selected nouns and adjective: Countries, Nationality and Professions. Articles definite and indefinite, Common Prepositions.

French text and vocabulary: Moment of the day, Numbers, Days of the weak, Months of the year, Common greetings in French, Introduction of self and others, How to see the time?

Unit: II

Grammar: How to make interrogative and negative sentence? Conjugation of verbs in present tense.

French text and vocabulary: Fixing of an appointment and interview, Expression of sentiments (Liking and Disliking), Activities of the day, describing one Individual (description of Physique and Psychological character).

Unit-III

Grammar: Adjectives, Imperative, Partitif articles, Conjunction of verbs in present tense.

French text & vocabulary: Description of a house/apartments, Office set up and office materials, Common conversation in office.

Unit-IV

Grammar: Adjective, Demonstrative, Adjective, Possessive, Conjunction of verbs in present tense. (Pronominal verbs)

French Text & vocabulary: The activities of the day, the menu/cuisine, Conversation in a Restaurant between client and waiter.

Unit-V

Grammar: Conjugation of verbs in present tense**.**

French text and vocabulary: Family & relationship, Dresses & materials, Different types of shops, Shop keepers and Materials, Conversation in shop to purchase the articles.

Suggested Reading:

1. Le Nouveau sans Frontieres: Method de Francais by Phialippe Dominique, Michele Verdelham. Part-I, Goyal Saab Publication, Delhi.
2. Francois Makowski: French Made Easy, Goyal Pyblishers (P) Ltd.
3. A. Talukdar: Parlez A'L' hotel !, Aman Publications New Delhi
4. Dounia Bissar, Helen Phillips, Cecile Tschirhart: French 1, Printed by J.W. Arrowsmith Ltd, Bristel

Title: Tourism Policy and Planning

Subject Code: SOM/MBAT/C-17 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: The module discusses Tourism Policy of India and of Tourism states of the country.

Course Contents

Part A: Policy

Unit I:

Formulating Tourism Policy: The Public Policy Framework for Tourism Approach, Policy Consideration, Role of Government, Public and private Sectors, Tale of International, National, States and Local Tourism Organization in Carrying out Tourism Policies.

Unit - II

Tourism Developments: forms of Tourism Development, Components of Tourism Developments, Linkages between Tourism Planning and Tourism Development, Development and Design Standards, Public and Private Sectors Role in Tourism Development, Analysis of Dayara Snow Skiing Tourism Project. Tourism Policy Through Different Five Year Plans in India and Tourism Policy of Uttarakhand.

Part B: Planning

Unit III

Understanding Tourism Planning, Environment and Socio-Economic Consideration: Conceptual Meaning of Tourism Planning, Evaluation of Tourism Planning, General Concepts of Planning, Levels and Types of Tourism Planning, Background Approach and Planning Scales. Environment Impact Assessment (EIA), Approach to Evaluating Impacts and Control Measures, Measuring Economic Costs and Benefits.

Unit IV

National and Regional Tourism Planning: Process and General Surveys, Approach to Survey and Evaluation, Tourist Market Survey, Integrated Analysis and Synthesis, Technique of Plan Implementation.

Unit V

Community-oriented Tourism Planning: Resort Planning Approach and Principles, Planning for Special Interest and Adventure Tourism, Planning Cultural Attractions, Case Studies of Garhwal Himalayas and Kerala.

Suggested Readings:

1. The Tourism System: An Introductory Text Mill & Morrison 1992, Prentice Hall, New Jersey, 1992.
2. Tourism Planning: An Integrated and Sustainable Development Approach Inskeep, Eward VNR, New York, 1991.
3. Gunn, Clare A, Tourism Planning: Basics, Concepts, Cases, Taylor & Francis, London, 1994.
4. Tourism Globalization and Developments: Responsible Tourism Planning, Donald & Reid Pluto Press, London.

(Any one Group as Elective Major and Any One Paper From the Other Group as Elective Minor)

Elective(Marketing Management Group)

Title: Tourism and Hospitality Marketing

Subject Code: SOM/MBAT/E-1A **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: Course aims at understanding service marketing and marketing approaches for various components of tourism and hospitality.

Course Contents

Unit I

Tourism and hospitality as Service Marketing: Understanding the relationship between Services Phenomenon, Characteristics of Services, and Study of Consumer, hospitality and travel industry, relationships between customer value, satisfaction and quality, marketing management philosophies, services, characteristics of hospitality and tourism marketing, the marketing environment.

Unit II

Understanding tourism and hospitality marketing: Marketing information system, developing information: internal records, marketing intelligence, marketing research and process, analyzing and distribution of information. The external influence, consumer behaviour, competitive strategy.

Unit III

Tourism and hospitality marketing mix: tourism and hospitality products, designing and delivering service quality, pricing and cost structure, choosing the channel.

Unit IV

Promotional mix in tourism and hospitality: communication strategies using a an advertising agency, integrated direct marketing system, effective sales promotion, public relation as promotional tool, designing the packaging, the changing role of personal selling.

Unit V

Implementing the marketing concepts: joint marketing ventures,

marketing tourist destination, domestic airlines hotels and amusement parks, barriers to implementation, control and monitoring the marketing effects.

Suggested Readings:

1. Ravishankar: Service Marketing
2. Stephen Shaw: Airline Marketing & Management
3. Philip Kotler, John Bowen & James Makens: Marketing for Hospitality and Tourism.
4. Alastair M. Morrison: Hospitality and Travel Markets.

Title: Consumer Behavior

Subject Code: SOM/MBAT/E-2 A **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points:03**

Objective: The Course is intended to develop students' understanding of the complex interactions determining consumer choice behaviour. This module provides sound base to understand Services Marketing.

Course Contents

Unit I: Characteristics Affecting Consumer Behaviour: Cultural factors, Social factors, Personal factors, Psychological factors. Models of Consumer Behaviour - Black Box model, High Commitment and Low Commitment Consumer Behaviour.

Unit II: Examination of Tourist Forms and Types and their Characteristics: Activities, Interests and Opinions of Tourism Market Segments and their Buying Decision Behaviour.

Unit III: Buyer Decision Process: Need recognition, Information search, Evaluation of alternatives, Purchase decision, Post purchase behavior. Buyer Decision Process for New Products. Stages in the adoption process, Individual differences in innovativeness, Influence of product characteristics on rate of adoption.

Unit IV: Specific Consideration of Host-Guest; Interaction and their impact on Physical, Social and Cultural Environments, Cross-cultural impacts.

Unit V: Management Implications: Consideration of the implications for

Tourism Management, Communication, Promotion, and Tourist-Guide Interactions.

Suggested Readings:

1. Hoyer, Consumer Behaviour, 1998.
2. Kotler, Philip and Armstrong, Philip, Principles of Marketing, Prentice Hall of India- 1999.
3. Mathiesen A. and Wall G., Tourism : Economics, Physical and Social Impacts Longman, London,1992
4. Mayo, E. and Jaris, L., The Psychology of Leisure Travel CBI Publishing Co., Boston Mass,1991
5. Pearc,e P.L., The Social Physiology of Tourist Behavior Pergamon Press,1982
6. Krippendorf, L., The Holiday Makers Heinemann, 1987
7. Smith, L.V. (ed.), Hosts and Guests : The Anthropology of Tourism Basil Blackwell,1978
8. Assael, H., Consumer Behaviour and Marketing Action, Kent, Boston, 1985

Elective (Financial Management Group)

Title: Advanced Financial Management

Subject Code: SOM/MBAT/E-1 B **Contact Hours : 45**
HoursWork Load: 03 Hours Per week **Credit Points: 03**

Objectives: The module discusses all the aspects of finance & Working capital management

Course Contents

Unit I: Finance, financial manager and risk

Role of financial manager, ownership and management, risk and return, capital investment decision and risk, CAPM, sensitivity analysis, decision tree. Concept of EVA and MVA.

Unit II: Private equity market

Raising of private equity funds, structuring of private equity funds, private equity funds, valuing private equity funds and interest rate. How corporate issues securities.

Unit III: Valuation and financing effect
Cost of capital, WACC, why should firm borrow business risk and financial risk changes, options and financial alchemy with options , determination of option values binomial option, option and investment opportunities

Unit IV: Financial distress dividend decisions
Dividend and its forms of payment, theories of dividend, debt policy and dividend decision

Unit V: Financial planning and Corporate restructuring
Financial planning module, short term financial planning, current assets and current liabilities, short term financial plan, cash and credits management, inventory control Mergers motives, mechanics, profits and losses and cost, corporate buyouts and restructuring

References:

1. Financial Management, S.N. Maheshawari, Sultan Pulication
2. Financial Management VIII edition, I.M. Pandey, Vikas Publication.
3. Financial Management III edition, Khan and Jain, Tata McGraw Hill.

Title: Working Capital Management

Subject Code: SOM/MBAT/E-2 B **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: The module discusses all the aspects of finance & Working capital management

Course Contents

Unit I: Concept and determination of working capital
Conceptual framework, Operating environment of working capital, Determination of working capital ,Theories and approaches

Unit II: Management of current assets, Management of receivable, Management of cash Management of marketable of marketable securities, Management of inventory

Unit III: Financing of working capital needs : Short term finance: framework non banking finance, Short term finance appraisal and assessment, Other sources of short term finance

Unit IV: Working capital management integrated views: Optimal working capital policy Credit policy, Short term source of international

financial transactions

Unit V: Investment and Financing: Planning short term investment and financing

References:

1. Finance management VIII edition, Chandra, Tata McGraw Hill
2. Financial Management, S.N. Maheshawari, Sultan Publication
3. Financial Management VIII edition, I.M. Pandey, Vikas Publication.
4. Financial Management III edition, Khan and Jain, Tata McGraw Hill.

Elective (Human Resource Management Group)

Subject Code: SOM/MBAT/E-1 C **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Title : Legal Environment and Industrial Relationship

Course Contents

Objectives:
The purpose of this course is to develop and understanding of the various facets of legal environment and Industrial relations.

Unit-1
Factories Act, 1948 Factory, Manufacturing process and services, Provision related to Health, Safety and welfare of the employees, Holidays, Employment of young persons

Unit-2
Workmen's Compensation Act, 1923- Types of Disablement, Wages, Dearness allowance, rules regading workmen's cpmpensation, Occupational diseases, Compensation for death, permanent disablement, permqannt partial disablemenet, and temporary disablement, notice and claims

Unit-3
Industrial Disputes Act, 1947- Ingredients of industrial Dispute, Individual and collective Dispute, Layoff, lock out, Retrenchment, Strike, Unfair labour Practices, Procedure for settlement of Industrial disputes and authorities under the act, Collective Bargaining

Unit-4

The industrial employment (Standing orders) Act, 1946- Industrial establishment, Procedure for certification of standing orders, Payment of subsistence allowance,

Unit-5

Trade Union Act, 1926- Registration of trade union, Registration, Cancellation of registration, Rights and privileges of a registered trade union, duties and liabilities of a registered trade union, Regulations and Penalties, Workers participation in management

ILO : Formation and mandatory provisions on employee welfare, Child Labour, legal provisions to prohibit Child labour in Business enterprises

Suggested Readings:

(1) Kuchhal M C - Mercantile Law
(2) Kapoor N D - Mercantile Law
(3) Singh Avatar - Company Law
(4 Yodar, Dale - Personnel Management and Industrial Relations, Prentice Hall India, New Delhi.

Title : Performance Appraisal and Counseling

Subject Code: SOM/MBAT/E-2 C **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: To give Students complete exposure to all aspects of Performance Appraisals and Counseling, Post Appraisal and Performance Management.

Course contents

Unit I

Performance Appraisal: The Past and the Future Human Resource Development and Performance Appraisal, Meaning, Need, Purpose, Content.

Unit II

Designing your Performance: Key Business Process, Competitive Advantage, Role Clarity, Accountability and Effectiveness increasing Self Awareness and Understanding, Self Appraisal.

Unit III

Performance appraisal process: Identifying KRAs, KPAS, SMART goals, and priority matrix, preparing a performance plan, using performance appraisals data, making performance appraisals work. Indian Successes Stories

Unit IV

Recent performance appraisal techniques and Score Card System: 360 Feed Back System, HR Accounting, Assessment Centers, Capital MBO and BARS. Balanced Score Card, Employee Score Card, HR Score Card, PcMM Model.

Unit V

Performance Counseling and Mentoring: Meaning and Definition, Principles of Counseling, Process, What is Counseling is NOT; Directive and Non-Directive Types of Counseling, Characteristics of Good Counselor, Post Appraisal Interviews, Potential Appraisal Performance improvement Strategies.

Suggestive Readings:

1. Human Resource Management by Gary Desler Pearson/ PHI Education 10th Edition
2. Appraising and Developing Managerial Performance by TV Rao, Excel Books 360
3. Appraisal and Management by TV Rao and Uday Pareekh

Self-Study Course

Title : Eco-Tourism Principles and Practices

Subject Code: SOM/MBAT/S-02 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: the module shall provide useful information on ecotourism operation and management in order to motivate a sizeable share of eco tourists from all over the world.

Course Contents

Unit I: Ecotourism Growth and Development: Emergence of ecotourism, basic features ecotourism in the context of other tourism types, types of ecotourism activity.

Unit II: Ecotourism Markets: Motivation, attitude and behaviour, socio-demographic criteria, size of ecotourism market, western environmental paradigm, green consumers and travelers.

Ecotourism as a Business Structure of Ecotourism Business: Business participants, business planning, business sectors, quality control.

Unit III: Ecotourism Environments: Distribution of public and private protected areas, parks sanctuaries, biospheres reserves, wetlands, marine parks etc. IUCN categories and ecotourism compatibility, reasons for establishment, modified spaces like agriculture land, artificial wetlands, artificial reefs and wasteland.

Unit IV: Ecotourism Impacts: Ecological benefits, costs, impact management strategies, economic and socio-cultural impact: economic benefits and costs, socio-cultural benefits and costs, indirect socio-cultural costs, and community based ecotourism.

Unit V: Ecotourism Organizations and Policies: Ecotourism organizations, characteristics, international ecotourism society, ecotourism societies of India, ecotourism policy of Sikkim, Kerala, Uttarakhand, Himachal states and govt. of India.

Suggested Readings:

1. **Ecotourism :-** David Weaver, John Wiley & Sons
2. **Special Interest Tourism (1992):** Betly Weiler, Bel Haven Pres, London.

FOURTH SEMESTER

Title : Inbound and Outbound Tour Operation

Subject Code: SOM/MBAT/ C-18 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The module will enable the students to acquire and upgrade professional knowledge in the area of inbound tour operation.

Course Content

Unit - I

Concept of Package Tour, Types of Package Tour, Principles of Making Effective Tour Itinerary, Study of the Popular Package Tour Itineraries in

India for inbound operation.
Inbound Tour Planning: Marketing Research, Understanding special needs of Inbound Tourists, Appointment of Handling Agencies, Pricing and Costing of Tour Packages.

Unit - II

Inbound Tour Handling and Operation: Systematic Handling of a Tour File, Reservation, Billing, Facilitation, Documentation, Passenger Handling, Appointing Tour Escort, Destination Representative; Role & Functions.

Unit - III:

Outbound Tourism Packages: Study of Selected Outbound Tour Packages to from India and their Salient Features, Study of Selected Outbound Tour Packages from India to Australia and Europe and their salient features.

Unit IV:

Documentation : Procedures Rules and Regulation for obtaining VISA for major outbound market segment of India like USA, UK, Australia. VISA, Currency, Custom, Health Regulations for Inbound Travel to India.

Unit V:

Handy Tips/ Guide lines for Outbound Tour, EURAIL, Travel Insurance for Outbound Tour

Suggested Readings

1. Travel Information Manual (TIM)
2. Mayo, E. and Jaris, L., The Psychology of Leisure Travel (1981), Publishing Co. Boston Mass.
3. Kotler, P., etal (1996), Marketing for Hospitality and Tourism, Printice Hall.
4. Burton Rosemery; The Geography of Travel and Tourism (London).
5. ABC Guide to International Travel.
6. Eric Law, (1997), Managing Packaged Tourism, Thomas Buhron Press, London.
7. Travel Information Manual (TIM), 2004.

Title: Training Report and Viva-Voce

Subject Code: SOM/MBAT/C-19 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Each Student is required to undergo six to eight weeks practical training in any approved Tourism and Travel Unit in which he or she may be attached by the Department. On completion of Training all students are required to submit their training report to the HOD. On the basis of training report Viva-voce shall be conducted. Marks shall be awarded separately by Internal and External Examiners and marks awarded by them will be averaged to determine the marks of the students.

Title: Project Report/Dissertation and Viva-Voce

Subject Code: SOM/MBAT/C-20 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: This module is prescribed to make students skilled in data compilation and project report writings.

Contents:

During the fourth semester, each student is required to select a topic to write a dissertation. The dissertation would be the outcome of field enquiry and data analysis as well as review of the existing literature in the particular area of study done under the supervision of one of the teaching faculty members of the Department. The Viva-Voce will be based on the dissertation completed by students and theory papers.

The distribution of marks for the dissertation will be as below:

Periodical presentation	20 Marks
Project report, Dissertation, Field Tour report and Training report	60 Marks
Viva-voce	20 Marks Total

100 Marks Dissertation/project report shall be valued jointly by eternal and one external examiner.

(Any one Group as Elective Major and Any One Paper From the Other Group as Elective Minor)

Elective(Marketing Management Group)

Title: Advertising and Public Relation in Tourism & Hospitality Business

Subject Code: SOM/MBAT/E-1 D **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: This module intends to train the students on Planning and Management of Advertising and Public Relation in Services Industries.

Course Contents:

Part A: Advertising

Unit I : Advertising - Its purpose and functions, Advertising Spectrum : Role of Advertising, Benefits of Advertising; Non-Commercial Advertising; Ethical Issues in Advertising; Need for Advertising; Advertising Process: Effectiveness of Advertising; Speed of Response; Audience Perception; Perceptual mapping; Media Decisions : Role of Media; Print media; related decisions; Media research and Advertising decisions.

Unit - II : Advertising Appropriation :
Introduction: Methods of Determining Appropriations; Current practices; Advertising Appropriation for Services Products; Allocation of Advertising Budgets; Area of Assessment; Pre-placement Evaluation of Advertising; Post Testing

Unit - III : Advertising Agency Function, Selection and Co-ordination: A Consultant's role; Function of Advertising Agency; Consideration for Advertising Agency Selection; Co-ordination with the Agency; Changing Agency; Specialized Advertising; Industrial Advertisements; Institutional Advertisements; Non-Commercial Advertisements

Part B: Public Relations

Unit - IV : Introduction to Public Relation: What is Public Relation? Public relation and other disciplines; Public Relation Business; Public Relations Strategies and Programmes; Preparing a Budget of Public Relation, Media Relations; Introducing the Media; Media Relation Development; Managing and Targeting News and Features.

Unit V: Sponsorship : Managing and Developing Sponsorship; Events, Organising Events; Public Relation at Exhibitions, Conferences; Openings and Inauguration; Developing PR skills and activities

Suggested Readings:

(a) Diwan, Parag, 1998, Advertising Management.

(b) Thakur, D., 1998, Advertising Marketing and Sales Management.

(c) Gupta, S.L., & Ratna, V.V., 2004, Advertising & Sales Promotion, Sultan Chand & Sons.

Title: Airline Marketing

Subject Code: SOM/MBAT/E-2D **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The objective of this Course is to give students a complete exposure to all aspects of Airline Marketing.

Course contents

Unit I

The Airline Industry: Marketing Environment: Historical Growth of Airline Industry, Scenario in Deregulated and Liberally Regulated Air Travel, Privatization of State Owned Airlines, Mega Carriers and Globalization, Internal Growth and Acquisition, Marketing Alliances.

Unit II

Market Segmentation: Air Passenger Market: Segment Variables, Need, Bond and Demographic Characteristics of Long Haul and Short Haul Travelers, Business Travel Market and Leisure Travel Market. Segmentation Variables: Air Freight Market, Future Changes in Customer requirements.

Unit III

Airline Marketing Strategy: The Business Market Strategy, Leisure Market Strategy, Air Freight Strategy, Diversification versus Specialization.

Unit IV

Designing the Product: The Product lifecycle Model and Airline Marketing, The Product Analysis for Airlines: Fleet and Scheduled Related Product Features, Customer Service Related Product Feature.

Unit V

The Structure of Passenger Pricing Policy, Distribution of Product: CRS/ GDS. Airline Selling, Advertising and Sales Promotion: Methods and Policies.

Suggested readings:

1. Stephen Shaw, Airline Marketing and management, Pitman publication
2. International Marketing Management, Jain, CBS Publication
3. International Marketing Rather & Jani, HH Publication
4. Service Marketing, PN Pandey, HR Appannaiah, S Anil Kumar

Elective (Financial Management Group)

Title: Global Financial Market

Subject Code: SOM/MBAT/E-1 E **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: To get an understanding of the global financial system and certain key issues of international finance**.**

Course Contents

Unit 1: A framework for global finance: Emergence of International finance, Need, scope and importance, global financial system-components and functioning **,** Global Money Markets and overview of Money Markets Instruments, International Capital Markets, The International Bond Markets, Currency and Interest Rates Swaps. The Emerging Challenges, Recent Changes in Global Financial Markets.

Unit II

The Balance of Payments: Understanding the Balance of Payment, Accounting Principles in Balance of Payment, Valuation and Timings, Components of Balance of Payment, Meaning of Current Account Deficit and Current Account Surplus, Importance of BOP Statistics.

Unit III

Exchange rate economics: Definition of Exchange rate, fixed versus floating exchange rate, approaches to determination of exchange rate- Asset market approach, balance of payments approach, keynesian approach, monetary approach. Foreign exchange contracts- forwards and

futures contracts , an over view of India's forex market The Structure of the Foreign Exchange Market, Types of Transaction and Settlement Dates, Exchange Rate Quotations and Arbitrage.

Unit IV

International Financial Institutions

IMF,World Bank, WTO, Asian Development Bank Functions, issues and challenges

Unit V

An over view of major crises in global financial system

Overview of US Market, European Markets, Asian Markets and the Indian Market.,The Global Debt problem, Asian Financial Crisis (1997), Global financial crisis(2007), European Sovereign Debt Crisis(2010)- Causes, consequences and policy responses

Suggested readings:

1. International Financial Management-Jeff Madura
2. Internatioinal Economics-Paurl.R.Krugman and Maurice Obstedfield
3. Global recession in Historical and Recent Perspectives-D.Sambandhan & M.B.Mohandas , New century publications
4. Financial accounting for management, 3rd edition, Gupta
5. Foundations of finance markets & institutions, 3rd edition, Fabozzi
6. Foundations of finance markets & institutions, 3rd edition, Fabozzi

Title: Security Analysis & Portfolio Management

Subject Code:SOM/MBAT/E-2 E **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The objective of this Course is to give students a complete exposure to all aspects of Security Analysis & Portfolio Management

Course Contents

Unit-I:

Securities market: Equities in India ,The dismal decade, investment versus speculation, financial Market: function of financial markets.

Unit-II:

Trading of securities

Primary equity market, secondary market and its operation, NSE and BSE, buying and selling shares, stock market quotations and stock market

indices, securities and exchange board of India, stock market board.

Unit-III:

Security analysis and valuation: Analysis and valuation of debt and equity, Types and feature of debt instrument, board terminology, bond pricing, bond yields, risk in debt, interest rate risk. Equity valuation: balance sheet valuation, dividend discount model, earning multiplier approach, and equity portfolio management

Unit-IV:

Fundamental and technical analysis

Macro economic analysis, industry analysis, company analysis, estimation o intrinsic, equity research in India, technical analysis: difference between fundamental and technical analysis, charting technical indicators and evaluation of technical analysis, Efficient market hypothesis strong. semi strong & weak form of market, random walk theory

Unit-V:

Introduction to port folio theory: Port folio management, introduction, approaches: traditional and modern(Markowitz), portfolio risk & return, optimal portfolio: basic assumption, capital market line (CML), Security market line, capital asse pricing model(CAPM), Arbitrage pricing model, Marowitz model, Portfolio evaluation

Introduction and common features of mutual fiunds: Sharps, Trenyor, Jensen and performance index

Suggested readings:

1. Bond markets: Analysis and Strategies,5th edition, Fabozzi
2. Foundations of finance markets & institutions, 3rd edition, Fabozzi
3. Security Analysis & Portfolio Management, 6th edition, Fischer

Elective (Human Resource Management Group)

Title :Wages and Salary Administration

Subject Code: SOM/MBAT/E-1 F **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The objective of this Course is to give students a complete exposure about salaries and wages management.

Course Content

Unit -1

Wages and Salary - Concepts of wages, Minimum wages, Fair wages, Living wages and other types of wages, Theories of remuneration, Components of remuneration, Incentives, Fringe Benefits, Types of Fringe benefits, Factors in determining the wages.

Unit-2

The Payment of Wages Act, 1936- Rules for payment of wages, Fixation of wage periods, Time of payment of wages, Medium of payment of wages, Deductions from wages, Limits on deductions, Maintenance of registers and records.

Unit-3

The Minimum Wages Act ,1948- Concept of adolescent, child, Cost of living index, wages as defined in Sec2(h)Minimum rate of wages, Different minimum rates, Minimum rate of wages, Procedure for fixing and revising minimum wages safeguards in payment of minimum wages, Rates of overtime, wages in kind, fixing hours for a normal working day.

Unit-4

The payment of Bonus Act, 1965 : Meaning of Bonus, Accounting Year, available surplus, Eligibility and disqualification for bonus, determination of Bonus, Allocable surplus, concept of maximum and minimum bonus, Time limit for payment of bonus, Penalties and offences.

Unit-5

Gratuity-Difference between gratuity and pension, Concept of superannuation, Rate of gratuity and provisions as per Payment of Gratuity act 1972.

Suggested Readings:

(1) Mamoria C.B. Human Resource Management
(2) Kapoor N. D. - Mercantile Law
(3) Flippo,E.B. Princilpes of Personnel mangement
(4) Heneman, Schwab, Fossum Dye:- Personnel/Human Resource Management.
(5) K. Aswathapa:- Human Resources and Personal Management.
(6) L.M. Prassad:- Principles and Practices of Management

Title : Corporate Restructuring and Human Dimension

Subject Code: SOM/MBAT/E-2 F **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objectives: To prepare Students as Organizational Change Facilitator.

Course Contents

Unit I

Organizations and the Need for Change: Why Organizations, Factors Influencing Organizations, Types of Change.

Unit II

Preparation for Corporate Restructuring: Human Aspects Plans, Restructuring Designs, Re-engeeniering, Downsizing, Optimization etc.

Unit III

Training and Development: Overview, Objectives, Definitions, System View, Needs Assessments, Organizational Analysis, Employee Obsoleteness, Multi skilling. Job Analysis, Personal Analysis, Designing a Learning Environment, Learning Patterns

Unit IV

Development of Training Materials: Training Transfer, Training Methods (Benefits, Limitations) Evaluation, Cost Factor in Training.

Unit V

Special Training Programs: Employee Orientation Programme, Training for Teams, Creativity Training, Training for International Assignments.

Suggestive Readings:

1. Udai Pareekh Training Instruments for Health Management, TATA Mc Graw Hill, New Delhi.
2. Jeffery N. Lowenthal, Re-engineering TATA Mc Graw Hill, New Delhi.
3. Josheph Weiss, O.B. and Change (Vikas Pub. II edition).
4. M.N. Mishra, O.B. and Corporation Development (Himalaya Publication)
5. Bohlander/ Snell/ Sher Man, Managing HR (For Training and Development) Thompson Publication.

Self-Study Course

Title: Adventure Tourism Management

Subject Code: SOM/MBAT/S-03 **Contact Hours: 45 Hours**
Work Load: 03 Hours Per week **Credit Points: 03**

Objective: The objective is to provide an understanding of basic of adventure sports and enable students to research, plan, market, implement and evaluate plethora of adventure tourism activities. The course contents help in understanding various processes and factors affecting the adventure tourism in a country like India.

Course Contents

Unit I: Understanding of Adventure Tourism

Definition, Scope and Nature of Adventure Tourism, History of Adventure Tourism, Adventure sports expeditions and Discoveries. The Existing Infrastructure, Growing Trends and Assessment of hard core and soft core adventure activities.

Unit II: Trends in Adventure Sports

Trend and prospects of different types of adventure sports in the Himalayan states of India and their tourism significance

Unit III: Forms of Adventure Tourism

Places of importance for Land based, water based and aero based adventure sports of India

Land-based Adventure i.e., Mountaineering, trekking, rock climbing, skiing, eco-trekking, mountain expedition, cycling, jungle camping, wildlife safari, nature walk, ice-climbing

Water-based Adventure i.e., white-water rafting, Body surfing, scuba diving, canoeing, kayaking, angling, sailing, snorkeling, para-sailing, motor biking

Aerial-based Adventure i.e., Parachute jumping, Gliding, para-gliding, bungee jumping, para sailing

Unit IV: Mechanics and Technicalities of Adventure Tourism

Equipment's used in adventure sports, safety management, high altitude sickness, technical skills and physical fitness, professional training for adventure tourism

Unit V: Case Studies

Nehru Institute of Mountaineering, Gulmarg Ski Resort, National Institute of Water Sports Goa

References:

1. Atkinson, E.T. Himalayan Gazetter, Cosmo Publication, New Delhi, 1993.
2. Gupta.S.K.(2002)Tourism and Heritage Resources of Garhwal,Kavery Books,New delhi.
3. Bisht, D.S. Garhwal and Kamaon Hills, Trishul Publication, Dehradun, 1982.
4. Bose, S.C. Geography of the Himalaya, National Book Trust, 1976.
5. Kaur, J, Himalayan Pilgrimages and the New Tourism, Himalayan Books, New Delhi, 1985.

ACADEMIC ORDINANCES
FOR UNDER GRADUATE AND POST GRADUATE COURSES OF STUDY

(Under section 28)

ADMISSIONS TO COURSES OF STUDY

1. The admission of candidates to courses of study in the University shall not be made, except in accordance with the provisions of this ordinance.

2. (a) Subject to the provisions of sub-clause (b), admission to a course of study shall be made in the order of merit of
   (i) the marks obtained at the Qualifying Examination; or
   (ii) the score at an Admission Test, comprising one or more written Papers, and, where so provided in the Rules, a Group Discussion or Personal Interview or other presentation, or more than one of them; or
   (iii) the marks, referred to in serial number (i), and the score referred to in serial number (ii) , taken together, as such or proportionately, as modified, in accordance with the provisions of the Rules, by the application of weightages, premia and discounts, and of special considerations for specified categories of candidates:
   Provided further that the admissions of foreign students and of candidates sponsored by any approved institution or organization against earmarked seats for such institutions or organizations shall be governed by the special rules in that regard.

   (b) Not with standing anything to the contrary contained in this Ordinance, or in the general or particular Ordinances or Regulations governing the courses of study to which this Ordinance applies, seats shall be reserved in each course of study for different categories of candidates, in accordance with the directions of the University Grants Commission and the Government of India and with the provisions of laws made by Parliament.

3. (a) There shall be an Admission advisory Committee of the University for the course of study which shall comprise
   (i) the Vice-Chancellor (Chairperson)
   (ii) the Pro-Vice-Chancellor or, where there is no Pro-Vice-Chancellor, a Professor nominated by the Vice-Chancellor, for such period as he/she may determine ;

(iii) the Deans of the Schools;

(iv) the Director of Campuses.

(v) Dean Student Welfare

(b) The Registrar shall ex officio be the Secretary of the Admissions Committee, but shall not be deemed to be a member thereof.

(c) The International student Advisor, if any, and the Proctor shall be specially invited to all meetings of the Admissions Committee.

4. (a) Subject to the provisions of this Ordinance or Regulations governing courses of study in the University, the Admission Committee shall, in respect of the courses of study within their respective jurisdiction :-

(i) lay down the principles or norms governing the policy of admission and determine the criteria, programme and procedure of admission thereto, in general or for each academic year;

(ii) frame the Admission Rules and revise them from time to time;

(iii) except in cases where the seats in a course of study have been specified in the Ordinance or the Regulations governing it, determine, for each academic year, the seats in the courses of study concerned the seats in different subjects under each course of study; Provided that in the case of professional discipline, such seats shall be in conformity with the provisions of the Regulation of Guidelines of the Apex Body for such professional discipline;

(iv) lay down the last date for admissions to the course of study concerned, which shall, in the case of academic programmes on the Annual system, not be more than five weeks after the date of commencement of the academic year or, in the case of an academic programme on the Semester system, not be more than three weeks after the date of commencement of the concerned Semester;

(v) appoint such number of sub-committees as it thinks fit and nominate a person or a Committee as the admitting authority in respect of each such course of study ; and

(vi) consider matters referred to it by any authority or other body of the University, or the Vice- Chancellor, and perform such other functions as may be assigned to them by the Ordinance or Regulations, the Executive Council, the Academic Council or the Vice- Chancellor .

(b) The rules and procedure of admissions, including the structure, organization and conduct of Admission Tests, in respect of different courses of the study in the University, as subsisting on the date immediately preceding the commencement of this Ordinance, shall

continue in force upon such commencement, pending the framing and implementation of the Rules and Procedure in that regard under the provisions of the Ordinances and Regulations, subject to such adaptations or modifications therein, as the Vice- Chancellor may direct in order to bring the same into accord with the Ordinances and Regulations, or as may appear to the Vice-Chancellor to be expedient or necessary in the circumstances;

Provided that all such adaptations and modifications shall be reported by the Registrar to the Admission Committee.

(c) While deciding any matter in respect of the rules, procedure and programme of admissions to degree-granting courses of study under the provisions of sub-clause (a), the Admission Committee shall give due consideration to the recommendations made in respect thereof by, or may seek the advice of, the Boards of Admissions for the said courses of study for degree programmes in the University under the Schools;

(d) The constitution of he Boards of Admissions, referred to in sub-clause (c), shall be as follows:-

(i) the Dean of the School concerned (Chairperson)

(ii) the Heads of the Departments assigned to the School, and

(iii) the two senior most Professors of the School (not being the Dean or the Head of the Department), by rotation in the order of seniority, for a period of two years.

(e) Every student admitted to a course of study in the University shall be required to complete the prescribed formalities of enrollment in the Schools, not later than one week from the date of his/her admissions: Provided that the Dean, may extend the last date for the completion of such formalities, but no such extension shall be granted beyond two weeks of the last date for admission.

(f) Within two weeks of the last date for completing the formalities of enrollment by the admitted students, referred to in sub-clause (e) the person or committee responsible for admission to courses of study in the School and Departments of the University, shall submit to the Registrar the final list of students admitted to different courses of study for the academic year concerned specifying in the score on which the order of merit was determined, in respect of each admitted candidate, and shall submit therewith the Transfer or Migration Certificates of such students as have been admitted to the University

system for the first time or have rejoined the University.

5 (a) The admissions Committee shall function under the general superintendence of the Academic Council, and their proceedings shall be reported to Academic Council, which may review any decisions taken by them and issue directions to them.

(b) The Academic Council may constitute a Standing Committee on Admissions, to deal, on its behalf, with matters relating to admissions.

GENERAL PROVISIONS ON COURSES OF STUDY
(Under Section 28)

1. The Ordinances and Regulations governing courses of study for degrees, Diplomas, Certificates of Proficiency and Special Certificates, as were in force on the date immediately preceding the commencement of this ordinance, or as had been approved by the Academic Council on or before the said date, shall continue to apply, or shall apply, as the case may be, to the courses of study concerned, up to their amendment, notification or repeal by the Executive Council on the recommendations of the Academic Council.

2. (a) The Academic Council may constitute a committee to review the Ordinance and Regulations referred to in clause 1, and recommend such changes in them as may be appropriate to effect structural rationality and uniformity in the same, and also to recommend the norms that may be followed in the framing of such Ordinances and Regulations and the distribution of the subject-matter thereof between each such Ordinance and the related Regulations.

(b) The Vice-Chancellor shall take all necessary steps towards the application and observance of the recommendation of the Committee referred to in sub-clause (a), as approved by the Academic Council and the Executive Council.

3. Admissions to the Masters Programme shall be through entrance examination conducted by the University or such agency as may be authorized by the University, and each programme shall be based on the choice based credit system in which Credit defines the quantum of contents/ syllabus prescribed for a course and determines the number of hours of instruction required per week. (Under clause 2 (iv) of Section 6)

4. Eligibility:

(a) No student shall be eligible for admission to a Master's degree programme in any of the school/faculty unless he/she has successfully completed a three year undergraduate degree or earned prescribed number of credits for an undergraduate degree through the examinations conducted by a University /autonomous institution or possesses such qualifications recognized by the HNB Garhwal University as equivalent to an undergraduate degree.

(b) In case of integrated Master's Degree programmes of five or more years, no student shall be eligible for admission unless he/she has successfully passed the examination conducted by a Board/ University at the Plus two level of schooling (either through formal schooling for 12 years or through open school system) recognized by the Central/State Government for this purpose or its equivalent.

5. Courses

(a) A Master's programme shall consist of a number of courses and a `Course' shall be a component (a paper) of a programme.

(b) Every course offered by any department shall be identified by a unique course code. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work / practical training /report writing / viva voce, etc or a combination of these, to meet effectively the teaching and learning needs and the credits may be assigned suitably.

6. Semesters

(a) An academic year shall consist of two semesters:
Odd Semester (I and III Semesters): generally July to November
Even Semester (II and IV Semesters): generally December to April
The academic calendar for each semester shall be notified well before the commencement of the semester by the University.

(b) A semester shall normally extend over a period of 15 weeks. Each week shall have 30 hours of instruction including lab/field/project work as applicable.

7. Credits

(a) Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus, normally in each of the courses, credits shall be assigned on the basis of the number of lectures / tutorials /

laboratory work/ project work and other forms of learning required to complete the course contents in a 15 week schedule:

(b) 1 Credit = 1 hour of lecture/instruction per week (1 Credit course = 15 hours of lectures per semester). Instruction can be in the form of lectures / tutorials / laboratory work / fieldwork or other forms. In determining the number of hours of instruction required for a course involving laboratory/field-work, 3 hours of laboratory/, field work shall be considered equivalent to 1 hour of lecture.

8. Roll Numbers and Enrollment Numbers

The Dean of a particular school shall allot a roll number to the students after payment realization, thorough scrutiny and verification of the required documents for a particular course. After the completion of the admission procedure the enrolment numbers for the students shall be allotted by the University at the entry point which shall remain same for the entire period of study in the University.

9. Course Numbering

Every course offered by any Department shall be identified by a unique course code.

Illustration

		L	T	P	C
SOS/FOA/ C 001	International Relations	3	0	0	3

In this example:

SOS C 001 is the course code in which:
SOS/FOA - is the school /faculty code (School of Social Sciences/ Faculty/School of Arts)

C - indicates that this is a Core Course
001 - is the serial number of the Course
International Relations - is the title of the Course

The figures under L, T and P indicate the weight (credits) attached to lectures, tutorials and practical work respectively. The figure under C indicates the total number of credits that the course carries (3 credits in this case)

10. Management and Administration of Choice Based Credit System

(a) Advertisement of CBCS programmes, Approval of Admission of Students made by Departments, Course Registration, issue of Identity

Cards, Coordination of Time Table and preparation of Academic Calendar, Attendance and Consolidation of awards in First Assessment and Second Assessment and forwarding the consolidated awards lists to the Controller of Examinations for scrutiny and distribution of Grade Sheets, Cumulative Grade Sheets and Provisional Pass Certificates.

(b) In order to optimize the use of resources and talents, to avoid duplication of courses and, for effective coordination of CBCS programmes within a School/Faculty, there shall be a School Committee consisting of all the teachers of all departments of the School/Faculty headed by the Dean of the School/Faculty.

(c) The School Committee shall prepare the common time-table in consultation with the Head of the Departments of that School/Faculty.

(d) The Departmental Committee consisting of all the teachers of Department shall be responsible for admission to all the programmes offered by the Department.

(e) The Departmental Committee will deliberate on courses and specify the distribution of credits semester-wise and course-wise, for each course. It will also specify the number of credits for lecturers, tutorials, practical, seminars etc.

(f) Courses (Core/Elective) shall be designed by the Board of Studies and approved by the School/ Faculty Board.

(g) Course teacher: A teacher offering a course will also be responsible for maintaining attendance and performance sheets of all the students registered for the courses.

(h) Each teacher offering a course will give the attendance and performance sheets for Sessional Test I and Sessional Test II to the Head of the Department who shall consolidate all such performance sheets of courses pertaining to the programmes offered by the department including the end semester and forward it to the Controller of Examination through the Dean.

11. Student Advisor

Every student shall have a teacher of the Department as his/her Student Advisor. All teachers of the department shall function as Student Advisors and will have more or less equal number of students. The Student Advisor will advise the students in choosing Elective courses and offer all possible student support services.

12. Structure of Master's Programme

(a) The term Master's programme is used to denote M.A., M. Sc., M. Com., M.B.A., M.C.A., M.Ed. or M. Pharm. Or any other Masters Degree programmes offered by the various departments of the University.

(b) A Master's Programme shall consist of:

(i) Core courses prescribed for every programme which shall be mandatory for all students registered for that Master's programme. A Core course may carry 2 to 4 credits.

(ii) An Elective courses shall carry not more than 3 credits

(iii) A Self-Study Course shall carry not more than 3 credits

(iv) A course (Core/Elective/Self-study) may also take the form of a Dissertation/Project work/Practical training / Field work / Internship/ Seminar, etc. However, a dissertation / project work may carry up to 6 credits; a semester-long field work may carry 10-15 credits.

(c) All Two-Year Masters programmes will have the following components, viz.

(i) Core Courses - Minimum 54 credits

(ii) Electives - Minimum 18 credits

(iii) Self-study courses - Maximum 9 credits (one minimum 03 credits course shall be mandatory but not to be included while calculating the grades)

The credits in the Post Graduate programme of two years shall be distributed in the following manner:

Course with Credits	Semester-I	Semester-II	Semester-III	Semester-IV
Core	18	18	08-12	08-12
Elective/Optional	Nill	Nill	08-12	08-12
Self-Study Courses		03	03	03

(d) In order to qualify for a two-year master's degree a student must acquire a minimum of 72 credits including a minimum of 18 credits in electives choosing at least two electives (leading to a minimum 6 credits) offered by other departments/other streams of specialties in the Department and one qualifying self study course of minimum 3 credits.

To qualify a three year Master's degree (MCA) a student must acquire a minimum of 108 credits. The minimum Core Courses shall be of 81 credits, Elective Courses 27 credits and Self Study Courses 12 credits, choosing at

least three electives offered by other departments (leading to a minimum of 9 credits) and one qualifying self study course of minimum 3 credits.

Courses/ Papers	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI
Core Papers	18	18	9-12	9-12	13	14
Elective/ Optional papers	NIL	NIL	9	9	5	4
Self Study Courses		3	3	3		

(e) The minimum duration for completion of a two year Master's Programme in any subject shall be four semesters. The maximum period for completion shall be eight semesters.
However, the minimum duration for completion of a three year Master's Programme in any subject shall be six semesters. The maximum period for completion shall be ten semesters

(f) Core courses shall be those, knowledge of which is deemed essential for students registered for a particular Master's programme. As such all core courses shall be mandatory and a student shall have to pass in all the core courses prescribed for the programme. Where feasible and necessary two or more programmes offered by the same department or two different departments may prescribe one or more common core courses. Core courses shall be spread over all the four semesters.

(g) Elective courses are intended to allow students to specialize in one or more branches of the broad subject area; to acquire knowledge and skills in a related area that may have applications in the broad subject area; or bridge any gap in the curriculum and enable acquisition of essential skills (e.g. statistical, computational, language, communication skills, etc); or help pursue an area of interest to the student

(h) A Department may also allow students to choose two additional courses to enable them to acquire extra credits through self-study (Not to be taken into account for awarding grades / class). The Self Study courses shall be in advanced topics in a subject (core or elective) under the supervision of a faculty member. The student shall be required to make a minimum of two seminar presentations (as sessional tests for assessment) for 40 marks and 60 marks for theory paper along with the other students of that department.

13. Course Advisement

(a) In P.G. and U.G. (Honors) classes every student shall register in the concerned department (in consultation with his/her advisor) and for the UG courses in the office of the concerned Dean for the courses he/she intends to undergo in that semester by applying in the prescribed proforma (duly signed by the candidate, student advisor and the Head of the Department), within the deadline notified in the Academic Calendar by the concerned Dean.

(b) After registration, a student shall be allowed to drop an elective course agreed to earlier and substitute it by another elective course for valid reasons with the consent of the Student Advisor, but before the deadline for withdrawal of courses provided that the candidate is able to fulfill the required minimum attendance in the substitute course. Withdrawal from a course will not be permitted for those who undergo late registration. Cancellation of a course (Core / Elective/ Self-study) may be permitted before the conduct of First Sessional test.

(d) From the Second Semester onwards, registration for the courses should be completed by students on or before a specified date in consultation with their Student Advisors. A student will become eligible for registration only if he/she has cleared all dues to the Institution, during the previous semester.

(e) The courses registered after withdrawal should enable the student to earn a minimum of 15 credits.

(f) A student shall register for a minimum of 15 credits and can register for a maximum of 24 credits in a semester, however, in the final semester, a student shall register for a minimum of 12 credits. Late registration may be permitted by the Dean up to two weeks after the commencement of the semester.

14. Attendance

(a) The teacher handling a course shall be responsible for maintaining a record of attendance of students who have registered for the course.

(b) All teachers shall intimate the Head of the Department at least seven calendar days before the last instruction day in the semester, the particulars of all students who have less than 75% attendance in one or more courses.

(c) A candidate who has less than 75% attendance shall not be permitted to sit for the End-semester examination in the course in which the shortfall

exists. However, it shall be open to the Dean to grant exemption to a candidate who has failed to obtain the prescribed 75% attendance for valid reasons on payment of prescribed fee and such exemptions shall not under any circumstances be granted for attendance below 65%.

(d) A candidate who fails to put in least 75% attendance in I semester shall not be allowed to pursue the studies in II semester. Such candidates may apply to the Dean of the concerned school for re-registration in the I semester in the next academic session. A candidate who fails to put in at least 75% attendance in the II semester shall not be promoted to III semester. Such candidates may apply to the Dean of the school for re-registration in the II semester in the next academic session.

A Candidate who puts in 75% attendance in the I and II semesters separately but fails to acquire 18 credits in the I and II semester examination taken together shall not be promoted to the III semester. He/She shall cease to be a regular student.

However, he/she may appear as an ex-student only in End Semester Examination of the course(s) in which he/she has failed, at the next semester examinations and subject to permission by the Academic Council at any further subsequent examination. A candidate who thus having ceased to be a regular student, acquires the minimum number of credits for promotion to III semester, shall re-register himself/herself as a regular student for appearing at the examination of III semester.

Provided that a regular candidate who having fulfilled the minimum attendance requirement, fails to secure the required number of credits for promotion to the III semester, may apply for re-registration as a regular student in the I or/and II semester. He/She shall have to fulfill the attendance requirement afresh and shall again perform sessional work and practical and shall appear in the End Semester Examination of all the courses at the next examination of I and II semesters. Any marks obtained in the immediately preceding year and the attendance being disregarded. Similarly a regular candidate who having fulfilled the minimum attendance requirement, fails to secure the required number of credits for attaining degree, may apply for re registration as a regular student in III and/or IV semester. He/She shall have to fulfill the attendance requirement afresh and shall again perform Sessional work and practical and shall appear in the End Semester Examination of all the courses at the next examination of III and IV semesters. Any marks obtained in the immediately preceding year

and the attendance being disregarded. However, no candidate shall be permitted to continue as a regular student for more than two times in any semester.

(d) The Head of the Department shall announce the names of all students who will not be eligible to take the End semester examinations in the various courses and send a copy of the same to the Dean's Office. Registrations of such students for those courses shall be treated as cancelled. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

15. Examination and Evaluation

(a) Evaluation will be done on a continuous basis, three times during each semester. For the purpose of uniformity, particularly for interdepartmental transfer of credits, there will be a uniform procedure of examination to be adopted by all teachers. There will be two Sessional tests and one End-semester examination.

(b) Sessional tests (of one to two hours duration) may employ one or more assessment tools such as objective tests, assignments, paper presentation, laboratory work, etc suitable to the course. This requires an element of openness. The students are to be informed in advance about the nature of assessment. Students shall compulsorily attend the two Sessional tests. The Sessional test as part of the continuous internal assessment shall be conducted and evaluated by the teacher offering the course.

A Student cannot repeat Sessional Tests. However, if for any compulsive reason the student could not attend the test, the prerogative of arranging a special test lies with the teacher with the approval of the Head of the Department. In case of students who could not attend any of the Sessional tests due to medical reason or under extraordinary circumstances, a separate test may be conducted before the Examinations by the concerned faculty member after the approval of the Head of the Department and the Dean concerned.

(c) The Sessional tests will carry 40% of total marks for the course. The marks of the two Sessional Tests shall be taken into account for the computation of Grades.

(d) There shall be a written End Semester Examination which shall be of 2 hours duration carrying 60% of total Marks assigned for the course,

covering the entire syllabus prescribed for the course. The End semester Examination shall be conducted by the University in consultation with the Dean concerned.

(e) The End Semester practical examinations shall normally be held before the theory examination. The internal faculty shall associate themselves with the examination process.

(f) Evaluation of Project Report / Dissertation and viva- voce

The distribution of marks for the dissertation will be as below:

Periodical presentation	-	20 Marks
Dissertation	-	60 Marks
Viva-voce	-	20 Marks
Total		100 Marks

Dissertation / project report shall be valued jointly by external and one external examiner.

16. Marks and Grading

(a) The total performance within the semesters shall be indicated by a Grade Point Average (GPA), Weighted Average Marks (WAM), Cumulative Grade Point Average (CGPA) and Overall Weighted Percentage Marks (OWPM), respectively. Hence CGPA and OWPM shall be the real indicators of a student's performance, the calculation of which is given below:

WAM = $(\sum Ci\ Mi)/(\sum Ci)$, GPA = $(\sum Ci\ Gi)/(\sum Ci)$

OWPM = $(\sum\sum Cni\ Mni)/(\sum\sum Cni)$,

CGPA = $(\sum\sum Cni\ Gni)/(\sum\sum Cni)$ where

Ci - number of credits for the i^{th} course,

Mi - marks obtained in the i^{th} course

Gi - grade point obtained in the i^{th} course,

Cni - number of credits of the i^{th} course of the n^{th} semester,

Mni - marks of the i^{th} course of the n^{th} semester,

Gni - grade points of the i^{th} course of the n^{th} semester

(b) A candidate has to secure a minimum of 50 percent marks in aggregate and 40 percent in each paper to pass. (Two Sessional Tests marks plus End-Semester examination marks) A student shall not be allowed to repeat the End Semester examination in a course in which he / she has passed, to improve the score.

(c) A student with arrears can reappear in examinations for a maximum of three times excluding the first appearance along with the subsequent examinations. The Sessional Marks obtained by the student shall be carried over for declaring the result. Final semester student of the P.G. programme be allowed to appear for arrears in July each year.

(d) A candidate who fails to obtain the minimum required marks to pass a semester may be allowed to appear only at the subsequent End Semester Examination as an Ex- student prescribed for that particular semester. In no case, supplementary or special examination shall be held. The marks awarded at the subsequent examination and the sessional marks obtained earlier as a regular student shall be taken into account. Ex-student shall not be allowed to take regular admission in any of the semester.

(e) Provided further that in case, a candidate fails to accumulate required number of credits to obtain the degree within 8 semesters from the date of his/her first admission, he/she shall cease to be a regular student. He/She may be permitted to appear at the next immediately following end semester examinations of I and II and/or of III and IV semester(s), as the case may be, as an ex-student permitted by the Academic Council only if he/she has undergone a regular course of study in III and IV semester and after having fulfilled attendance and other requirements of III/IV semesters;

(g) A candidate pursuing a regular course of study, promoted to III/IV semester cannot receive instruction or undertake sessional work in any course of the I/II semester. Provided that a candidate while studying as a regular student of III/IV semester, may appear in the End Semester Examination of the backlog courses of I/II semester as the case may be.

(h) A candidate who fails to obtain minimum required marks to pass in the courses at the I or/and III Semester Examinations, or is unable to take that examination for reasons beyond his/her control may be allowed to pursue the course of study for the II and/or IV semester examination as the case may be, approved by the Dean of the concerned school.

(i) No candidate shall be eligible for M.A./M.Sc./M.Com Degree in a subject unless he/she has passed in all courses for the I, II, III, and IV semester examinations.

(j) No candidate shall be promoted to Second Year of MCA if:

i) he/she failed in sessional work of more than two courses prescribed

for I and/or II Semester.

ii) he/she failed end semester examination in more than two courses prescribed for I year and II Semester.

iii) No candidate shall be promoted to Third year of MCA unless:

a) he/she has passed in sessional works of all courses prescribed for I , II, II and Iv semester.

b) he/she passed in all courses prescribed for I and II semester and not failed in more than two courses prescribed for III and IV semester.

(iv). There shall be supplementary after VI semester for candidates, who have failed in not more than two courses of V & VI semesters.

(k) A candidate, who fails to accumulate the requisite credits within Ten Semester after his/her admission, shall not be allowed to further pursue courses for the degree without the permission of the Academic Council on the recommendations of the Head of the Department and the Dean concerned.

Provided that he/she had been a regular candidate for V and VI semester and has fulfilled attendance requirements;

(m) A student who has passed in all the core courses and the minimum number of electives prescribed for the programme and earned a minimum of 72/108 credits shall be considered to have passed the Masters Programme.

(n) Grading System

(i) The marks and the grades obtained in the courses corresponding to the best 72 credits including the best 54 core credits and the best 18 credits for electives will be taken into consideration account in arriving at the OWPM (for two year Masters' Programme).

(ii) The OWPM obtained by a student in a course shall be indicated by a grade point and a letter grade. A Ten (10) point scale shall be used for the evaluation of the performance of the student as given below

TEN POINT SCALE (10 Point Scale)

Letter Grade	Grade Point
A+	9+
A	8
A-	7
B+	6
B	5
B-	4
C+	3
C	2
C-	1
F	0

iii. Grade Point 9 is the highest possible grade in 10 point scale. The grade point between 8.01 and 9.00 is allotted A+ Letter grade: between 7.01- 8.00 A ; between 6.01 to 7.00 A-; between 5.01-6.00 B+; between 4.01-5.00 B: between 3.01-4.00 B-; etc.

CGPA	Class
8.5 and above	Outstanding
7.5 and above but less than	Middle First
6.5 and above but less than 7.5	Lower First
5.5 and above but less than 6.5	High Second
4.5 and above but less than 5.5	Middle Second
4.0 and above but less than 4.5	Lower Second
Less than 4.00	Fail

iV. The percentage of marks obtained by a candidate will be indicated in a letter grade. A student is considered to have completed a course successfully and earned the prescribed credits if he/she secures a letter grade other than B-. A letter grade B- in any course implies a failure in that course. A letter grade F implies a failure in that course. A Course successfully completed cannot be repeated for the purpose of improvement.

v. The B- grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the subsequent semester in which the

candidate has appeared for clearance of the arrears.

vi. A student who secures B- grade in a core course has to pass it compulsorily. A candidate who does not pass a core course in the stipulated period (eight semesters) may be permitted to re-register for the same course of a substitute core course by paying the prescribed fee when it is offered next in consultation with the student advisor.

vii. If a student who secures B- grade in an elective wants to change the elective he/she has to register by paying the prescribed fee and attend the classes for that course when it is offered.

viii. Any candidate who falls short of the required number of credits for the award of the degree may be permitted to register, by paying the prescribed re-registration fee, for the required number of course (core and/ or elective) when it is offered.

ix. If a student secures F grade in the Project Work / Dissertation, Field tour report/ training report, either he/she shall improve it and resubmit it if it involves only rewriting/incorporating the revisions suggested by the evaluators or the student can re-register by paying the prescribed re-registration fee and complete the same in the subsequent semesters.

(o) Conversion of Percentage of Marks to Grade points

(1) The marks obtained by a student will be indicated by a grade point and a letter grade. A Ten (10) point scale is used for the evaluation of the performance of the student as given below:

Marks	Grade Point
75-100	8.16-9.-0
65-74	6.5-8.15
60-64	5.66-6.49
55-59	4.83-5.65
50-54	4.00-4.82
0-49	0.00-3.99

(2) The multiplication factors of 0.0336 per mark between 75 and 100 marks, 0.1 833, per mark between 65 and 74, 0.1778 per mark between 50 and 64 and 0.0814 per mark between 0 and 49 may be applied in calculating the exact Grade Point. These multiplication factors should not be applied to OWPM for conversion to CGPA.

(p) Grade Card

(i) The Grade Card issued at the end of the semester to each student will contain the following:

(a) The marks obtained for each course registered in the semester

(b) The credits earned for each course registered for that semester

(c) The performance in each course indicated by the letter Grade

(d) The Grade Point Average (GPA) and Weighted Average Marks (WAM) of all the courses registered for that semester and

(e) The Cumulative Grade Point Average (CGPA), Overall Weighted Percentage of Marks (OWPM), the class and grade, after completing the programme.

Illustration: CUMULATIVE GRADE STATEMENT

Course Code	Course Title	Credits earned	Marks Secured-	Grade Point,	Letter Grade	Result
First Semester			(i)	(ii)	(iii)	
PS C001	Political Science	4	80	8.33	A+	PASS
PS C002		4	70	7.42	A	PASS
PS C003		3	60	5.66	B+	PASS
PS C004		3	75	8.16	A+	PASS
PS C005		2	75	8.16	A+	PASS
PS C006		2	80	8.33	A+	PASS
Grade Point Average Weighted Average Marks		18	73.34			PASS

Similar mark Sheet/ Grade statement can be prepared for other semesters as well for example GPA & WPA for the second, third and fourth Semester are given below.

First Semester	Credits (i)	Marks secured (ii)	Grade Point (iii)
GPA/WPA	24	73.34	5.20

Second semester	(i)	(ii)	(iii)
GPA/WPA	24	63.89	4.40

Third Semester

GPA/WPA	(i)	(ii)	(iii)
	24	62.50	4.26

Fourth Semester

GPA/WPA	(i)	(ii)	(iii)
	24	72.61	4.88

Commutative CGPA/ OWPM	96	68.08	4.78 First Class	A+

(Result First Class with 'A+' Grade)

17. Performance sheets, Results and Student Redress:

(a) The system of evaluation shall be transparent and students shall have the right to examine their marked answer scripts and for redress. The teacher of a course shall give the attendance and performance sheets for Sessional Test 1, Sessional Test II to the Head of the department who in turn shall *consolidate* all such sheets and forward these to the Controller of Examination through the Dean of the School/Faculty.

(b) After the successful conduct of the End Semester examination The Controller of Examinations shall finalize the results and issue Mark and. Grade Statements to the Students.

			Model I		Model II			Model III			Model IV			
Distribution		Credits	P1	P2	P1	P2	PRA	P1	P2	P3	P1	P2	P3	PRA
Core/elective Courses	Course –I	6	3	3	2	2	2	2	2	2	2	1	1	2
	Course –II	6	3	3	2	2	2	2	2	2	2	1	1	2
	Course –III	6	3	3	2	2	2	2	2	2	2	1	1	2
Non-mandatory courses (self study courses)	Course –I	2	P1		P1			P1			P1			
	Course –II	2	P2		P2			P2			P2			
Total		22												

Note :

i) P1, P2, P3 are theory papers and PRA denotes practical.

ii) The credit distribution for different papers is given in the model I, II, III and IV.

iii) Any one model may be selected (column-wise) for a undergraduate program. However, in core/ elective-courses, different rows of different models may be selected for courses (as the case may be) according to the nature of course and its requirement.

iv) The entire UG program should not exceed to 22 credits with 18 credits for core/elective-courses and 4 for non- mandatory (self-study) courses.

v) The result at the end of each semester shall be prepared only on the basis of core/elective courses.

vi) Other rules and regulations shall be as laid down in the structure of Master's Program.

vii) General English shall be mandatory non credit course to all Under Graduate students.

Post Graduate Diploma/ Diploma/ Certificate Programmes

(a) The procedures for the P. G. Diploma, Diploma and Certificate Programmes such as course registration, etc shall be similar to the Master's programme.

(b) Eligibility:

(i) A Graduate

(ii) P.G. Diploma programme may be offered as a full-time programme or as a part-time add-on programme. The number of credits for a P. G. Diploma programme shall be 48 credits

(iii) The courses prescribed for a P. G. Diploma programme may be fully independent of the courses for the master's programme. Alternatively a Department may include some of the courses (Core or Electives) offered under the Master's programme in the P. G. Diploma programme. The Departmental / School committee shall decide on the exact structure and content of the P. G. Diploma. programme conforming to the above broad structure.

(iv) The duration of a P. G. Diploma programme shall be 2 semesters (Full-time) or 3 or 4 semesters (Part-Time).

(v) Passing minimum for Post Graduate Diploma programme shall be 50% of marks in each paper/course.

(c) Distribution of Credits

(i) A Diploma programme shall carry 36 credits distributed as under: Core Courses 24 credits, Elective Courses 12 credits

(ii) The duration of a diploma programme shall be two semesters

(iii) Passing minimum for Diploma programme shall be 40% of Marks in each paper/course.

Courses with credits	Semester I	Semester II
Core	12	12
Elective/Optional	6	6

Short-term Certificate Programmes

(i) A certificate programme shall carry 12 credits.

ii) The duration of a certificate programme shall be one semester (Part-time) or 10 weeks full-time.

iii) Passing minimum for Certificate programme shall be 40% of marks in each paper/course.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – YOGA

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

SYLLABUS FOR PH.D.QUALIFYING EXAMINATION IN YOGA

The qualifying exam will consist of a single paper of 100 marks and duration of twohours. Paper will be divided into two sections. Section-A will carry 20 marks and it will be common to all disciplines. In this section, questions related to Aptitude test and General knowledge will be asked. Section-B will carry 80 marks. In this section subject specific multiple choice questions will be asked.

Section A

- Aptitude test and General knowledge (Common to all disciplines)

Section B

Unit 1: Introduction to Yoga: Meaning, Definitions and Historical Development of Yoga, Relevance of Yoga in Modern age, Philosophical foundation of Yoga

Unit 2: Kinds of Yoga: Jnana, Karma, Bhakti yoga with special reference to Bhagwat Gita, Rajyog, Mantra Yoga, Laya Yoga and Kundalini Yoga.

Unit 3: Anatomy, Physiology and Yoga: General Introduction of anatomical structure of human organs and physiological functions of Digestive system, Respiratory system, Circulatory system, Nerves system and Endocrine system, Effect of yoga practices on them.

Unit 4: Introduction to Hatha Yoga: Meaning, Definitions and limbs of Hatha Yoga, Cleansing Processes, Fundamental text of Hatha Yoga- Hatha pradipika, Gherandsamhita and Shiv samhita.

Unit 5: Yoga Therapy: Meaning and concept, Management of common diseases through yoga-Obesity, Asthma, Heart Disease, Diabetes, Tension & Anxiety.

24.8.13
Dean, School of Education
24/8/2013
24/8/13
24/08/2013
24/8
24/8/13
24/8/13

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2024-25

SUBJECT – ZOOLOGY

HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR (GARHWAL)
UTTARAKHAND

DEPARTMENT OF ZOOLOGY

M.Sc. Zoology

Course Contents & Syllabi

(w.e.f. 2020)

Hemvati Nandan Bahuguna Garhwal University
(A Central University)
Srinagar (Garhwal), Uttarakhand

M.Sc. Zoology

M.Sc. 1st Semester (July to November)

Code	Course	L T P C	MM
SOLS/Zool/C 001	Animal Diversity I – (Lower Non-Chordata)	3 0 0 3	100
SOLS/Zool/C 002	Cell Biology & Molecular Biology	3 0 0 3	100
SOLS/Zool/C 003	Genetics, Evolution & Taxonomy	3 0 0 3	100
SOLS/Zool/C 004	Developmental Biology & Parasitology	3 0 0 3	100
SOLS/Zool/C 005	Lab Course I Based on C001 & C002	0 0 3 3	100
SOLS/Zool/C 006	Lab Course II Based on C003 & C004	0 0 3 3	100
	Core Credits = 18		**600**

M.Sc. 2nd Semester (December to April)

Code	Course	L T P C	MM
SOLS/Zool/C 007	Animal Diversity-II (Higher Non-Chordata)	3 0 0 3	100
SOLS/Zool/C 008	Animal Physiology	3 0 0 3	100
SOLS/Zool/C 009	Instrumentation, Computer Application and Biostatistics	3 0 0 3	100
SOLS/Zool/C 010	Elementary Biotechnology & Microbiology	3 0 0 3	100
SOLS/Zool/C 011	Lab Course I Based C007 & C008	0 0 3 3	100
SOLS/Zool/C 012	Lab Course II Based C009 & C010	0 0 3 3	100
		Total	**600**
SOLS/Zool/SS01	Basic Bioinformatics	0 0 0 3	100
SOLS/Zool/SS02	Human Population Genetics	0 0 0 3	100
	Core Credits = 18		

M.Sc. 3rd Semester (July to November)

Code	Course	L T P C	MM
SOLS/Zool/C 013	Animal Diversity (Chordata)	3 0 0 3	100
SOLS/Zool/C 014	Ecology & Wildlife	3 0 0 3	100
SOLS/Zool/C 015	Lab Course Based on C013 & C014	0 0 3 3	100
SOLS/Zool/E 01a SOLS/Zool/E 01b SOLS/Zool/E 01c SOLS/Zool/E 01d	Fish Biology I Entomology I Environmental Biology I Reproductive Biology I	3 0 0 3	100
SOLS/Zool/E 02a SOLS/Zool/E 02b SOLS/Zool/E 02c SOLS/Zool/E 02d	Fish Biology II Entomology II Environmental Biology II Reproductive Biology II	3 0 0 3	100
SOLS/Zool/E 03	Lab Course Based on E001a/b/c/d & E002 a/b/c/d	0 0 0 3	100
		Total	**600**
SOLS/Zool/SS03	Biological & Radiotracer Techniques	0 0 0 3	100
SOLS/Zool/SS04	Aquatic Biodiversity	0 0 0 3	100
	Core Credits 09 + Elective Credits 09; Total Credits = 18		

M.Sc. 4th Semester (December to April)

Code	Course	L T P C	MM
SOLS/Zool/C 016	Endocrinology & Animal Behaviour	3 0 0 3	100
SOLS/Zool/C 017	Biochemistry & Immunology	3 0 0 3	100
SOLS/Zool/C 018	Lab Course Based on C016 & C017	0 0 3 3	100
SOLS/Zool/E 04a SOLS/Zool/E 04b SOLS/Zool/E 04c SOLS/Zool/E 04d	Fisheries Science Applied Entomology Applied Environmental Biology Applied Reproductive Biology	3 0 0 3	100
SOLS/Zool/E 05a SOLS/Zool/E 05b SOLS/Zool/E 05c SOLS/Zool/E 05d	Methodology in Fishery Science Methodology in Entomology Methodology in Environmental Biology Methodology in Reproductive Biology	3 0 0 3	100
SOLS/Zool/E 06	Lab Course Based E004 a/b/c/d & E005 a/b/c/d	0 0 3 3	100
SOLS/Zool/E 07	Dissertation*	0 0 6 6	100
		Total	**500/600***
SOLS/Zool/E 008	Report based on Field work/Excursion –organized by the Department	0 0 3 3	100
SOLS/Zool/SS05	Cold Water Fisheries	0 0 0 3	100
SOLS/Zool/SS06	Environmental Biotechnology	0 0 0 3	100
***Students securing Minimum 70% marks in I & II Semester together can opt for dissertation**			

Total: 54 (Core Credits) + 18 (Elective Credits) = 72 Credits

Max. Marks for each paper: 100 [40 (Sessional Tests) + (60 End Term Test)]

Sessional (Mid Term Test, Assignment, Classroom Seminar & Laboratory Work, Internship, Industrial/Institutional visits, Winter/Summer Training based report Writing & Presentation, Report based on field trips, excursion organized by Department etc.)

All 2-year Master's Programs will have the following components, viz.
(i) Core Course **(C) -** Minimum 54 credits; (ii) Electives **(E) -** Minimum 18 credits; (iii) Self Study Course **(SS) -** Maximum 09 credits (one minimum 03 credits course shall be mandatory but not to be included while calculating the grades)

*M.Sc. 4th Semester – Core Course 3 (2 Theory +1 Lab Courses of 3 credits each), Elective Courses 3 (2 Theory + 1 Lab Courses of 3 credits each) / 1 Theory of 3 Credits + 1 Dissertation of 6 Credits), Dissertation be allotted in the beginning of 3rd semester to the students securing more than 70% in the First & Second Semester together).

Note: Corrigendum in syllabus of M.Sc. Zoology Syllabus (3rd Semester) Core Course SOLS/Zool/C014 Ecology & Wildlife approved by Board of Studies (BoS) in the 21st meeting held on 30.10.2021.

M.Sc. Zoology 1st Semester

SOLS/Zool/C001 Animal Diversity I (Lower Non-Chordata)

No. of Credits = 3

UNIT I

Major and minor Invertebrate phyla: General characters, organization, classification up to order and their types. Origin and evolution of lower and higher invertebrates. Overview of economic importance of invertebrates.

UNIT II

Protozoa: Comparative morphology of all classes. Locomotor organelles and locomotion. Nutrition: holophytic, holozoic, saprozoic, myxotrophic and parasitic. Reproduction: A sexual and sexual reproduction, parthenogenesis, regeneration.

UNIT III

Porifera: Comparative morphology of allclasses. Types of canal system Reproduction: A sexual, sexual reproduction and regeneration in sponges.

UNIT IV

Coelenterata: Comparative morphology of all classes. Polymorphism, Coral reefs & formation, Affinities of Ctenophora.

Helminthes: Comparative external and internal morphology of platyhelminthes and Aschelminthes.

Recommended Books:

1. Barnes: Invertebrate Zoology (4th ed.), Holt-Saunders, 1980.
2. Barrington: Invertebrate Structure and function, Nelson, 1987.
3. Iyer: A Manual of Zoology, Part I. Viswanathan, 1973.
4. Hickman, Roberts & Hickman: Integrated principles of Zoology (7th ed) Times-Mirror, Mosby, 1984.
5. Kotpal, Agrawal & Khetrapal: Modern Text-book of Zoology, Invertebrates. Rastogi, 1976.
6. Marshall & William: Text book of Zoology, Vol I (Parker & Haswell, 7th ed.) Macmillian, 1972.

M.Sc. Zoology 1st Semester

SOLS/Zool/C002Cell Biology & Molecular Biology

No. of Credits = 3

Cell Biology

UNIT I

Ultrastructure of pro-and eukaryotic cells.
Plasma membrane: Structure - organisation, lipid bilayer, proteins & glycoconjugates, liposomes. Function- Ionic transport, transporter proteins, types of transport (symport, antiport, active & passive, endocytosis, exocytosis).
Endomembrane system: Intracellular compartments/organelles involved in protein sorting, secretory and endocytic pathways.
Cytoskeleton: Components & functions & derived organelles (cilium, flagellum).
Mitochondria: Structure function & genetic organisation. Ribosome: Biosynthesis & formation in nucleolus.

UNIT II

Signal Transductions
Cell signaling-types of signaling. Cell surface receptor mediated signaling.
Cell cycle: Molecular events during interphase, genetic regulation of cell cycle (including yeast as model system).
Cellular transformation and malignancy. Retroviruses, Apoptosis and causes of cancer.

Molecular Biology

UNIT III

The central Dogma of Molecular Biology.
DNA: Structure and conformation, supercoiling, packing of DNA into chromosomes. Structural polymorphism of DNA & RNA. Three-dimensional structure of t-RNA.

UNIT IV

DNA replication. Genetic code.
Transcription and translation in prokaryotes and eukaryotes. RNA processing. Mutations & DNA repair systems.

Recommended Books:

1. Mayr: Animal species and Evolution Belknap Press, 1966.
2. Moody: Introduction to evolution (Indian Edition) Kalyani Publ., 1978.
3. Strickberger: Evolution, (Indian Edition). CBS Publ., 1994.
4. Richard Swann Lull: Organic Evolution Seema Publications, 1976
5. Simpson G.G.: Principles of Animal Taxonomy, Columbia Univ. Press, 1961.
6. Mayr, E. Systematics and the Origin of Species, Columbia Univ. Press, 1942.
7. Blackwelder RE: Guide to the Taxonomic Literature of Vertebrates, Iowa State Univ. Press, 1972.

M.Sc. Zoology 1st Semester

SOLS/Zool/C003 Genetics, Evolution & Taxonomy

No. of Credits = 3

Genetics

UNIT I

Monohybrid and Dihybrid crosses with molecular explanations. Incomplete and Co dominance, Gene interaction, Lethal Alleles, Multiple Alleles, Pedigrees.

Modification of Dihybrid Ratios and their biochemical basis. Fine structure of Gene. Statistical Applications in Genetics (Probability and Significance Testing).

UNIT II

Linkage and Crossing over, Genetic mapping techniques. Sex Linked inheritance and genetic disorders. Mutations and Chromosomal Aberrations.

Operon hypothesis, Lac operon (positive and negative control). Regulation of gene expression in eukaryotes.

Population Genetics: Hardy Weinberg equilibrium, Genotypic and Allelic frequencies, Inbreeding, Random mating, Genetic Drift.

Evolution

UNIT III

Natural Selection: Types of Selection and Selection coefficient. Role of Mutation in Evolution, (Gene mutation, Mutation Rates, Mutation and selection, Genetic Polymorphism).

Speciation: Isolating mechanism, Modes of Speciation (Allopatric, Sympatric, Parapatric).

Micro and Macroevolution.

Animal Distribution: Zoogeographical division of the World (Characteristics and Fauna). Island Biogeography theory. Fossils and fossilization.

Taxonomy

UNIT IV

Theories of biological classification, Linnaean hierarchy.

Stages in taxonomy, Importance of Taxonomy.

Nomenclature: ICZN, Taxon, Rank and Categories. Important rules of Nomenclature, Latin words and abbreviations.

Biological Species Concepts (Polytypic and monotypic species, Subspecies).

Taxonomic characters and taxonomic keys. Preservation of collected material and curating

Recommended Books:

1. Gardner, Gimmons and Snustad: Principles of Genetics, John Wiley & Sons.
2. Robert, H. Tamarin: Principles of Genetics, Tata McGraw Hill Education Pvt. Ltd.
3. Daniel L. Hartl and M. Ruvolo: Genetics Analysis of Genes and Genomes, Jones and Bartlett India Pvt. Ltd.
4. William S. Klung Cummings, Spencer and Palldino: Concepts of Genetics, Pearson Education, Pearson Benjamin Cummings.
5. Benjamin A. Peirce: Genetics A conceptual Approach, W.H. Freeman and Company
6. TA Brown: Gene Cloning and DNA Analysis and Introduction, Wiley-Blackwell.
7. Allendorf, Luikart, Aitken: Conservation and the Genetics of Populations, Wiley-Blackwell.
8. Strickberger: Evolution, Jones and Bartlett Publishers.
9. Species Evolution: Role of Chromosomal Change, Cambridge University Press.
10. Ernst Mayr and Ashlock: Principles of Systematic Zoology, McGraw-Hill.
11. Ashok Verma: Principles of animal Taxonomy, Alpha Science International Ltd.
12. Judith E. Winston: Describing Species Practical and Taxonomic procedure for biologists, Columbia University Press.
13. V.C. Kapoor: Theory and Practice of Animal Taxonomy, Oxford and IBH Publishing Co. Pvt. Ltd.

SOLS/Zool/C004 Developmental Biology & Parasitology

No. of Credits = 3

Developmental Biology

UNIT I

Development and differentiation of sperm and oocytes, capacitation, vitellogenesis.
Mechanism of fertilization acrosomal reaction, cortical reaction and fertilization membrane.
Blocks to polyspermy, Parthenogenesis.
Cellular differentiation (transcriptional regulation of gene expression, differential RNA processing and translation).
Concept of organiser and embryonic inductions: primary, secondary & tertiary cellular interactions.
Eye morphogenesis.

UNIT II

Development in Drosophila: Cleavage, gastrulation; Molecular basis of development, maternal-effect genes, segmentation genes and homeotic selector genes.
Metaplasia & trans differentiation.
Lymphocyte differentiation and genomic alterations.
Limb morphogenesis. Regeneration, Teratogens.
Metamorphosis: Insect, Amphibian metamorphosis.

Parasitology

UNIT III

Parasitism and evolution of parasitism.
Protozoan parasites: Biology, life cycle and diseases caused by selected pathogenic protozoans of man their preventive and control measures (*Entamoeba histolytica,* Trypanosomes, *Leishmania donovani*, *Trichomonas vaginalis, Giardia intestinalis & Plasmodium).*

UNIT IV

Parasitic adaptations in Platyhelminthes and Aschelminthes. Common trematode, cestode and nematode parasites. Biology, life history and preventive measures of economically important helminth parasites of man and domesticated animals (*Ascaris, Schistosoma, Fasciola, Wuchereria, Taenia*)
Introduction to arthropods and vectors of human diseases (mosquitoes, lice, flies & ticks).
Parasitism in Crustacea

Recommended Books:

1. Gilbert: Developmental Biology. Sinauers Associates Publ. Massachusetts, 1997.
2. Balinsky: An Introduction to Embryology. W.B. Saunders Company. Philadelphia and London.
3. Berill: Development Biology. Tata McGraw Hill Publishing Co. Ltd
4. Casselman: Histochemical techniques, John Wiley, 1959.
5. Smyth (1994): Introduction to Animal Parasitology Cambridge University Press
6. Chatterjee: Parasitology, Chatterjee Medical Publisher, 1981.
7. Read: Animal Parasites, Prentice Hall, 1977.
8. Schmidt & Roberts 1989 Wiliam & Wilkins Foundations of Parasitology (IVth ed.)

SOLS/Zool/C 005 Lab Course Based on C001 & C002

SOLS/Zool/C 006 Lab Course Based on C003 & C004

M.Sc. Zoology 2nd Semester

SOLS/Zool/C007 Animal Diversity II (Higher Non-Chordata)

No. of Credits = 3

UNIT I

Minor Group: Classifications to order level, Characters and Affinities of Phoronida and Rotifera.

UNIT II

Annelida: Classification to order level, Comparative morphology of all classes, Coelom, Segmental organs.

Arthropoda: Classification to order level, Appendages & Mouth parts in insects, Larval forms in Crustacea, Arachnida.

Organization and Affinities of Onychophora.

UNIT III

Mollusca: Classification to order level, Comparative morphology of all classes, Major features of the Respiratory and Reproductive Systems, Larval forms, Torsion, Pearl formation.

UNIT IV

Echinodermata: Classification to order level, Water vascular system, Larval forms and affinities.

Recommended Books:

1. Kotpal R.L: Modern Text Book of Zoology: Invertebrates, Rastogi Publications.
2. Nigam H C: Biology of Non-Chordates, Nagin Chand, 1985.
3. Parker TJ & Haswell WA: A Text book of Zoology Vol I & II, McMillan
4. Hyman L: Invertebrate Series, Academic Press
5. Starr et al: Biology, The Unity and Diversity of Life
6. Twenhofel et al: Principles of Invertebrate Palaeontology
7. Doyle P: Understanding Fossils Invertebrate Palaeontology

M.Sc. Zoology 2nd Semester

SOLS/Zool/C008 Animal Physiology

No. of Credits = 3

UNIT I

Physiology of respiration: Exchange of respiratory gases at the pulmonary surface. Transport of respiratory gases by blood. Factors affecting oxyhaemoglobin dissociation. Neural and chemical control of respiration.

Physiology of digestion & absorption: Functional anatomy of the gastrointestinal tract. Gastrointestinal motility and its regulation. Secretions of the gastrointestinal tract. Liver and biliary system.

Digestion and absorption of proteins, fats and carbohydrates.

Physiology of excretion: Formation of urine: Functional anatomy of the kidney. Glomerular filtration and its control. Reabsorptions & secretions in the tubules. Mechanisms of active transport. Excretion and control of urea, sodium, potassium and other ions.

Functions of aldosterone, antidiuretic hormone and renin-angiotensin system in renal physiology. Osmoregulatory mechanisms.

UNIT II

Physiology of cardiovascular system: Characteristics of vertebrate cardiac muscle. Initiation, conduction and regulation of heart beat. Cardiac cycle and cardiac output.

Regulation of cardiac amplitude and frequency. ECG and myocardial infarction. Blood pressure and its regulation.

Circulation (open and closed, blood composition and function). Blood groups.

The cascade of biochemical reactions involved in coagulation of blood. Blood groups. Lymphatic systems.

UNIT III

Nervous system: Neuron - the basic functional unit, the sensory & motor divisions.

Ionic basis of resting and action potentials of neurons, significance of myelinated nerve fibers and velocity of conduction. Physiologic anatomy of the synapse.

Mechanism of synaptic transmission, transmitters (acetylcholine, norepinephrine, histamine, GABA). Reflexes and types of reflexes.

Neuromuscular physiology: Structural proteins of muscle cells, actin myosin complex and source of energy for contraction. Sliding filament theory of muscle contraction. Excitation-contraction coupling.

UNIT IV

Sensory physiology: The eye and visual processes - Functional anatomy of the structural elements of the retina. Photochemistry of vision. Extraretinal photoreception. Visual adaptations in vertebrates.

The ear and auditory processes - Tympanic membrane and the ossicular system. Conduction of sound from tympanum to cochlea. Functional anatomy of cochlea. Sound transmission in cochlea.

Mechanism of thermoregulation in poikilotherms, homeotherms and heterotherms. Aestivation and hibernation.

Recommended Books:

1. Knut Schmidt-Nielsen. Animal physiology-Adaptation and Environment. Cambridge University Press (1979)
2. Lauralee Sherwood, Hillar Klandorf, and Paul Yancey. Animal Physiology: From Genes to Organisms. Cengage Learning (2012)
3.. . Richard W. Hill, Gordon A. Wyse, Margaret Anderson - Animal Physiology, 3rd Ed-Sinauer Associates, Inc. (2012)
4. Srivastava A K. Animal Physiology and Biochemistry S. Chand Publications (1986)
5. Singh H. R and Kumar N. Animal Physiology and Biochemistry. Vishal Publishing Co.

M.Sc. Zoology 2nd Semester

SOLS/Zool/C009 Instrumentation, Computer Application and Biostatistics

No. of Credits = 3

Instrumentation

UNIT I

Principles and applications of Microscopy: Light, phase contrast, transmission electron microscopy (TEM & SEM). Colorimeter, Spectrophotometer.

UNIT II

Centrifugation. Clinical, high-speed and ultracentrifuges.
Chromatography: Paper, thin layer chromatography, GLC.
Electrophoresis: Agarose, Polyacrylamide, two-dimensional gel electrophoresis

Computer Application

UNIT III

Introduction to Computers: Mini, micro, mainframe and super computers; Components of a computer system (CPU, I/O units). Data storage device, Memory concepts.
Software and types of software.
Computer applications in biology and information communications (databases, e-mail and local networks).

Biostatistics

UNIT IV

Biostatistics: Importance of statistics in biological research. Introduction to some distributions of random variables: Binomial, Poisson, normal. Basic/Descriptive statistics: Measures of central tendency and measures of dispersion.

Skewness & kurtosis. Simple correlation and linear regression (scatter diagram, regression coefficients, regression lines).

Elementary idea of random variables. Students-t, chi-square and F-Tests of Significance testing and their purpose: Introduction to Statistical softwares. MS Excel and their purpose.

Recommended Books:

1. Hoel, P.G.: Elementary Statistics. John Wiley & Sons, Inc. New York.
2. Mahajan: Methods in Biostatistics, (4th ed.). Jaypee Bros. 1984.
3. Milton & Tsokos: Statistical Methods in Biological and Health Sciences, McGraw Hill, 1983.
4. Sokal & Rohlf: Introduction to Biostatistics. Freeman, Toppan, 1973.
5. D. Rajaraman & V. Rajaraman: Computer Primer (2nd ed.). Prentice Hall of India, New Delhi.
6. Roger Hunt & John Shelley: Computer and Commonsense. Prentice Hall of India, New Delhi.
7. Peter Norton's: Introduction to Computers with CD-ROM, 2nd ed. Tata McGraw Hill.
8. Zar JH: Biostatistical Analysis. Pearson.
9. Sharma, V.K.: Techniques in Microscopy and Cell Biology Tata McGraw Hill

M.Sc. Zoology 2nd Semester

SOLS/Zool/C010 Elementary Biotechnology & Microbiology

No. of Credits = 3

Biotechnology

UNIT I

Biotechnology: History, definition & Scope.

General steps of Gene cloning-cutting, legation, transformation and analysis of clones, genomic & C-DNA library.

A general idea of cloning vectors based on plasmid & phages, blotting techniques, DNA-sequencing, polymerase chain reaction.

UNIT II

Gene therapy, DNA finger printing, Transgenic animals and plants. Potential hazards of recombinant DNA technology.

Products of recombinant DNA technology, Human genome project and its applications.

Microbiology

UNIT III

Microbiology: Bacteria - classification, staining techniques, pathological significance.

Physiology, genetics & reproduction of viruses of plants and animals, Bacteriophage, lysogenic & lytic cycle, Bacterial genetics.

Microbial culture techniques & media enrichment techniques.

Microbial fermentation: Microbes in decomposition and recycling processes.

Microbes as pathological agents in plants, animals and man.

UNIT IV

Laboratory facilities, culture media for animal cell culture, Primary culture, cell lines and cloning, Tissue and organ culture, Transfection methods & transgenic animals. Molecular markers CRFLPs, RAPDs, minisatellites, microsatellites. Application of animal cell culture.

Recommended Books:

1. Pelczar: Microbiology, Tata McGraw Hill,1993
2. Davis: Microbiology (3rd ed.) Harper & Row, Publ. Inc., 1980
3. Dubey and Maheshwari: An Introduction to Microbiology, S Chand Publications, New Delhi

SOLS/Zool/C 011 Lab Course Based on C007 & C008

SOLS/Zool/C 012 Lab Course Based on C009 & C010

M.Sc. Zoology 2nd Semester

Self Study Course

SOLS/Zool/SS01 Basic Bioinformatics

No. of Credits = 3

UNIT I

Biology & IT, Computers in biology & medicine, Introduction to Genomics, Proteomics, Drug Design, etc.

Introduction to networking. Networking protocols. LAN, MAN, WAN, Internet (www), FTP.

UNIT II

Biological sequence data banks (GENBANK, EMBL, PDB, SWISSPROT).

Sequence alignments (Global & Local), Algorithms used (Dynamic & Heuristic) –

Needleman Wunsch, Smith Waterman, BLAST, FASTA; Substitution matrices.

UNIT III

Sequence analysis using s/w tools (DNASIS, GENESCAN).

Introduction to Phylogenetic trees, Algorithms for construction of phylogenetic trees.

UNIT IV

Molecular structure prediction, RNA secondary structure prediction and algorithm used.

Introduction to Human genome project.

Introduction to Bio Perl.

Recommended Books

1. Attwood & Smith: Introduction to Bioinformatics, Pearson Education Pt. Ltd., 2004.
2. Arsthur M. Lest: Introduction to Bioinformatics, Oxford University Press, 2002.
3. Bioinformatics-Sequence, structure and Databanks, 4th ed. Oxford University Press, 2006.
4. Lacroix and Critchlow: Bioinformatics-Managing Scientific Data, 1st ed., Margan Kaufmann Publishers, 2003.
5. Misener and Krawetz: Bioinformatics-Methods & Protocol, Vol. 132, Human Press, New Jersey, 2003.

M.Sc. Zoology 2nd Semester

SOLS/Zool/SS02 Human Population Genetics

No. of Credits = 3

UNIT I

Definition, aim and scope of population genetics, Mendelian principles of inheritance and their relevance to human populations. The Mendelian population, gene pool.

UNIT II

Mutations in Man- Determining the human mutation rate, selection, Fitness, Balance. Hardy – Weinberg Law and its applications in human populations genetics.
Population distance – Genetic Distance, Morphological distance and population heterogeneity.

UNIT III

Genetic polymorphism – Concept, Balanced and transient stages models explaining maintenance of genetic polymorphism.
Heterozygans selection, Intra uterine selection, fitness as a function of gene frequency.

UNIT IV

Genetic isolates – Formation and disintegration, genetic consequences of isolate formation with special reference to genetic drift.
Genetic and variability of (i) Skin pigmentation (normal & induced) (ii) dermal ridge patterns (iii) serological traits (ABO, MN, Rh & secreted factors).

Recommended Books

1. Caualli-Sforza, L.L.: The genetic of Human Population Crow.
2. Kimura, M: An Introduction to Population Genetic Theory, Harrison and Boyce.
3. Stern, Curt: Principles of Human Genetics.
4. Vogel, F. & Matulsky A.G.: Human Genetics: Problems & Approaches.

M.Sc. Zoology 3rdSemester

SOLS/Zool/C 013 Animal Diversity (Chordata)

No. of Credits = 3

UNIT I

General Characters, classification, development of Urochordata and Cephalochordata.

Affinities of Hemichordata, Urochordata & Cephalochordata.

UNIT II

General Characters, Classification and affinities of Cyclostomata

Salient features of different groups of fishes; comparison between Chondrichthyes and Osteichthyes; Dipnoi.

Origin and evolution of Amphibia
Parental care in Amphibia

UNIT III

General characters and classification of Reptilia and Aves.
Origin of Reptilia and adaptive radiation in Reptilia.
Characters and affinities of Chelonia and Rhynchocephalia
Origin and ancestory of birds, Characters and affinities of Ratitae
Origin and mechanism of flight in birds.
Palate in birds.
Migration in birds.

UNIT IV

General characters and classification of mammals.
Origin of mammals.
Characters and affinities of Prototheria and Metatheria
Dentition in mammals
Aquatic and flying adaptations in mammals
Adaptive radiation in mammals.

Recommended Books:

1. Parker T.J. & Haswell W.A.: A Text Book of Zoology, Vol II, ed. 7th, Macmillan & Co. Ltd, London, 1962.
2. Young J.Z.: The Life of Vertebrates, Oxford, 1950.
3. Kotpal, R.L. Modern Text Book of Zoology, Vertebrates. Rastogi Publication, Meerut.

M.Sc. Zoology 3rd Semester

SOLS/Zool/C014 Ecology & Wildlife

No. of Credits = 3

Unit I

Limiting Factors: Liebig's law of minimum, Shelford's law of tolerance. Combined concept of limiting factors, Factor interaction.
Biogeochemical cycle: Concept & types of biogeochemical cycle (nitrogen, phosphorus, carbon & water cycle)
Ecosystem: Concept & types of ecosystems. Energy flow, food chain & ecological pyramids
Habitat Ecology: Concept of habitats & niche. Ecotone & Edge effect, Habitat fragmentation, Habitat Management; Use of Toposheets and GIS Imageries.

Unit II

Population: Concepts & attributes; Biotic potential; Density, Natality, Mortality and reproductive rates; Intrinsic rate of natural increase; Survivorship curves.
Population Growth & Regulation: Logistic theory, Stochastic models. Carrying capacity; Population regulation (density dependent & density independent); Cycles & fluctuations.
Community: Concept & characteristics (stratification, density, dominance & diversity); Ecological succession (concept & models), keystone species.

Unit III

Biodiversity: Concept & importance. Genetic, species and ecosystem diversity; Factors influencing biodiversity; Endemism, Hot spots of biodiversity.
Environmental Pollution: Definition and types of pollution. Sources and effects of pollution (air, water, solid waste, radioactive).
Environmental Impact Assessment (EIA): Concept, process & importance; Hydropower projects, E flows, ecosystem services, decommissioning of dams.
Physiography of India: Biogeographic zones their characteristics and faunal composition.
Himalayan Region: Habitat types and distribution of endangered fauna.

Unit IV

Wildlife population estimation techniques: Transects, Drive counts, Aerial Counts, Point counts, Quadrates.
Population indices: Camera traps, natural marking, pug marks, cells, dung, pallets, scats, tags & rings.
Capturing, Handling and Immobilization of Wildlife: Types of Traps & trap setting; Methods for capturing (Fish, Reptiles, Birds and Mammals); Darts and guns, drugs and antagonists used.
Radiotelemetry: Concept & use; Radio collars, antenna and receivers, satellite collars.
Conservation: IUCN categories for conservation; Indian Wildlife Protection Act, CITES, WWF.
Use of Biotechnology in Conservation: Collection, extraction and preservation of DNA samples from Wild, Amplification, Sequencing and Molecular markers. Ancient DNA.

Recommended Books:

1. Bookhout, A. Theodore: Research and Management Techniques for Wildlife Habitats. The Wildlife Society, Bethesda, 1996
2. Krebs, C.J.: Ecology (6th ed.) Harper Collins College Publisher, 2016
3. Majupuria T C: Wildlife Wealth of India, Tecpress Service, Bangkok, 1990
4. Menon, Vivek: Indian Mammals: A Field Guide. Hachette Book Publishing India Pvt. Ltd.
5. Odum: Fundamentals of Ecology, Saunders Co. Publ., 1993 Indian ed.
6. Prater, S.H.: The Book of Indian Animals, BNHS, Oxford University Press 1993.
7. Richard D. Teague: A Manual of Wildlife Conservation, Nataraj Publishers, 1989.
8. Ricklef, R.E.: Ecology, Newton Mass, Chiron Press, 1973
9. Robert H. Giles: Wildlife Management Techniques (3rd ed.) Natraj Publishers, Dehradun, 1981
10. Smith RL: Ecology and Field Biology, Harper Collins Publ. 1996.
11. Sutherland, William J.: Ecological Census Techniques. Cambridge University Press, 2006

SOLS/Zool/C 015 Lab Course Based on C013 & C014

M.Sc. Zoology 3rd Semester

SOLS/Zool/E 01a Fish Biology I

No. of Credits = 3

UNIT I

Systematics and Phylogeny

Introduction and History of Ichthyology. Zoogeographical distribution, Origin, evolution, and phylogeny of fishes. Schemes of classification of fossil and recent fishes. General Characters of Teleost and Elasmobranch fishes.

UNIT II

Agnatha: Characters, basic biology and affinities of Cyclostomes and Ostracoderms.

Placoderms: General characters and affinities.

Holocephali: Salient features external and internal morphology and affinities.

Dipnoi: Salient features and affinities.

UNIT III

Comparative Morphology of Telesosts and Elasmobranchs

Integuments (Teleosts and Elasmobranchs), colouration and its significance, mechanism of colour change.

Exoskeleton: Structure and development of placoid and nonplacoid scales.Fins and their origin.

Skeletal system: Skull. Vertebrae, Girdles, Opercular bones, Pharyngeal bones in teleosts and elasmobranch.

UNIT IV

Comparative morphology of following organs in teleosts and elasmobranchs.

Alimentary canal and associated glands. Modifications based on different feeding behaviour.

Structure of heart, afferent and efferent branchial arteries.

Structure of a Gill and Pseudobranch.

Brain and cranial nerves.

Urinogenital system.

Recommended Books:

1. Khanna, S.S. and Singh, H.R. A Text Book of Fish Biology and Fisheries. Narendra Publishing House, Delhi- 110 006
2. Gupta, S.K. and Gupta, P.C. General and Applied Ichthyology (Fish and Fisheries). S Chand Publications, New Delhi-110055

SOLS/Zool/E 01b Entomology I

No. of Credits = 3

UNIT I

Introduction to external morphology: body wall, segmentation. The head: structure of head; appendages, and antennae. The thorax: pro, meso and metathorax; legs. The wings: origin, structure and articulation. The abdomen: structure, appendages; external female and male genitalia.

UNIT II

Classification of insect with special reference to that of different orders. General characters, habits, habitats, importance of the insect orders-Collembola, Protura, Diplura, Thysanura, Ephimerida, Placoptera, Odonata.

General characters, habits, habitats, importance of the insect orders-Embioptera, Orthoptera, Phasmida, Dermaptera, Blattaria, Menteodea, Isoptera, Zoraptera.

UNIT III

General characters, habits, habitats, importance of the insect orders-Psocoptera, Thysanoptera, Heteroptera, Homoptera, Anoplura, Neuroptera, Megaloptera, Trichoptera.

UNIT IV

General characters, habits, habitats, importance of the insect orders-Coleoptera, Strepsiptera, Hymenoptera, Lepidoptera, Diptera.

Recommended Books:

1. Metcal & Flint: Destruction and useful Insects, Tata McGraw-Hill, 1979
2. Ayyar, TVR: Hand Book of Economic Entomology for South India, International Book & Periodical Supply Service, 1984.
3. Pruthi HS: Text Book on Agricultural Entomology, ICAR Publication, 1969.
4. Fernald HT, HH Shepard: Applied Entomology, McGraw-Hill, 1955
5. Frost SW: Insect life and insect Natural History, Dover Publication, New Yark, 1959.
6. Mehta PR & Varma BK: Plant Protection, Directorate of Extention, Ministry of Food, Community development & Co – operation, New Delhi, 1968.
7. Ananthakrishnan TR: Applied Entomology
8. Evans JW: Insect Pests and Their Control, Periodical Expert Book Agency, 1984.
9. Bhutani DK & Jotwani MG: Insects in Vegetables, Periodical Expert Book Agency

SOLS/Zool/E 01c Environmental Biology I

No. of Credits = 3

UNIT I

Introduction to Environmental biology, its multidisciplinary nature and scope.
Components of Environment: atmosphere, lithosphere & hydrosphere.
Climate (micro, regional and global); Hydrological cycle; Soil profile.
Changing interactions between man and environment (cultural, political, ecological).

UNIT II

Terrestrial biomes of the world their characteristics and major biota (Grassland, Desert, Forest, Tundra).
Aquatic biomes (lotic, lentic, marine, estuaries, coral reef), their status.
Wetlands of India. Environmental adaptations: Aquatic, Aerial, Desert, Arboreal, Fossorial, Defensive.

UNIT III

Island biogeography theory.
Habitat fragmentation, Habitat selection, Corridors, Community patterns (gradients and Continuum), Community indices. Ecological niche.
Population cycles and fluctuations; Dispersal. Intra & Inter specific relationship.
Models of succession; Pioneer & climax concept.

UNIT IV

Concept of biological indicators; biological monitoring; Indicator organisms.
Invasive species and its impact.
Biological control: Biomagnification, Bioassimilation & Bioaccumulation.
Elementary Toxicology, Xenobiotics: Carcinogenic (heavy metals, radioactive substances and pesticides) their chemical nature.

SOLS/Zool/E 01d Reproductive Biology I

No. of Credits = 3

UNIT I

Sex Genetics: Sex determination, Gondal Differentiation and development.
Role of Y chromosomes (mammals) and autosomes and sex hormones.
Sex hormones and differentation of brain and reproductive behaviour.

UNIT II

Hormones of Reproduction: Gonadotropins, Chemistry and Synthesis.
Sex steroids: Synthesis (/\4 and /\5 pathways) & excretion of steroids.
Mechanism of action: GnRH, androgens, estradiol and progesterone.

UNIT III

Endocrine control of male reproduction (rat/man).
Hormonal control of spermatogenesis, Androgen binding protein (ABP), Inhibin.
Neurendocrine control of testicular functions (Gn RH regulation, FSH- effects on germinal epitheluim, LH-effects on Leydig cells, negative feedback regulation).

UNIT IV

Endocrine control of female reproduction (rat/man)
Hormonal control of ovulation. The ovary and the reproductive tract. The ovarian cycle.
Folliculogenesis, Ovulation, formation & degeneration of corpus luteum. Neurendocrine control of ovarian function. (GnRH secretion, FSH LH-effects on developing follicles, ovulation, corpus luteum formation & function, cellular effects of LH, FSH in hormone production). Foetoplacental Unit and Feedback mechanisms.
Estrus & menstrual cycles.
The Role of CNS, Hypothalamus and Pineal in Reproduction. Reproduction in wild animals.
Timing of reproduction phenomenon of seasonality. The Biological clock.

M.Sc. Zoology 3rd Semester

SOLS/Zool/E 02a Fish Biology II

No. of Credits = 3

UNIT I

Specialized Characters
Accessory Respiratory organs in fishes.
Swim Bladder and its modifications, Blood supply of Air bladder, Gas secreting complex, Functions
Weberian ossicles: Structure and arrangement, Working mechanism and functions.
Electric organs: Structure, Mechanism of electric discharge, Functions.
Bioluminescence: Luminiscent organs, Mechanism of light emission, Significance.
Sound production in fishes

UNIT II

Fish Behaviour
Fish behavior: Social, ecological, reproductive, migratory, foraging behavior. Parental care in fishes.
Receptor organs: Eye, Acoustico-Lateralis system, olfactory organs and Taste buds
Migration in fishes: Pattern, Causes and Factors influencing.
Parental care and viviparity in fishes.
Pheromones and their role in sexual behavior of fish.

UNIT III

Fish Physiology and Embryology
Fertilization and development of fish egg (Teleost). Cleavage, Blastulation, Gastrulation and fate map.
Hatching and post-embryonic development.
Respiration: Functional organization of Gill lamellae, Blood supply of gill, Mechanism of gas exchange, Counter current mechanism.
Physiology of excretion and osmo-regulation, Mechanism of water- salt balance in freshwater, marine and estuarine fishes.
Reproductive physiology: Spawning patterns and stimulating factors, Follicular atresia.
Haemopoiesis: Composition of Blood, haemopoietic tissues, synthesis of Haemoglobin.
Physiology of Thermo-regulation in fishes.

UNIT IV

Endocrine and Biochemistry
Pituitary gland: Micro-anatomy, Hormones of Pituitary and their physiological actions.
Thyroid gland: Structure and function
Structure and functions of Pancreatic islets in fishes.
Location and functions of Corpuscles of Stannius, Pineal and Urophysis in fishes.

Recommended Books:

1. Kyle: The Biology of Fishes, 2007.
2. Singh H.R.: Advances in Fish Biology, Hindustan Publishing Corp., 1994.
3. Munshi J.D. & Munshi J.S.D.: Fundamental of Freshwater Biology, Narendra Publ. House, 1995.
4. Khanna S. S. & Singh H.R. : A Text Book of Fish Biology & Fisheries, Narendra Publ. House, 2014
5. Srivastava C.B.L.: Fish Biology, Narendra Publication House, 2008.
6. Ojha J.: Biology of Hill Stream Fish, Narendra Publication House, 2002.

M.Sc. Zoology 3rd Semester

SOLS/Zool/E 02b Entomology II

No. of Credits = 3

UNIT I

Digestive system: Structure, physiology of digestion and absorption of different types of food.

Structure of circulatory system: Haemolymph its composition and function.

Physiology of respiration: The tracheal system, spiracles, respiration in aquatic insects.

Nervous system: Structural basis

Excretion: Structure and physiology of malpighian tubules and its secondary functions. Reproduction: male and female gonads.

UNIT II

Structure of compound eye, mosaic vision; Production and reception of sound; Light producing organs. Hormones: Neurosecretion and co-ordination, Metamorphosis: types, hormonal control of metamorphosis, Pheromones.

UNIT III

Structure of the insect egg, maturation, cleavage, formation of blastoderm, gastrulation, blastokinesis, germ layers, Various types of larvae and pupae, moulting, diapauses, Oviparity, viviparity, ovo-viviparity in insects.

UNIT IV

Abiotic factors: effect of temperature, light and humidity on growth of insect population; biotic potential, Malthusian principle and dynamics of population fluctuation, hibernation, aestivation. Biotic factors: parasitism, predation and social life in insects, phase theory of locust, parental care.

Recommended Books:

1. Mani MS: An Introduction to Entomology, National Book Trust, 1971.
2. Mani MS, Introduction to High Entomology, Mathuen & Coy. Ltd. 1962.
3. Snodgrass RE: Arthropod Anatomy, Comstock Publ. Associates, NY, 1952.
4. Wigglesworth VB: Insect Physiology, Cambridge University Press, 1954.
5. Essig EO: College Entomology, Satish Book Enterprise, Agra, 1982.
6. Fox RM & Fox JW: Introduction to Comparative Entomology. Affiliated East-West Press Pvt. Ltd. New Delhi, 1968.
7. Little VA: General & Applied Entomology, Oxford & IBH Publ. Copy, 1963.
8. Imms AD: Insect Natural History, Collinns St. James's Place London, 1947.
9. Elzinga RJ: Fundamentals of Entomology, Prentice Hall of India Pvt. Ltd., 1978.
10. Comstock JH: An Introduction to Entomology, Comstock Publ. Coy. INC., 1950.
11. Richard DW and Davies RG: A General Text Book of Entomology, Mathuen & Coy., Ltd.

M.Sc. Zoology 3rd Semester

SOLS/Zool/E 02c Environmental Biology II

No. of Credits = 3

UNIT I

Natural Resources: Management & conservation; Renewable & non-renewable resources;

Concept and currencies of Sustainable development.

Biodiversity & its conservation. Environment Protection laws. Earth Summit, Rio+20.

UNIT II

Concept of Protected areas: Sanctuary, National Parks & Biosphere Reserves. IUCN. Categories Biodiversity hot spots, conventions on biodiversity.

International efforts in biodiversity conservation (UNFP, IUCN, WWF); CITES; UNESCO's World heritage mission; Convention on Biological Diversity (CBD).

UNIT III

Global Environmental Problems: Climate change, Green house effect; Acid rain; Ozone layer depletion; Deforestation; Desertification; Marine pollution; Urbanization.

Elementary Toxicology:

Exposure to Toxicants: Routes & sites of exposure (inhalation, injection & through food or intestinal).

Duration & frequency of exposure: Acute, subacute, chronic & subchronic.

Chemical nature of toxicants.

Mechanism of action: Receptors (Proteins), mechanism of action of DDT, Lead (Pb) & UV rays.

UNIT IV

Environmental Problems/Hazards in Hills: Earthquake; Land slide; Soil erosion; Sedimentation; Cloud burst; Flash floods; Glacial retreat.

Application of Remote sensing & Geographical Information Systems (GIS) in environment management.

Disasters, their types and management.

Recommended Books:

1. D.E. Hathwny: Molecularly aspects of Toxicology: The Royal Society of Chemistry, Burlington House, London.
2. V.V. Metelev, A.I. Kanaev & N.G. Dzasokhova: Water Toxicology Amerind Pub. Co. Pvt. Ltd., New Delhi.
3. Omkar: Concepts of Toxicology, Shoban Lal Nagin Chand & Co. 64. B Bunglow Road, Delhi Ecology and Environment
4. Singh, H. R. Environmental biology. S Chand & Company, New Delhi., 2014
5. Joshi, P C and Joshi, N. Ecology and Environment. Himalayan Publishing House, Delhi, 2005

M.Sc. Zoology 3rd Semester

SOLS/Zool/E 02d Reproductive Biology II

No. of Credits = 3

UNIT I

Abiotic & Biotic factors influencing life. Zoogeographical regions of the world.

Physiographic diversity of Indian main land. Biogeography of India. Himalayan Biogeography.

Forest types of India. Representative fauna from different biogeographic zones.

Biological diversity: Genetic diversity. Taxonomic diversity, Functional diversity, Measurement of biodiversity (morphological & karyotypic variation, protein & DNA markers).

Evolution of diversity (e.g. birds). Species and speciation, Variation within species.

UNIT II

Population Ecology: Density, Dispersion, Age Structure, Sex ratio, Mortality, (Survivorship & Mortality curves). Natality. Population growth & regulation: Population growth (Exponential, Logistic) & Fecundity. Prey predator relationship. Interspecific and intraspecific competition: Territoriality and Home range. Resource partitioning and utilization.

UNIT III

Population Genetics: Genetic variation and evolution, Genetic heterozygocity (genotypes, phenotypes, sources of variation, Hardy-Weinberg equilibrium, nuclear and Mt DNA).

Gene flow, Inbreeding depression, Coefficients, Genetic drift, Minimal viable population.

UNIT IV

Reproductive patterns (mating, sexual selection, resource-based, genes based, Lek behaviour).

Reproductive isolation, ecological isolation. Reproductive efforts (Parental care, parental investment, parental energy budget). r selection, k selection.

Endangered species: Cheetah, Project Elephant, Gir Lions, Tiger project, Musk deer. Sanctuaries and National parks of India.

Wildlife Trade. Role of NGO's, IBWL, WWF, IUCN, CITES. Wetlands, Wildlife Protection Act.

SOLS/Zool/E 03 Lab Course Based on E 01 a/b/c/d & E 02 a/b/c/d

Self Study Course
SOLS/Zool/SS 03 Biological & Radiotracer Techniques

No. of Credits = 3

UNIT I

Analytical separation methods:

Chromatography - General principle and application

Adsorption chromatography, Partition chromatography, Gas chromatography, liquid chromatography, Paper chromatography, Thin layer chromatography, Gel filtration chromatography, Ion exchange chromatography, Affinity chromatography, HPLC (High Performance/Pressure Liquid chromatography).

UNIT II

Electrophoresis - General principle and application

Paper electrophoresis, Moving boundary method, Gel electrophoresis (Native, Denaturing & Reducing),

Disc Gel electrophoresis, Slab Gel electrophoresis, Isoelectrofocussing (IEF), Isotachophoresis.

UNIT III

Centrifugation: Basic principles. Common centrifuges used in laboratory (clinical, high speed & ultra centrifuges). Sedimentation rate, Sedimentation coefficient, Zonal centrifugation, Equilibrium density gradient centrifugation

Types of rotors (fixed angle, swing bucket), Types of centrifugation: Preparative, differential & density gradient.

Microscopy: Light, phase contrast, Fluorescence and Confocal microscopy, Scanning and Transmission Electron microscopy.

UNIT IV

Biosensors: Introduction & principles. First, second & third generation instruments**,** cell based biosensors,

enzyme immunosensors.

Spectroscopic methods: principle and applications of UV-visible, IR, NMR, ESR Spectroscopy. Principle & application of X-ray crystallography.

Application of radioisotopes in biology. Properties and units of radioactivity.

Radioactive isotopes and half life.

Measurement of radioactivity: GM Counter, gamma counter, liquid scintillation counter.

Tracer techniques of Autoradiography, Radioimmunoassay.

Safety rules in handling of radioisotopes and hazardous chemicals.

Recommended Books:

1. Sharma, V.K.: Techniques in Microscopy and Cell Biology Tata McGraw Hill, 1991.
2. Alberts et al.: Molecular Biology of the cell (2nd ed.), Garland, 1989.
3. Biochemical Technique: Theory & Practical J.F. Robyt & B.J. White Waveland Press, Inc.
4. Wilson & Walker: Practical Biochemistry (4th ed) University of Hertfordshire Cambridge University Press
5. Jayraman: Laboratory Manual in Biochemistry
6. Arnold L. Demain & Julian E. Davies: Manual of Industrial Microbiology & Biotechnology 2nd ed.

SOLS/Zool/SS 04 Aquatic Biodiversity

No. of Credits = 3

UNIT I

Biodiversity: Definition, Concept, Scope and measurement of biodiversity.
Types of Biodiversity: Species, Genetic, Community, Ecosystem.
Factors governing biodiversity: Historical & Proximate
Endemic species: Definition, Concept, Scope, Hot spots

UNIT II

Types of aquatic ecosystem & biomes and their characteristics.
Freshwater biodiversity.
Marine biodiversity.
Biodiversity data bases of CMFRI, CIFRI, NBFGR.

UNIT III

Threats to habitats and Biological diversity in Freshwater and marine ecosystems.
Endangered species: Definition, Concept, Scope.
Conservation; Definition, Concept, Scope.
Physical and chemical characteristics of freshwater rivers, lakes, reservoirs and wetlands.
Over view of freshwater biodiversity in important Rivers, Lakes Reservoirs and Wetlands of India with emphasis on Himalaya.

UNIT IV

Impact of Hydroelectric Projects (HEP) on aquatic biodiversity.
Environmental Impact Assessment (EIA): Case studies.
Environmental flows: Importance for the aquatic flora & fauna.
Environmental flows assessment methodology: Hydrological, hydraulics rating, habitat simulation & holistic.

Recommended Books:

1. KJ Gaston & JI Spicer: Biodiversity: An Introduction
2. WT Edmondson: Freshwater Biology
3. VG Jhingran: Fish & Fisheries of India
4. EP Odum: Ecology
5. HBN Hynes: Freshwater Ecology
6. WK Dodds: Freshwater Ecology
7. Rivers for Life: Managing water for people and nature, Sandra Postel, Brain D. Richter
8. Nautiyal P & Singh H R Biodiversity & Ecology of Aquatic Environments. Narendra Publishing House, New Delhi, 2009
9. Nautiyal et al. Ecology & Diversity of Freshwater Environments. Transmedia, Srinagar Garhwal, 2005

M.Sc. Zoology 4th Semester

SOLS/Zool/C016 Endocrinology & Animal Behaviour

No. of Credits = 3

Endocrinology

UNIT I

Endocrine messengers: hormones, neurohormones, hormone like substances (neuronal peptides, autocoids, pheromones, neurosecretion).
Hormones and Physiological actions of the following endocrine glands in vertebrates: Thyroid, Parathyroid, Pancreas, Gastro-intestinal tract, Adrenal cortex and Medulla, Thymus & Pineal.
Hormone biosynthesis: Protein peptide hormones (gonadotrophins, thyrotrophin, corticotrophin, Steroids and catecholamines).
Mechanism of action of Protein hormones and Catecholamines: membrane bound receptors, G-protein and control of adynelate cyclase, Cyclic nucleotide cascade.

UNIT II

Organisation & physiological actions of the Testis: Androgen binding protein (ABP), Inhibin. Neurendocrine control of testicular functions (Gn RH regulation, FSH- effects on germinal epitheluim, LH-effects on Leydig cells, negative feed back regulation).
Organisation & physiological actions of the Ovary: Folliculogensis, Ovulaton, Luteinization, Ovarian cycles; Seasonal reproductive cycles; sexual dysfunctions in man.

Animal Behaviour

UNIT III

The science of behaviour: History, scope and terminology. Proximate and ultimate causes of behaviour.
Instinct: Definition and characteristics (sign stimuli and Fixed Action Pattern).
Learning behaviour: Definition. Spatial learning. Associative learning, classical conditioning, operant conditioning, language learning. Imprinting. Kin recognition. Instinct versus learning behaviour.
Timing of behaviour: Biological rhythms. The Biological Clock. Circadian rhythms and their synchronisation seasonal rhythms. Photoperiodism.

UNIT IV

Communication: Visual, olfactory, accoustic. Bird songs. Amphibian calls. Communication in bats.
(echolocation in bats, electrolocation in fish)
Chemoreception: Chemicals (pheromones) as signals in insects, fish and mammals. Role of olfaction in communication behaviour (territorial, sex recognition, feeding etc) in fish and mammals.
Neural control of behavior:
Components of brain involved in various behaviours. Neural control of drinking, learning, eating, activity & rest, sleep, aggression, sexual behaviour.
Hormonal Control of behaviour. Hormone brain relationships. Sexual behaviour in mammals (eg. rat).
Sociobiology: Elements of sociality and social grouping in animals.

Recommended Books:

1. Alcock: Animal behaviour Sinaur Associates, Inc. 1989.
2. Goodenough et al.: Perspectives on animal behaviour. Wiley & Sons, New York. 1993.
3. Grier: Biology of animal behaviour, Mosby 1984.
4. Krebs & Davies: An introduction to behavioural ecology (3rd ed.) Blackwell 1993.
5. Lehner: Handbook of ethological methods, Garland STPM Press, New York, 1979.
6. Halliday, T.R.: Animal Behaviour Vol. 1 & 2 Communication, 1983.
7. Saunders: Insect Clocks Pergamon Press. 1982.
8. Palmer: An Introduction to Biological Rhythms Academic Press New York.1976

9. Ross & Salisbury: Plant Physiology, Indian ed. (FOR BIOLOGICAL RHYTHMS)
10. Mac E. Hadley: Endocrinology, Prentice-Hall International ed.1988/1992.
11. G J Goldsworthy et al: Endocrinology, Blackie, 1981.
12. Maurice Goodman: Basic and Medical Endocrinology, Raven Press.
13. F.S. Greenspan & P.H. Forsham: Basic and Clinical Endocrinology Maruzen Asian Ed. Lange Medical Publ. USA, Singapore
14. Chester-Jones: Fundamentals of Comparative Vertebrate Endocrinology Plenum Press, New York & London, 1987.
15. P.J Bentley: Comparative Vertebrate Endocrinology S. Chand & Company Ltd, Ram Nagar New Delhi, 1980
16. Wilson Foster: Williams Textbook of Endocrinology, Seventh ed.Saunders International ed. London, 1985.

M.Sc. Zoology 4th Semester

SOLS/Zool/C017 Biochemistry and Immunology

No. of Credits = 3

UNIT I

Enzymes: Classification (rationale, overview and specific example) Zymogens and their activation (protease and Prothrombin).
Enzyme substrate complex: concept of E-S complex, binding sites, active site, specificity, Lock and Key Hypothesis, Induced –Fit Hypothesis, Michaelis- Menten equation and its derivation, Different plots for the determination of Km and Vmax.
Carbohydrate Metabolism I: Pathway and regulation of Glycolysis, Gluconeogenesis, Glycogenolysis, Glycogenesis.
Carbohydrate Metabolism II: Citric acid cycle and its regulation, electron transport chain and oxidative phosphorylation, pentose phosphate pathway and its regulation.

UNIT II

Amino Acid Metabolism: Overview of Amino acid degradation, Urea cycle (conversion of ammonia into urea, linkage between urea cycle and citric acid cycle) and its regulation.
Conversion of nitrogen to ammonia by microorganisms, overview of amino-acid biosynthesis.
Fatty Acid Metabolism: Fatty Acid Oxidation and regulation β-oxidation, Oxidation of unsaturated fatty acids and odd chain fatty acids. β-oxidation in peroxisomes, ketone bodies and their overproduction.
Fatty Acid Biosynthesis and Regulation. Reactions of fatty acid synthase, synthesis of triglycerols, membrane phospholipids & prostaglandins.
Cholesterol biosynthesis and regulation.

UNIT III

Nucleic Acid Metabolism: Purine biosynthesis and its regulation, pyrimidine biosynthesis and its regulation. Formation of deoxyribonucleotides.
Salvage pathway for purine & pyramid in nucleotides, Degradation of purines and pyrimidines into uric acid and urea. Integration of Metabolism.
Overview of the Immune System. Cells and Organs of the Immune System. Antigens, Antigenicity versus Immunogenicity. Haptens & Epitopes
Immunoglobulins: Structure and Function. Major Histocompatibility Complex. Antigen processing and presentation. Structure and functions of BCR & TCR.

UNIT IV

Cytokines. The Complement System. Cell mediated cytotoxicity: Mechanism of T cell & NK cell mediated lysis. Ab-dependent cell mediated cytotoxicity (ADCC)
Overview of Hypersensititivity and Autoimmunity. Introduction to Transplantation.
Vaccines: Active and Passive Immunization
Introduction to Monoclonal Antibodies and Hybridoma technology.
Antigen-Antibody Interactions: Precipitation Reaction, Agglutination Reactions, RIA, ELISA,
Western Blotting, Immuno precipitation, Immuno-fluorescence.

Recommended Books:

1. Lehninger: Principles of Biochemistry, 4th ed., Nelson & Cox, WH Freeman and Company, 2007
2. Voet & Voet: Biochemistry, 2nd ed., Wiley & Sons.
3. Berg, Tymoczko, Stryer: Biochemistry, 5th ed., WH Freeman and Company, 2003.
4. Garett & Grisham: Biochemistry, 4th ed., Brooks/Cole Cengage learning, 2010.
5. Murray, Granner, Rodwell: Harper's Illustrated Biochemistry, 27th ed. McGraw Hill, 2006
6. Conn & Stumpf: Outlines of Biochemistry, 5th ed., Willey India, 2007.
7. Kuby: Immunology (4th ed.).
8. Roitt, Male & Brostof : Immunology (3rd ed).
9. Elgert & Elgert : Immunology.
10. Wilson & Walker: Practical Biochemistry (4th ed.).

SOLS/Zool/C 018 Lab Course Based on C016 & C017

SOLS/Zool/E 04a Fishery Science

No. of Credits = 3

UNIT I

Aquaculture:

Scope, importance and present status.

Concept of different culture systems: Extensive and intensive fish culture, Fish culture in ponds and reservoirs. Culture in rice fields, bheries, Cage culture, Pen culture, Monoculture and polyculture.

Preparation and maintenance of fish farm: Fertility and pH maintenance. Role of fertilizers, required water quality and its maintenance. Control of aquatic weeds, insects and predatory fishes.

Fish nutrition: Development of natural food and supplementary feeding.

Culture techniques Procurement of stocking material from natural sources, Induced breeding and use of new generation drugs, ovaprim, different hatching techniques, Transport of fish seed.

UNIT II

Culture Practices:

Culture of Common carp and Exotic Trouts

Prawn culture

Sewage – fed Fisheries and Integrated fish farming

Common fish diseases and their control

Mahseer and Schizothoracid fishery. Current status, problems and perspectives

Culture of Larvicidal fishes. Characters and importance

UNIT III

Harvesting and Post harvesting

Fishing gears used in inland waters and seas.

Fish preservation and processing techniques.

Fish by-products and their uses.

Fish spoilage: Causes of rigor mortis, precautions to control rancidity, microbial spoilage.

Nutritive value of fish, biochemistry of fish flesh of Indian major carps.

Storage, transportation and marketing.

UNIT IV

Capture and Ornamental Fishery:

Rivers, Lakes, Dams / Reservoir fishery- Problems and perspectives in Capture fisheries.

Estuarine fishery. Characteristics and species dynamics.

Marine fishery: Coastal, off shore and deep sea fishery. Exclusive Economic Zone.

(Hilsa, Oil sardine, mackerel, Bombay duck, Sole, Ribbon, Shark and Rays).

Recreational fishery and Cooperative movements. Fish Farmers Development Agencies (FFDA). Climate change and fishery.

Major, Marine and freshwater ornamental fishes, their food & breeding needs.

Health management of ornamental fishes. Specific diseases and their cure.

Setting and maintenance of aquaria.

Recommended Books

1. S.K. Gupta, P.C. Gupta: General and Applied Ichthyology, S. Chand & Comp., 2006.
2. Vadapalli Satyanarayana: Fish Culture, Narendra Publ. House, 2002.
3. R.K. Rath: Freshwater Aquaculture, 2nd ed., Scientific Publishers, 2000.
4. Singh & Mittal: Dictionary of Aquaculture, Daya Publishing House, 1963.
5. Tor G. Heggberget: The Role of Aquaculture in World Fisheries, Oxford University Press, 1996.
6. Jhingran V G: Fish and Fisheries of India. Hindustan Publication Corp.
7. Nautiyal, P., Bhatt, J P, Gusain, O P and Dobriyal A.K. (Ed): Biological Diversity in Freshwater Environments, Transmedia, Media House, Srinagar Garhwal, 2005
8. Bahuguna, P. and Dobriyal, A K . Biology of the Ornamental Fish *Puntius conchonius* (Ham. Buch.), Narendra Publishing House, Delhi, 2019

M.Sc. Zoology 4th Semester

SOLS/Zool/E 04b Applied Entomology

No. of Credits = 3

UNIT I

Insects in relation to man: sericulture, apiculture and lac culture and its parasites, predators and diseases. Insect of veterinary importance; sand fly, horse fly, sucking louse, fleas.

UNIT II

Brief knowledge of important household, vegetable, store grain and fruit pests with special reference to distribution, habits, habitat, nature of damage, life history and control.

Cut worm (*Agrotis ipsilon*)

Cabbage cateripillar (*Pieris brassicae*)

Rice weevil (*Sitophilus oryzae*)

Mustard aphid (*Lipaphis erysimi*)

Red cotton bug (*Dysdercus cingulatus*)

Woolly apply aphid (*Eriosoma lanigerum*)

Termite: Important termites of Fam. Termatidae (*Odontotermis sp*.)

UNIT III

Origin of pests, Insect pest control; mechanical, physical, culture, biological. Genetic control: chemosterilants, radiation.

UNIT IV

Integrated Pest Management (IPM), Role of pheromones and hormones in insect pest management. Legislative control of insect pests and quarantine law.

Nomenclature and classification of insecticides on the basis of mode of action, chemical nature. Environmental factors influencing effectiveness of insecticides, persistence, biodegradability, hazards of insecticides, precaution and antidotes.

M.Sc. Zoology 4th Semester

SOLS/Zool/E 04c Applied Environmental Biology

No. of Credits = 3

UNIT I

Air: Air pollutants (chemistry, sources & control); Air Quality standards, carbon credits, carbon footprint, Thermal pollution sources and effect.
Water: Biochemical aspects of water pollutants (domestic, industrial & agricultural waste). Waste water treatment (Aerobic & anaerobic treatment processes); Water quality standards.
Case study-Ganga Action Plan.
Noise Pollution: Effects of noise and its control.

UNIT II

Radioactive fallouts its effects & safe disposal.
Solid waste management: Sources & control methods (composting, Vermi Culture, Biogas).
Hazardous waste & their management.
Bioremediation (herbicides, pesticides, hydrocarbons, oil spills).
Ecological Restoration: wasteland & its reclamation & restoration.

UNIT III

Environmental Impact Assessment (EIA): Case study of River valley projects & Mining.
Bioassay: Dose-response relationships; Frequency; Response & cumulative response; statistical concepts (LD50-potency v/s Toxicity).
Concept of hyper & hypo sensitivity factors affecting Toxicity.

UNIT IV

Ecological experimentation & models: Theories & hypothesis; experimentation; Inductive & deductive methods.
Models: Analytical & simulation models; Validation & verification.
Biological pest control: Use of predators; Parasites, parasitoids & pathogens; Integrated Pest Management.

Recommended Books:

1. Singh, H. R. Environmental biology. S Chand & Company, New Delhi., 2014
2. Joshi, P C and Joshi, N. Ecology and Environment. Himalayan Publishing House, Delhi, 2005
3. Dey, S and Nasrin, B. Ecology of Aquatic Systems, MEDTECH, 2016

SOLS/Zool/E 04d Applied Reproductive Biology

No. of Credits = 3

UNIT I

Wildlife Maps: Toposheet (use and interpretation), Satellite Imageries, Habitat mapping, Food, shelter and cover).
Interpretation of Satellite data, GIS and GPS systems. Computers, softwares used for interpretation.
Wildlife Habitat Studies: Understanding forest types, quality and age. Vegetation structure and storeys.
Techniques for the assessment of wildlife Habitat and vegetation cover (Quadrat, Transects, PCQ etc.).

UNIT II

Wildlife Census: Indirect signs of wildlife (Pallets, pug marks, hoof marks, scratches, dens, Burrows etc).
Estimating Wildlife Populations: Transects in different habitats, landscapes. Transects for different groups of animals.
Estimating wildlife in Himalayan Ecosystem.
Camera traps in wildlife census and behavioural studies. Animal body signs and population estimation. Wildlife photography.

UNIT III

Capturing and Handling Wildlife: Types of traps and trap setting. Methods for Capturing carnivores, large and small mammals, birds, reptiles, ungulates, rodents, fishes.
Types of Darts and guns used in capturing wildlife. Drugs used for immobilizing wildlife. Antagonists used.
Handling and care of captured wildlife animals.
Radio telemetry and collaring: Types of collars, radio tags (insects to large mammals).
Transmitters, radio receivers, antenna.

UNIT IV

Collection and preservation of samples (pallets, dungs, scats) from wild. Analyzing food contents.
Application of biotechnology to Wildlife Conservation: Sample Collection and preservation. DNA extraction procedures and amplification. Ancient DNA extraction.
Molecular marks used in amplification. Sequencing.
Instruments used for setting up Conservation genetics laboratory.

SOLS/Zool/E 05a Methodology in Fishery Science

No. of Credits = 3

UNIT I

Habitat Ecology (Abiotic characteristics)
Physiography of pond, lake, streams, river, reservoir. Substrate conditions, hard and soft substrate, partied size sampling for determining abiotic conditions; sample type sampling frequency, sampling and preservation of water for laboratory analysis.
Methods for determining physical environment: Air and water temperature, current velocity, turbidity, transparency.
Methods for estimation of chemical environment, pH conductivity DO, Free CO_2, Alkalinity, Hardness, Chlorides, Phosphate and Nitrate.

UNIT II

Habitat Ecology (Biological characteristic)
Qualitative analysis, Inventory of floral and faunal elements in aquatic ecosystems to class/order level.
Collection and quantitative analysis of biotic communities (density, % composition) plankton and benthic communities (periphyton, macro invertebrates). Multivariate analysis for comparing communities at different locations.
Computation of indices; species richness, species diversity, Margalef diversity index. Similarity index- Identification of fish fauna (carps, catfish); use of keys, monographs.

UNIT III

Life history traits
History of Fisheries Science, Fish stocks; concept, test of homogeneity using morphometric and meristic analysis, truss analysis, molecular techniques.
Length-weight relationship, Relative Condition Factor, Quantitative estimation of dietary components; Numerical, volumetric, gravimetric, Points method.
Determining category of food (basic, secondary etc) and dietary habits (herb-omni, carnivore), feeding intensity (Gastrosomatic index, Kn).
Determining stages of sexual maturity (macroscopic and microscopic methods), size at first maturity, spawning season and frequency (Gonado-Somatic index) fecundity.

UNIT IV

Determination of age and growth in fishes by hard parts (Scale, otolith and operculum), Length frequency method.
Identification of annuli, Growth rate, back calculation method.
Estimation of harvestable size of fish.
Fishery biology of snow trout and Golden mahseer.
Stock assessment, growth parameters, mortality exploitation rate and ratio. FiSAT software.
Fishing gears, Catch per Unit Effort (CPUE).

Recommended Books

1. Talwar, P.K. and Jhingran, A.G. Inland fishes. Oxford ad IBH Publishing Co., New Delhi
2. Nautiyal P: Methods in fisheries Science & Aquatic Ecology. Bishen Singh Mahendra Pal Singh, Dehradun 2019
3. Carlander: Handbook of Freshwater Fishery Biology, vol. 2, Iowa State Univ. Press,1977.
4. Nautiyal P: The Golden Mahseer (A Threatened Fish of Himalaya). Lambert Academic Publishing, Amazon Distribution GmbH, Leipzig,2012
5. Nautiyal P: (Compiled & Edited) Mahseer – The Game Fish [Natural History, Status and Conservation practices in India and Nepal] Jagdamba Prakashan, Dehradun 1994
6. Bahuguna, P. and Dobriyal, A K . Biology of the Ornamental Fish *Puntius conchonius* (Ham. Buch.), Narendra Publishing House, Delhi, 2019
7. Agarwal, N K and Singh, G. The Ganga in the Himalayas (Fish Diversity and Environment). NPH, Delhi, 2020

M.Sc. Zoology 4th Semester

SOLS/Zool/E 05b Methodology in Entomology

No. of Credits = 3

UNIT I

Introductory Entomology

Research methodology in entomology in introduction. Role of entomology in agriculture (Beneficial and Harmful insects).
Medical entomology: Disease vectors (Mosquito, Sand fly, tsetse fly, pathogens, lifecycle and diseases).
Veterinary entomology: Vector insect (Ticks, Mites, Flies, pathogens, lifecycle and diseases). Forensic.
Entomology: Principle, Forensic entomological flies, use of human lice in forensic entomology, Importance.

UNIT II

Entomological techniques–I

Type of sampling survey, Different Collection Methods, Collection of wild flies and Domestic insects.
Collecting Insect in the wild area-Tools and Equipments, Preparing and using baits, Collecting from natural substances, Collection permission from govt. agency like forest department State Biodiversity Board (SBB), National Biodiversity Authority (NAB), Transporting live adults or larvae.

UNIT III

Preservation of insects, classification of insects up to the level of families with hands-on experience in identifying the families of insects and Catalogues.
Insect Laboratory and rearing equipment, Experimental designs in field and Laboratory Observation techniques and Molecular techniques in insect taxonomy.
Mortality correction, Bioassay: Principles, Importance, Factor affecting, Procedures apparatus used.

UNIT IV

Entomological Techniques–II

Trophic relationships.
Use of ecological data, insect diversity: Indices, richness, rarity.
Population estimates.
Coexistence and Competition.
Distribution patterns.
Study of terrestrial/aquatic insect biodiversity, physic-chemical parameters of water (turbidity/transparency, velocity, pH, temperature, estimation of CO_2, O_2 hardness).

M.Sc. Zoology 4th Semester

SOLS/Zool/E 05c Methodology in Environmental Biology

No. of Credits = 3

UNIT I

Importance and need of environmental research. Problem identification, objectives, significance, scope and limitations.
Literature survey. Importance and designing of the problem to be undertaken.
Field survey: Site selection, source selection for data acquisition.
Sampling strategies, Sample size, Frequency, Bias, Error. Project Report Preparation.

UNIT II

Measurement of solar radiation, wind velocity, air quality monitoring, measurement of oxides of nitrogen, carbon, sulphur, lead, tropospheric ozone, methane, aerosol, pesticide.
Stack sampling, sample collection for particulate matters (Dustfall collection, High volume sampler), indoor air pollutants (radon) measurement.

UNIT III

Water quality analysis: Measurement of water temperature, velocity, depth, transparency, dissolved oxygen, free carbon dioxide, pH, turbidity, hardness, alkalinity, BOD, COD, dissolved nutrients (Nitrates, phosphates, sodium, potassium, chloride, etc.), heavy metals. Sampling methods for terrestrial flora and fauna (quadrate method).

UNIT IV

Sampling methods for aquatic fauna and flora (plankton, periphyton, micro and macroinvertebrates, nekton, etc.). Soil types, measurement of soil pH, water holding capacity, organic matter, soil nutrients (nitrate, nitrite, calcium and magnesium), Sampling of soil fauna. Sampling of soil for microbial diversity.
Application of statistical Descriptive and regression analysis in Environmental Science: Parameteric and Nonparameteric Tests, Hypothesis testing, t-test, Z-test, F-test, multivariate test chi square test, Kruskal Wallis test.
Statistical Softwares: Excel, Statistica, SPSS, etc.

Recommended Books:

1. Welch, P.S. Limnological methods, Mc Graw Hill Book Co. NY.
2. APHA. Standard Methods for Examination of Water and Wastewater. 22nd Edn., APHA, AWWA, WPCF, Washington DC, USA; 2012.
3. Edmondson TH. (ed). Freshwater biology, Ward. H B and Whipple, G H, John Wiley and Sons, NY; 1992.
4. Gupta, S.L. & Gupta, H. Research methodology (Text and cases with SPSS application). IBH Pvt Ltd, 2011

M.Sc. Zoology 4th Semester

SOLS/Zool/E 05d Methodology in Reproductive Biology

No. of Credits = 3

UNIT I

Collection and cryopreservation of gametes and embryos; Assessment of sperm function; Capacitation.
In vitro fertilization.
Multiple ovulation & Embryo transfer technology for farm animals, artificial insemination.
Recovery and maturation of oocyte.
Assessment of reproductive cycles of wildlife in captive and natural conditions.
Reproductive Cycles of some endangered species.(musk deer, elephant, tiger, pheasants) and farm animals (cattle, sheep, goat and Pig). Real-time ultrasonic scanning.
Hormones of Pregnancy. Pregnancy tests.

UNIT II

Principles and methods of fertility control (rhythm method, diaphragm, condom, IUD, oral contraceptives, surgical intervention, pregnancy termination).
Immunoendocrinology, immunoreproduction and immunocontraception – basic principles;
candidate vaccines; Gamete antigens and their immuno contraceptive potential. Male and female infertility (causes and dignosis). Hysterosalpingeography, Laproscopy.

UNIT III

Captive breeding programs. Role of CZA in Conserving endangered wildlife. Techniques for improving reproductive efficiency. Superovlulatory response and associated factors.
Infrastructure required to setup laboratory.

UNIT IV

Gene cloning and reproduction. Cloning of animals by nuclear transfer. Impact of artificial insemination technology.Embryo transfer and associate techniques. Factors influencing cloning techniques. Production and applications of transgenic animals and knock outs.
Bioethics

SOLS/Zool/E 06 Lab Course Based on E 04 a/b/c/d & E 05 a/b/c/d

M.Sc. Zoology 4th Semester

Self Study Course

SOLS/Zool/SS 05 Cold Water Fisheries

No. of Credits = 3

UNIT I

Coldwater fisheries in India: Concept and scope.
Natural and man-made coldwater fishery resources, their distribution and extent in various states of India (Himalaya and Peninsular India).
Coldwater fish fauna in India and Nepal Himalaya and their threat status.

UNIT II

Source (glacier and spring fed) based classification of fluvial resources.
Origin based classification of lacustrine resources.
The physical and chemical environment of fluvial and lacustrine resources their characteristic biota and communities.

UNIT III

Coldwater capture fisheries in lotic and lentic ecosystems.
Coldwater culture fishery, history in India, cultivable fishes fundamentals of coldwater fish culture, fish farm for trout and mahseer.
Mahseer and trout culture techniques.

UNIT IV

Fish stocks, concept and importance in capture fishery.
Morphometric and meristic analysis for determining the homogeneity of stocks.
Life history traits of barils, mahseer, snow trout and exotic carps (common grass, silver).
Stock assessment features: growth parameters mortality, ratio and rate of exploitation.
Statistical techniques in fishery science.

Recommended Books

1. Singh H R & Lakra W S: Cold Water Aquaculture and Fisheries, Narendra Publication House, 2000.
2. Carlander: Handbook of Freshwater Fishery Biology, vol. 2, Iowa State Univ. Press,1977.
3. Nautiyal P: The Golden Mahseer (A Threatened Fish of Himalaya). Lambert Academic Publishing, Amazon Distribution GmbH, Leipzig,2012
4. Nautiyal P: (Compiled & Edited) Mahseer – The Game Fish [Natural History, Status and Conservation practices in India and Nepal] Jagdamba Prakashan, Dehradun 1994
5. Bahuguna, P. and Dobriyal, A K. Biology of the Ornamental Fish *Puntius conchonius* (Ham. Buch.), Narendra Publishing House, Delhi, 2019

M.Sc. Zoology 4th Semester

SOLS/Zool/SS 06 Environmental Biotechnology

No. of Credits = 3

UNIT I

Environmental Biotechnology: Concept.
Air pollution and its control through Biotechnology (deodorization, reduction in CO_2 emission, bioscrubbers, biobeds, biofilters etc).
Water pollution and its controls: Sources of water pollution, waste water treatment-physical, chemical and biological processes (aerobic & anaerobic processes)
Solid waste: Sources and management (composting, vermiculture and biogas production)

UNIT II

Xenobiotics in Environment: Xenobiotic compounds, Recalcitrance, Bioleaching and Biomining.
Bioremediation: Types, in situ and ex situ bioremediation; Bioremediation for herbicides,Pesticides, hydrocarbons and oil spills
Hospital wastes, hazardous waste and their management.
Biopesticides in integrated pest management.
Biofertilizers.

UNIT III

Global Environmental Problems: Ozone depletion, UV-B, green-house effect and acid rain, their impact and biotechnological approaches for management.
Restoration of waste land/degraded ecosystem.
Industrial pollution and its control: Pulp & Paper, Tannery, Dairy and Petroleum.
Basic concepts of Environmental Impact Assessment (EIA)
Environment Management: Concept & Approaches

UNIT IV

Introduction to fermentation processes and types of fermentation
Microbial Growth Kinetics; Isolation, Preservation and Improvement of industrially important microorganisms
Production of solvents (Ethanol, Butanol), Antibiotics (Penicillin, Tetracycline) and Alcoholic beverages by fermentation.