SCHOOL OF AGRICULTURE AND ALLIED SCIENCES

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – FORESTRY

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

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.

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.

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.

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.

Unit II

Measurement of tree parameters. Determination of tree age and dendrochronology for growth history and climate change studies. Estimation of volume, growth and yield of individual tree and forest stands. Preparation of volume tables. Application of yield and stand tables.
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. 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.

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.
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.
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.

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.

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. 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. Community forestry and social forestry, linear strip plantations. Trends in agroforestry systems research and development, Diagnosis and Design –PRA-RRA tools in agroforestry problem diagnosis. Climate Change mitigation and adaptation through agroforestry- climate negotiations- LULUCF- agroforestry options.

Unit III

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.

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics. 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.

Unit IV

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.

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. Management options to neutralize negative (competitive) interactions, tree husbandry practices for alleviating competition- tree density manipulation, pruning, mixture of trees and herbaceous crops.

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. Root culturing techniques. Types of green house and mist chamber for propagation. 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.

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. Preliminary site preparation for establishing plantation. Plantation planning. Project formulation and appraisal. Planting programme. Time of planting. Spacing, pattern and planting methods. 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. Sustainable yield from plantations. Case studies in plantations of Eucalyptus. *Poplars, Acacias, Pine, Gmelina, Bamboo,* etc. Production technology of energy plantations. Industrial plantations.

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.

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.

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.

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.

Unit V

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. 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. 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. General concept of forest tree breeding, tree improvement and forest genetics. Reproduction in forest trees, dimorphism, pollination mechanism. Pollen dispersal, pollinators. Attractants for pollinators. Variation in trees, importance and its causes. Natural variations as a basis for tree improvement. Geographic variations – Ecotypes, clines, races and land races.

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. 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. Heterosis breeding: inbreeding and hybrid vigour. Manifestation and fixation of heterosis. Species and racial hybridization. Indian examples – *Teak, shisham, eucalypts, acacias, poplar*, etc. Polyploidy, aneuploidy and haploidy in soft and hard wood species. Induction of polyploidy. Unit VIII Elements of biotechnology in tree improvement.

Introduction to Clonal Forestry. History of clonal forestry. Clonal propagation. Clonal planting. Strategies for clonal forestry for higher productive potential.

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.

Biotechnological approaches for clonal forestry, Plant tissue culture, micropropagation, Rejuvenation of tissues from mature trees, Testing of Clonal fidelity using molecular markers.

Unit VI

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.

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.

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.

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.

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.

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.

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.

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.

Basic principles of economics applied to agroforestry. Financial measures. Quantification and valuation of inputs and outputs- direct and indirect methods.

Optimization techniques-Planning, budgeting and functional analysis. Role of time, risk and uncertainty in decision making. Agroforestry budgeting. Risk analysis, reassessment.

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.

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.

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.

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.

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.

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.

Unit VII

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.

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.

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.

Principles of weed control. Methods of weed control-cultural, biological, mechanical and chemical. Herbicide/ weedicide classification, properties and their application.

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 VIII

Origin of EIA and historical perspective, scope and purpose of EIA; Key merits of environmental assessment in regulating the state of environment. Global experience in EIA; Comparative review of EIA systems in different countries and regions. Salient features of EIA legislation and other statutory obligations. Environmental decision making in India Environmental clearance procedures and national

requirements.

Methodological approaches and tools for key stages in the process: Screening (classification of developments and stage to determine the level of EIA, exclusion and inclusion lists of projects, different approaches to screening) Scoping (scoping steps, guidance and tools, and stakeholder involvement), Impact prediction and evaluation (approach for baseline development and methods of impact identification checklists, Matrices, Networks).

Introduction to various impact assessment methods: checklist, matrices, networks, indices and weight scaling techniques and their scope and limitations · Prediction and assessment of impact on the land, air, water, noise, biological and socioeconomic environments Mitigation: definitions and hierarchy of measures including avoidance, reduction, rectification and compensation enhancement approaches, principles and concepts of offsets, type of offsets.

EIA administration and practice. Cost and benefits of evaluation of EIA; understanding strengths and limitation of EIA. EIA standards; risk assessment; potential impact to water and air pollution.

Unit – IX

Classification of non wood forest products like gums and resins, katha, dyes, tannins, oils, raw drugs, bamboos, canes and other products.

Technologies for extraction of gums, resins, katha, dyes, tannins, oils, raw drugs and other products. Utilization of various non wood forest products and their scientific management for processing, value addition, marketing and disposal.

Quality assessment of important products and their methods for storage. Important industries based on non wood forest products and their management

Physical properties of wood-wood density, specific gravity and methods of their determination. Effect of growth on density of wood. Moisture content and its measurement. Effect of sound on wood resonance. Color of wood, phosphorescence, fluorescence and residual luminescence. Thermal properties-conductivity and diffusivity. Electrical properties-conductivity, dielectric constant and current resistivity. Wood permeability.

Mechanical properties-elastic constants, plasticity, Hook's Law, Poisson's ratio, elastic constants, modulus of elasticity, factors affecting strength properties, elastic theory of bending, shear stresses in simple beams, supported beams and cantilevers carrying concentrated and uniformly distributed loads, direct and bending safe working stresses and their evaluation.

Standard tests of timber specimen's-compression, tensile strength. Mechanics and Rheology of wood, abrasion, brittleness and hardness. Suitability coefficient and indices of different wood species. Vibration properties. Effect of environment on mechanical properties of wood. Effect of radiations on strength of wood.

Important medicinal plants used in treating various diseases in modern and complementary systems. Biological activity of selected medicinal plants. Methods of preparing poultices, decoctions, powders, tinctures, active content rich extracts.

Unit X

Relevance and scope; National Forest Policy – 1894, 1952 and 1988 Forest laws; Indian Forest Act 1927, general provision and detailed study; Forest Conservation Act, 1980, Wildlife Protect Act, 1972 Important Forest Rules and Guidelines; Indian evidence act applied to forestry matters, Legal

definitions; objectives of species forest laws.

History of environmental policy in India. Constitutional and legislative provisions—constitutional provisions and the environment, Environmental protection and fundamental rights, Digest of environmental legislation (Interpretation of environmental statutes, Environmental protection Act, 1986; Biodiversity Act, 2002, Schedules tribes (Recognition of forest rights), Act, 2007. Judicial remedies and procedures, public interest litigations, Intellectual Property Rights (Patents, Copyrights, Trade mark, Trade secrets), freedom of information, and right to know.

Important case studies and landmark judgments. Case studies of different forests divisions/areas of India. International conventions of forestry issue. e.g. Role of international treaties like CITES, IUCN, RAMSER, CBD, etc.

Organic compounds and their classification such as aliphatic, aromatic, alkaloids, steroids, terpenoids, glycosides, phenolic compounds, heterocyclic compounds and carbohydrates. Primary and Secondary plant metabolites and theurapeutical uses of phyto-constituents such as anthraquinones, steroidal and triterpenoidal glycosides, phenolic compounds, lipids, alkaloids and terpenoids.

Basic principles and extraction techniques of different phyto-constituents. Analysis of active principles using TLC, HPLC, Gas chromatography, etc. Quality standards in herbal products. Drug descriptors for medicinal and aromatic plants. Postharvest processing-drying, grading and storage. Extraction techniques of essential oils and their quality analysis.

Need for disease resistance in forest trees, Process of infection. Variability in plant pathogens. Types of resistance. Inheritance of resistance. Disease resistance mechanisms in trees, Clonal resistance. Disease resistance breeding techniques. Techniques of isolating resistant genes; developing disease resistant transgenic plants.

History and importance of insect pest resistance, types and mechanism of resistance. Insect-tree relationships. Basis of resistance: Induced resistance and acquired resistance. Defense mechanisms against insects. Factors affecting tree pest resistance. Breeding for insect resistance.

Unit XI

Satellite remote sensing and recent developments in geomatics, different satellite emissions of India and abroad. Spatial and spectral resolution of different data products and applications.
Unit II
Geo-referencing of topo-sheets and satellite imageries, Satellite Image Interpretation, Digital Image Processing (DIP)-image registration, image enhancement, classification, supervised and unsupervised classification.

RS softwares, Application of Remote Sensing in forest resource management-landuse and land cover mapping, vegetation mapping and change detection, forest biomass and carbon mapping and monitoring, forest damage assessment (pests and diseases, mining, fire), forest fire risk zonation and mapping, Watershed delineation and mapping, wildlife habitat assessment, etc.

GIS for the collection, storage and spatial analysis for geo-referenced forest resources data and information. Integration of spatial data analysis systems with knowledge-based systems and/ or simulation systems for the development of information/decision support systems for forest management. GIS application in FRM.

---------- End of Syllabus ----------

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – HORTICULTURE

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

Syllabus for Ph.D. Entrance Examination Horticulture, 2025-26

Life cycle in plants, cellular basis for propagation, apomixis, polyembrony, cutting, layering, grafting and budding, categories of root-stock, formation of graft and bud union, scion-stock relationship, techniques of grafting, budding and layering. Types of nursery, location, components planning and layout of a commercial nursery, structures, media mixtures, nursery management practices. Importance and scope of orchard management, concept of HDP, orchard soil management systems, recent techniques of training and pruning, fruit thinning, pre-harvest fruit drop, rejuvenation of old orchards. Internal and external factors of unfruitfulness, irregular bearing of fruit trees. History and systems of plant classification, nomenclature. Origin, distribution, area, production, taxonomy, classification and description of important cultivars, nutrition, bearing habit, pollination and fruit set, use of bio-regulators, canopy management, special problems, physiological disorders and breeding strategies of important tropical, subtropical and temperate fruits. Origin and distribution, area and production, taxonomy, classification and description of cultivars, use of bio-regulators, seed production, specific problems and physiological disorders of important medicinal, aromatic and spices crops. Types of vegetable farming, vegetable forcing, principles of vegetable seed production and protected cultivation.Origin and distribution, area and production, taxonomy, classification and description of cultivars, use of bio-regulators, seed production, specific problems, physiological disorders and breeding strategies of the warm and cool season vegetable crops.
Bio-technology in horticultural crops, callus culture, suspension culture, establishment of tissue cultured plants, organ culture, construction and identification of somatic hybrids and cybrids, artificial seeds, cryopreservation, rapid clonal propagation, genetic engineering in horticulture crops, use of molecular markers. Post harvest losses, history, objectives and scope of fruit and vegetable preservation, principles of preservation, general principles and procedures of canning and bottling, principles and methods of preparation of jam, jelly and marmalade, preserve, candy, pickles, chutneys, sauces, ketchup, soup and cocktail from suitable fruits and vegetables. Styles and type of gardening, principle and elements of landscaping, landscaping for enhancing esthetic value of important places. Bio-aesthetic planning, bonsai culture, and flower forcing. Origin and distribution, area and production, taxonomy and morphological features, classification and description of some important cultivars, propagation, special practices and problems, protected cultivation of bio-regulators of important flower crops. Seed germination, seed dormancy, bud dormancy, study of Auxin, Gibberellins, Cytokinins, Ethylene, Inhibitors (ABA), photo-periodism, florigen concept; vernalization, pollination and fruit-set, growth and development of fruits, parthenocarpy and seedlessness, maturity and ripening. Climacteric and non-climacteric fruits, senescence, tropism. Techniques of development and management of dry land horticulture. Stress Management due to water, temperature, radiation, wind, soil conditions, impact of stress in horticultural crop production, horticultural crops suitable for different stress situations. Organic farming systems, components of organic horticultural systems, different organic inputs, their role in organic horticulture, role of biofertilizers, biodynamics and the recent developments, global scenario of organic movement, post-harvest management of organic produce.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – PLANT PHYSIOLOGY

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

Entrance Syllabus for Pre-Ph.D. (Plant Physiology) –HAPPRC

1. **Cell Organelles and Water Relations:** Cell organelles and their physiological functions Structure and physiological functions of cell wall, cell inclusions. Cell membrane structure and functions. Water and its role in plants, properties and functions of water in the cell, water relations, water potential of plant cells.
2. **Energy flow**: Principles of thermodynamics, free energy and chemical potential, redox reactions, structure and functions of ATP
3. **Fundamentals of enzymology**: General aspects, allosteric mechanism, regulatory and active sites, isozymes, kinetic catalysis, Michaelis-Menton equation and its significance.
4. **Photosynthesis:** Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO_2 fixation-C3, C4 and CAM pathways. Biosynthesis of starch and sucrose, physiological and ecological considerations
5. **Respiration and photorespiration:** Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.
6. **Lipid metabolism**: glyoxylate cycle, alternative oxidation system, structure and function of lipids, fatty acid biosynthesis, lipids synthesis, structural and storage lipids, and their catabolism
7. **Nitrogen metabolism:** Nitrate and ammonium assimilation; amino acid biosynthesis.
8. **Plant hormones:** Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.
9. **Sensory photobiology:** Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks. Control of flowering. Thermoperiodism - photo and thermo-period interactions.Vernalization-mechanism
10. **Solute transport and photoassimilate translocation:** Uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates.
11. **Secondary metabolites** – Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.
12. **Stress physiology:** Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress and tolerance to abiotic stress
13. **Tissue Culture and Plant Morphogenesis**: The cellular basis of growth and morphogenesis; polarity in tip growing cells and diffusive growing cells. Control of cell division and differentiation, phyto-chromes, different forms, physiological effects and gene regulation, and cellular totipotency, physiology and biochemistry of differentiation, in organ cell, tissue and cultures, micropropagation strategies, application of tissue culture in agriculture, horticulture and forestry.
14. **Seed Physiology:** Structure of seeds and their storage. Seed development patterns and source of assimilates for seed development. Pathway of movement of assimilates in developing grains of monocots and dicots. Chemical composition of seeds. Storage of carbohydrates, proteins and fats in seeds. Hydration of seeds. Physiological processes. Seed respiration, mitochondrial activity Mobilization of stored resource in seeds.

15. **Climate and Climate Change:** The greenhouse gases and global warning. CO_2 as an important greenhouses gas, global carbon deposits, fluxes in the sinks and sources.. Effect of elevated CO2 on plant growth and development. High temperature and CO2 interaction on plant growth and productivity.

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 (4th 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 (2nd 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.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – RURAL TECHNOLOGY

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

UNIT-1

Definitions, Principles, Objectives and Philosophy of Extension Education, Extension Education as a Discipline and Profession, Historical and Emerging Perspective of Agricultural Extension in India, Extension Systems in India, Poverty Alleviation Programmes, Employment Generation Programmes, Women Development Programmes, Problems in Rural Development, Current Approaches in Extension, Participatory Extension, Different Participatory Approaches Participatory Tools and Techniques, Relation-Oriented Methods, Participatory Planning and Action, Participatory Monitoring and Evaluation (PM&E), Key Participatory Approaches and Tools, Introduction to Project Management, Project Management Overview, Project Planning Project Implementation, Project Monitoring, Evaluation & Control, Closing the Project, Practical Components (Applied Skills).

Diffusion Concept and Elements, Innovation, Innovation-Decision Process, Adopter Categories, Perceived Attributes of Innovations, Diffusion Effects and Opinion Leadership, Types of Innovation-Decisions, Consequences of Innovation-Decisions, Decision Making. Concept and Elements of Communication, Models and Theories of Communication, Communication Skills and Concepts, Barriers in Communication, Message: Meaning and Dimensions, Methods of Communication, Media in Communication, Agricultural Journalism, Photojournalism and Broadcast Media.

Introduction to Research and Behavioural Sciences Research, Types and Methods of Research, Review of Literature, Research Problem, Concept and Construct, Variable, Hypothesis, Measurement, Validity and Reliability, Sampling, Research Design, Data Collection Devices. Data Processing and Analysis, Report Writing

UNIT-2

Concept, characteristics, Approaches, Theories of Entrepreneurship, Agri-Entrepreneurship, Traits and Types of Entrepreneurs, Stages of Establishing an Enterprise, Project Management and Appraisal, Micro Enterprises and Support Systems, Marketing for Enterprises, Gender Issues in Entrepreneurship Development, Success and Failure Stories: Issues, Management: Foundations, Extension Management, Planning, Change Management, Decision Making, Organizing, Coordination, Staffing, Direction, Leadership, Organizational Communication, Managing Work Motivation, Supervision, Managerial Control

Human Resource Development, Human Resource Management (HRM), Human Resource Accounting (HRA), Intra-Personal and Inter-Personal Processes, Group and Inter-Group Processes, Supervisors, Role of a Professional Manager, Decision Making and Behavioral Dynamics, Training and Development,

Gender Concepts, Issues, and Challenges, Gender Analysis Tools and Techniques, National Policy for Empowerment of Women Since Independence, Developmental Programmes for Women Gender Mainstreaming in Agriculture and Allied Sectors, Gender Budgeting, Women Empowerment Dimensions, Women Empowerment Through SHG Approach, Rural Institutions for Women Empowerment, Women Human Rights, Action Plans for Gender Mainstreaming.

UNIT-3

Watershed Management, Hydrology of Watershed, Geo-hydrology of Watershed, Topographic Surveying, Erosion Control Measures (Non-Agricultural/Wastelands), Erosion Control Measures (Agricultural Lands). Introduction: The Soil Body, Soil Genesis, Soil Physical Properties, Soil Classification and Distribution, Soil Water, Soil Air and Temperature, Soil Reaction (pH) and Buffering, Soil Colloids, Soil Organic Matter, Soil Organisms, Soil Pollution.

Climatology Koppen's Classification of Climate. Clouds and Precipitation, Global Climate Change, Pollution, Biodiversity, Endangered, Threatened, and Rare Species, Sustainable Development and Ecological Economics.

Remote Sensing, Spectral Response of Natural Earth Surface Features, Sensor Systems in Remote Sensing, Aerial Photography, Global Positioning System (GPS), Principles of Geographic Information System (GIS), Types of Data Structure: Raster and Vector, Spatial Objects and Relationships, Data Input and Output.

Types, collection and disposal of waste, Types of sewerage systems, Sewerage Systems, Sewage Treatment, Disposal of Night Soil and Rural Latrines, Wastewater Management, Solid Waste Management

UNIT-4

Mushroom Cultivation History in India and Abroad, Types of Edible Mushroom Species, Nutritional and Medicinal Value, Mushroom Production Techniques (Button, Oyester Mushroom, Paddy Straw Mushroom), Spawn Production Techniques, Post-Harvest Handling and Preservation, Disease and Pest Management.

Introduction to Apiculture. Origin and Classification of Bees, Equipments and Appliances, Life Cycle and Colony Biology. Anatomy of Honeybees, Properties of Honey, Honey Processing Unit, Diseases and Management.

Vermi Technology (Earthworm classification, Use of earthworms, vermicomposting materials etc.,) Biocomposting, ADEP Compost, Organic Farming, Introduction to Nursery, Establishment of Commercial Nursery, Nursery Management, Nursery Propagation, Importance, needs, nutritional value of f Medicinal and Aromatic plants, Medicinal Plants: Cultivation (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: Cultivation Lemon grass, Lavender grass, Citronella grass, Geranium, Ocimum, Mentha, Eucalyptus and other species related to local conditions of Uttarakhand

Importance and scope and of fruit and vegetables preservation industry in India, Principles and methods of preservation. Causes and control of Post-Harvest Losses, Value Addition, Drying/ Dehydration of Fruit and Vegetables, Freezing of Fruit and Vegetable, Marketing

SCHOOL OF SCIENCES

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – PHYSICS

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

Syllabus of Physics for Ph.D. Entrance Test

Laws of Motion, conservation laws and Rotational Motion: Frames of reference, Newton's Laws of motion, Work and energy, uniform circular motion, Conservation of energy and momentum, Conservative and non-conservative forces, Centre of mass, system of variable mass, escape velocity, motion of the rocket, Newton's Law of Gravitation, Gravitational field, potential and potential energy, Gravitational potential and field intensity for spherical shell, solid sphere and circular disc, Kaplar's laws for planetary motion, Dynamics of a system of particles, Centre of mass, Angular velocity and momentum, Torque, Conservation of angular momentum, Equation of motion, Moment of inertia, theorem of parallel and perpendicular axes, moment of inertia of rod, rectangular lamina, disc, solid sphere, spherical shell, kinetic energy of rotation, rolling along a slope.

Properties of Matter: Hooke's law, Elastic potential energy, Young's modulus, Bulk modulus, modulus of rigidity, Poisson's ratio, relation between elastic constants, Torsion of cylinder, bending of beam, cantilever, shape of Girders, Surface Tension, surface energy, Excess pressure inside a curved surface, Rise of liquid in a capillary tube, Flow of liquid, equation of continuity, Bernoulli's theorem, viscosity, Flow of liquid through a capillary, Poiseuille's formula, Capillaries in series and parallel, Stokes' law.

Vector Calculus and Electrostatics: Vector differential operators: Gradient, Divergence, and Curl, Gauss's theorem (statement and applications), Electric field due to point charge, infinite line charge, uniformly charged spherical shell and solid sphere, Electric potential, line integral of electric field, potential due to point charge, dipole, and spherical charge distributions, Calculation of electric field from Potential, Parallel plate capacitor and spherical capacitor, energy stored in electrostatic field, Dielectrics, Concept of polarization, displacement vector, Gauss's law in dielectrics, capacitor with dielectric.

Electromagnetism: Biot–Savart law and its applications, Magnetic field due to straight wire, circular loop, and solenoid, Ampère's circuital law (integral form) and applications, Magnetic vector potential; divergence and curl of magnetic field (B), Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, introduction to diamagnetic, paramagnetic, and ferromagnetic materials, Faraday's laws of electromagnetic induction, Lenz's law, Self and mutual inductance, energy stored in magnetic field, Equation of continuity, displacement current, and modified Ampère's law, Maxwell's equations (differential form) in vacuum and isotropic dielectrics, Electromagnetic wave equation; plane wave solutions, Poynting vector, energy density in EM field, and transverse nature of electromagnetic waves.

Laws of Radiation and Thermodynamics: Black body radiation, Spectral distribution, Concept of energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law, Einstein's contribution to the understanding of Black Body radiation, Thermodynamic systems and variables, Zeroth Law of thermodynamics and temperature, First Law and internal energy, Conversion of heat into work, Various Thermodynamic Processes, Applications of First Law, Reversible and irreversible processes, quasi-static processes, Limitations of the first law, Heat engine and refrigerator, Carnot's cycle and Carnot theorem, Kelvin-Planck and Clausius statements, Concept of entropy, Entropy changes in reversible and irreversible processes, Entropy-temperature diagrams, Clausius inequality and principle of increase of entropy, Third law of thermodynamics, Entropy at absolute zero and unattainability of zero Kelvin**,** Thermodynamic Potentials, Enthalpy, Helmholtz and Gibbs free Energies, Maxwell's relations and their applications, Joule-Thomson effect and inversion temperature, Inversion temperature, Linde and Claude systems for air liquefaction, Liquefaction of helium, hydrogen, nitrogen gases, Cryocoolers and refrigeration cycles, Phase transitions and Clausius-Clapeyron equation, Triple point, Real gas: Van der Waals equation and critical constants, Expression for $(C_P - C_V)$, C_P/C_V, TdS equations.

Kinetic Theory of Gases: Basic assumptions of kinetic theory of gases, Derivation of pressure of an ideal gas, Maxwell's law of distribution of velocities and its experimental verification, Concepts of mean, r.m.s and most probable velocity, Mean free path (Zeroth Order), Transport Phenomena (Viscosity, thermal conduction and diffusion), Law of equipartition of energy and its applications to specific heat of gases for mono-atomic and diatomic gases.

Solid State Physics: Crystal structure, Bravais lattices, reciprocal lattice, diffraction, Lattice dynamics: phonons, thermal properties, Free electron theory and band theory of solids, intrinsic and extrinsic semiconductors, band structure, Fermi surface, and transport phenomena, Dielectric properties and ferroelectricity, paramagnetism, ferromagnetism, Superconductivity: Meissner effect, BCS theory, Optical properties of solids, Defects and dislocations, Applications in electronic materials.

Electronics: Diode, Triode, Tetrode, Pentode, and their characteristics, Conductors, insulators, and semiconductors, n-type and p-type semiconductors, Active and passive devices, Nodal and loop circuits, Thevenin theorem, Norton Theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer Theorem, Principles of CRO, Formation and characteristics of p-n junction diode, Diffusion of charge carriers and formation of the depletion region, Breakdown voltage, Zener diode, Schottky diode, Tunnel diode, Varactor diode, Point contact diode, Light emitting diode, Photodiode, JFET and MOSFET. Power devices: SCR, TRIAC, Bipolar junction transistor, p-n-p and n-p-n transistors, emitter, base, and collector regions, Input and output characteristics in common base and common emitter configurations, Integrated circuits, Amplifiers and oscillators, Boolean algebra, logic Gates, Binary, hexadecimal, octal and decimal systems, Amplitude, Frequency and Phase modulations, Receiver and transmitter.

Waves and Oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats), Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses, Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves, Spherical waves, Wave intensity, Simple harmonic motion. Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations, Simple harmonic motion, forced vibrations and resonance, Fourier's Theorem, Application to saw tooth wave and square wave, Intensity and loudness of sound, Decibels, Intensity levels, musical notes, musical scale, Acoustics of buildings: Reverberation, Absorption coefficient, Sabine's formula, measurement of reverberation time, Acoustic aspects of halls and auditorium.

Optics and Lasers: Electromagnetic nature of light, Definition and Properties of wave front, Huygens Principle, Interference: Division of amplitude and division of wavefront, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's Biprism, Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes, Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index, Michelson's Interferometer: Idea of form of fringes, Determination of wavelength, Wavelength difference, Refractive index, Visibility of fringes, Fraunhofer diffraction: Single slit; double Slit. Multiple slits & Diffraction grating, Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis, Transverse nature of light waves, Plane polarized light – production and analysis, Circular and elliptical polarization, stimulated emission, population inversion, Laser rate equations, solid-state, gas, semiconductor lasers.

Wave–Particle Duality and Atomic Structure: Planck's quantum theory, photo-electric effect, Compton scattering, pair production, De Broglie hypothesis and matter waves, phase and group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle, energy-time uncertainty, Rutherford and Bohr's models, atomic spectra, Bohr's quantization rule and atomic stability, energy level and spectra, atomic excitation, electron spin, Pauli's exclusion principle, fine structure, spin orbit coupling, L-S & J-J couplings, total angular momentum, Electron Angular Momentum, Space Quantization, Electron Spin and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment, Stem-Gerlach Experiment, Normal and Anomalous Zeeman Effect, Stark effect, Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

Nuclear and Particle Physics: Size and structure of nucleus, non-existence of electron in the nucleus, atomic weight, binding energy, semi-empirical mass formula, Liquid drop, shell and collective models, nature of nuclear force, ground state of deuteron, Law of radioactive decay, half-life and Mean lifetime, α-Decay, β-decay, energy released, γ-ray emission, fission and fusion, mass deficit and generation of energy, elementary idea of nuclear reactors, thermonuclear reactions, elementary particles, Leptons and hadrons classification, Quark model, Fundamental interactions, CP violation. Particle interactions and symmetries, Conservation laws, Standard model.

Time Dependent and independent Schrodinger Equations: Time dependent Schrodinger equation and dynamical evolution of a quantum state; properties of wave function, interpretation of wave function, probability and probability current densities in three dimensions, physical significance of wave functions, normalization, linearity and superposition principles, eigenvalues and eigenfunctions, position, momentum and energy operators, commutator of position and momentum operators, expectation values of position and momentum, wave function of a free particle, Hamiltonian, stationary states and energy eigenvalues, expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions, time independent Schrodinger equation and stationary states, wave packets, application to the spread of a Gaussian wave-packet for a free particle in one dimension, Fourier transforms and momentum space wavefunction, uncertainty principle: example and applications.

General Discussion of Bound States in an Arbitrary Potential: Continuity of wave function, quantization of momentum and energy, boundary condition and emergence of discrete energy levels, application to one-dimensional problem, particle in a box, potential barrier, square well potential, one-dimensional harmonic oscillator, energy levels and energy eigenfunctions.

Quantum Theory of Hydrogen-Like Atoms: Time-independent Schrodinger equation in spherical polar coordinates, separation of variables for the second-order partial differential equation, spherical harmonics, angular momentum operator, radial wavefunctions, orbital angular momentum, quantum numbers and their significance.

Astrophysics: Stellar structure and evolution, Nuclear processes in stars, Radiative transfer and stellar atmospheres, Galaxies and cosmology basics, Expansion of universe and Hubble law, Dark matter and dark energy concepts, White dwarfs, neutron stars, black holes, Solar physics and solar wind, Observational astronomy techniques, Cosmic microwave background radiation.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

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 2025-26

SUBJECT – HOME SCIENCE

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

UNIVERSITY GRANTS COMMISSION
NET BUREAU

NET SYLLABUS

Subject: Home Science **Code No. : 12**

UNIT-I : FOOD SCIENCE AND FOOD SERVICE MANAGEMENT

1. Food science and nutrition.
2. Properties of food – physical and chemical properties
3. Quality evaluation of foods- objectives and subjective.
4. Effects of cooking and processing techniques on nutritional components and other physical parameters, food preservation and application.
5. Food pigments and additives.
6. Food standards, microbiological safety of food, HACCP, food packaging.
7. Perspectives of food service-menu planning, food cost analysis.
8. New product development - nano technology
9. Food service management of institutional level-hospital, educational institutions, social and special institutions
10. Research methods-fundamental issues, concept, need relevance, scope and ethics in research

UNIT-II : NUTRITION AND DIETETICS

1. Food groups – balanced diet, food pyramid, macro and micro nutrition.
2. Nutrients-role of nutrients in the body, nutrient deficiencies and requirements for Indians.
3. Public health nutrition
4. Nutrition through life span-physiological changes, growth and development from conception to adolescence, nutritional needs and dietary guidelines for adequate nutrition through life cycle, nutrition concerns.
5. Community nutrition, sports nutrition, nutrition in emergencies and disasters.

6. Nutritional assessment-methods and techniques.
7. Nutritional intervention-national nutrition policies and programmes, food and nutrition security.
8. Clinical and therapeutic nutrition.
9. Diet counseling and management.
10. Research methods- research designs, principles and purpose of research

Unit-III : TEXTILES

1. Textile terminologies- fibre, yarn, weave, fabric etc., classification of fibers, yarns and weaves, Identification of fibres and weaves.
2. Manufacturing process of major natural and manmade fibres, properties and their end uses.
3. Different methods of fabric construction-woven, knitted and non woven fabrics, their properties and end uses.
4. Textiles finishes-classification, processing and purposes of finishes.
5. Dyeing and printing-classification, method of block printing, tie and dye, batik, roller printing, screen printing, discharge, heat transfer printing and digitized printing.
6. Traditional textiles of India-embroidered textiles, printed textiles, woven textiles, dyed textiles of various regions in India. Identification on the basis of fibre content, technique, motif, colour and designed.
7. Textile Testing and quality control-need of testing, sampling method, techniques of testing fibres, yarn, fabrics and garments. Testing of colour-fastness, shrinkage, pilling and GSM of fabrics.
8. Textile and environment-banned dyes, eco-friendly textiles, contamination and effluent treatment, Eco-label and eco marks.
9. Recent developments in textiles and apparels- nano textiles, technical textiles, occupational clothing, zero waste designing, up cycling and recycling.
10. Research methods-types of research, descriptive, survey, historical, qualitative, quantitative, analytical and action research

UNIT-IV : APPAREL DESIGNING

1. Body measurements-procedure, need, figure types and anthropometry.
2. Equipments and tools used for manufacturing garments-advancements and attachments used for sewing machine. Types of machines used and their parts.

3. Elements and principles of design and its application to apparel. Illustrations and parts of garments.
4. Fashion-Terminologies, fashion cycle, fashion theories, fashion adoption, fashion forecasting and factors affecting fashion.
5. Pattern making-drafting, draping and flat pattern making techniques, pattern alteration and dart manipulation techniques.
6. Apparel manufacturing-terminology used, seams, techniques and machines used, process of fabric to apparel manufacture.
7. Apparel Quality testing-Quality standards and specification, Quality parameters and defects of fabrics and garments.
8. Care and maintenance of clothing-principles of washing, laundry agents, storage techniques case labels and symbols.
9. Selection of clothing for different age groups. Selection of fabrics for different and uses.
10. Research methods-hypothesis testing, types and scope

UNIT-V : RESOURCE MANAGEMENT AND CONSUMER ISSUES

1. Management-concept, approaches, management of time, energy, money, space, motivating factors, motivation theories, decision making.
2. Functions of management-planning, supervision, controlling, organizing, evaluation, family life cycle-stages, availability and use of resources.
3. Resources-classification, characteristics, factors affecting use, resource conservation, time management, work simplification techniques, classes of change, fatigue and its management.
4. Management of natural resources-land, forest, water, air, water harvesting, municipal solid waste management, concept of sustainable development, SDGs.
5. Money management-family income, types, supplementation, budgeting, household accounts, family savings and investment, tax implications.
6. Human resource management- functions, need, human resource development-challenges, functions, manpower planning, training need assessment, training methodologies, training evaluation.
7. Consumer-definition, role, rights and responsibilities, consumer behavior, consumer problems, education and empowerment.
8. Consumer protection- consumer organization, cooperatives, alternative redressal, standardization, standard marks, quality control, buying aids, consumer legislation.
9. Entrepreneurship-concept, process, barriers, entrepreneurial motivation, challenges, enterprise setting, project planning and appraisal, enterprise management.
10. Research methods-sampling techniques, types of sampling, sampling procedures, probability and non probability sampling

UNIT-VI : HOUSING AND INTERIOR DESIGN

1. Design fundamentals – elements of art, principles of design, principles of composition.
2. Colour - dimensions of colour, psychological effects of colour, colour schemes, factors affecting use of colour.
3. Space planning and design-housing need and important, principles of planning spaces, types of house plans, economy in construction, planning for different income groups.
4. Building regulations-norms and standards, zoning, housing for special groups and areas, housing finance.
5. Housing and environment- building materials- impact on environment, green rating systems, energy efficiency in buildings, energy auditing, indices of indoor comfort.
6. Energy as a resource- conventional and non- conventional sources, renewable /non-renewable energy, energy management, national efforts on energy conservation.
7. Product design - design thinking process, diffusion and innovation, design communication, ergonomic considerations.
8. Ergonomics - significance, scope, anthropometry, man, machine, environment relationship, factors affecting physiological cost of work, body mechanics, functional design of work place, time and motion study, energy studies.
9. Furniture and furnishing - historical perspectives, architectural styles, contemporary tends, wall finishes, window and window treatments.
10. Research methods-selection and preparation of tools for data collection-questionnaire, interview, observation, measuring scales, ranking and measurement, reliability and validity of tools

UNIT-VII : CHILD/HUMAN DEVELOPMENT

1. Principles of growth and development, care during pregnancy and pre-natal and neonatal development.
2. Theories of human development and behavior.
3. Early childhood care and education – activities to promote holistic development.
4. Influence of family, peers, school, community and culture on personality development.
5. Children and persons with special needs, care and support, special education, prevention of disabilities, rehabilitation.
6. Children at risk-child labour, street children, children of destitute, orphans, child abuse and trafficking.
7. Adolescence and youth: changes, challenges and programs to promote optimal development.
8. Adulthood, characteristics, changing roles and responsibilities in early and middle adulthood.
9. Aging-physical and psychological changes and care needs.
10. Research methods-types of variables and their selection.

UNIT-VIII : FAMILY STUDIES

1. Dynamics of marriage and family relationships.
2. Family welfare-approaches, programmes and challenges, role in national development.
3. Domestic violence, marital disharmony, conflict, resolution of conflict.
4. Parent education, positive parenting, community education.
5. Family disorganization, single parent families.
6. Family studies-family in crisis, family therapy, initiatives for child development.
7. Human rights, rights of children, rights of women, status of women, gender roles.
8. Guidance and counseling- across life span and for care givers.
9. Health and well being across life span development.
10. Research methods- data collection and classification, coding, tabulation, inferential and descriptive statistics.

UNIT-IX : COMMUNICATION FOR DEVELOPMENT

1. Basics of communication- nature, characteristics, functions, process, models, elements, principles, barriers, perception, persuasion and empathy, types of communication, levels (settings) of communication transactions, process of listening.
2. Communication systems and communication theories- human interaction theories, mass communication theories, message design theories, communication systems, culture and communication.
3. Concept of development- theories, models, measurement and indicators of development.
4. Concept of development- communication models and approaches, diffusion and innovation, mass media, social marketing.
5. Role of communication in development- need and importance, development journalism, writing for development-print, radio, television and internet.
6. Concerns of development communication- gender, health, environment, sustainability, human rights, population, literacy, rural and tribal development.
7. Advocacy and behavior change communication- concept, theories, models, approaches, application and challenges.
8. Traditional, modern and new media for development - folk forms of songs, art, dance, theatre, puppetry, advertisement, cinema, ICTs for development-community radio, participatory video, social media and mobile phones.
9. Organisation/agencies/institutes working for development communication-international/national/state and local.
10. Research methods-analysis of data through parametric and non parametric tests.

UNIT-X : EXTENSION MANAGEMENT AND COMMUNITY DEVELOPMENT

1. Historical perspectives of extension–genesis of extension education and extension systems in India and other countries, objectives of extension education and extension service, philosophy and principles of extension programme development.
2. Programme management- need assessment, situation analysis, planning, organization, implementation, monitoring and evaluation.
3. Extension methods and materials- interpersonal, small and large group methods, audiovisual aids-need, importance, planning, classification, preparation and field testing, use and evaluation of audio-visual materials.
4. Curriculum development and planning for extension education and development activities, Bloom's taxonomy of educational objectives and learning.
5. Non-Formal, adult and lifelong education-historical perspectives, concept, theories, approaches, scope, methods and materials used, challenges of implementation and evaluation, issues to be addressed.
6. Training, skill development and capacity building for human resource development-methods of training, entrepreneurship development.
7. Community development- perspectives, approaches, community organization, leadership, support structures for community development, Panchyati raj institutions, NGOs and community based organisations.
8. People's participation and stakeholders' perspectives, Participatory Learning and Action-methods and techniques.
9. Development programmes in India for urban, rural and tribal population groups-programmes for nutrition, health, education, wage and self employment, women's development, skill development, sanitation and infrastructure.
10. Research methods-scientific report writing, presentation of data, interpretation and discussion.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – PHARMACEUTICAL SCIENCE

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

The syllabus for the Ph.D. (Pharmaceutical Sciences) Entrance Examination is aligned with GPAT (Graduate Pharmacy Aptitude Test) and closely follows the B.Pharm curriculum, covering all major Pharmaceutical Science disciplines.It assesses both theoretical and application-based knowledge, making balanced preparation essential.

The subject-wise syllabus with key topics is outlined below:

Subject	Topics
Microbiology	Vaccines & Sera, Sterilization & Disinfection, Microbial Spoilage
Pharmaceutics	Emulsions, Tablets, NDDS, Dosage Forms, Suspensions
Pharmaceutical Jurisprudence	Code of Ethics, Drugs & Cosmetics Act, Indian Patent Act, NDPS Act
Biochemistry	Enzymes, Vitamins, Lipids, Nucleic Acids, Carbohydrates
Organic Chemistry	General Principles, Aromatic Compounds, Carbohydrates, Heterocyclic Chemistry
Clinical Pharmacy	Drug Interactions, TDM, Pediatric & Geriatric Therapy
Pharmacognosy	Herbal Drugs, Phytoconstituents, Herbal Formulations, Quality Control
Pharmacology	General Pharmacology, CVS Drugs, Immunopharmacology, Chemotherapy
Physical Chemistry	Solutions, Electrochemistry, Thermodynamics, Ionic Equilibrium
Pharmaceutical Analysis	Chromatography, Spectroscopy, Acid–Base Titrations
Pathophysiology	Infectious Diseases, Neoplastic Diseases, Homeostasis Disorders
Biopharmaceutics & Pharmacokinetics	Bioavailability, Bioequivalence, Biostatistics
Pharmaceutical Chemistry	Medicinal Chemistry, Inorganic Chemistry, Isotopes

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – PHARMACEUTICAL CHEMISTRY

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

PHARMACEUTICAL CHEMISTRY

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.

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.

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).

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. $KMnO_4$) 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 CaC_2 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 $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.

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 Phthalimid

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.

Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclicstructure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, maltose, lactose) and polysacharrides.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC, Column, ion-exchange chromatography

Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization)

Raman Spectroscopy-Principle, Instrumentation and Application.

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

Mass Spectroscopy**:** Principle, techniques, instrumentation, fragmentation pattern & structural elucidation of compounds. GC-MS and LC-MS Principle and Application.

Proton Magnetic Resonanace, Principle, techniques, instrumentation, ^{1}HNMR signals, chemical shift, spin-spin coupline, shielding desheilding effect, diamagnetic anisotropy, geminal coupling, shift reagents & interpretation of spectra. ^{13}C-NMR, introduction and interpretation of data.

Quality Control of various dosage forms. Disintegration, Disintegration time, factors affecting disintegration. Dissolution, Dissolution models, factors affecting dissolution rate.

Drug disposition: Distribution in blood, plasma protein binding, cellular distribution, drug excertion, biotransformation of drugs.

Bioavailability **:** Concept of of bioavailability & comparative bioavailability, methods of estimation of bioavailability.

Nomenclature and classification of each topic, Structure Activity Relationship(SAR) (where stand) ,Mode of action ,Biochemical and Molecular basis (where applicable) and Therapeutic uses of : Sulphonamides, penicillins & semisynthetic penicillins. Cephalosporins, tetracyclines & Aminoglycosides, Antibiotics Antimycobacterial agents-anti-T.B. & antileprosy drugs. Antimalarials.

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.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – STATISTICS

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

Statistics
Syllabus for Ph.D. Entrance Examination 2025-26

Descriptive statistics, exploratory data analysis

Sample space, discrete probability, independent events, Bayes' theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshev, Markov, Jensen). Modes of convergence, weak and strong law of large numbers, Central Limit Theorems (i.i.d. case).

Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution, Poisson and birth-and-death processes.

Standard discrete and continuous univariate distributions, sampling distributions, standard errors and asymptotic distributions, distribution of order statistics and range.

Methods of estimation, properties of estimators, confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.

Simple nonparametric tests for one and two sample problems, rank correlation and test for independence. Elementary Bayesian inference.

Gauss-Markov models, estimability of parameters, best linear unbiased estimators, confidence intervals, tests for linear hypotheses. Analysis of variance and covariance. Fixed, random and mixed effects models. Simple and multiple linear regression. Elementary regression diagnostics. Logistic regression.

Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms. Inference for parameters, partial and multiple correlation coefficients and related tests. Data reduction techniques: Principal Component Analysis, Discriminant Analysis, Cluster Analysis, Canonical Correlation.

Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling. Ratio and regression methods.

Completely randomized designs, randomized block designs and Latin square designs. Connectedness and orthogonality of block designs, BIBD. 2k2^k2k factorial experiments: confounding and construction.

Hazard function and failure rates, censoring and life testing, series and parallel systems.

Linear programming problem, simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/c, M/M/c with limited waiting space, M/G/1.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – COMMERCE

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

DEPARTMENT OF COMMERCE
Syllabus for Ph. D Entrance Exam
(Important Contents & Syllabus)

1- Corporate Financial Accounting
2-Management Principles and Practice
3- Business Environment
4-Managerial Economics
5-Computer Applications in Business
6-Financial Management
7-Marketing Management
8-Human Resource Management
9-Research Methods & Statistics
10-Management Accounting
11-Legal Aspects of Business
12-International Business
13-Management of Financial Services
14-Income Tax Laws and Practice
15-Financial Markets and Institutions
16-Security Analysis and Portfolio Management
17-Marketing Communication
18-E-Commerce
19-Risk Management and Insurance
20-International Financial Management
21-International Marketing

1-CORPORATE FINANCIAL ACCOUNTING:

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

2-MANAGEMENT PRINCIPLES AND PRACTICE:

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.

3-BUSINESS ENVIRONMENT:

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.

4- MANAGERIAL ECONOMICS:

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.

5- COMPUTER APPLICATIONS IN BUSINESS:

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.

.

6- FINANCIAL MANAGEMENT:

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**.**

7- MARKETING MANAGEMENT:

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.

8- HUMAN RESOURCE MANAGEMENT:

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 , Promotiondegree, 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.

9- RESEARCH METHODS & STATISTICS:

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.

10-MANAGEMENT ACCOUNTING:

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 AnalysisMaterial, Labour, Overheads, Managerial Use of Variances.

(b) Responsibility Accounting: Concept of Responsibility Accounting, Responsibility Central-Cost Centre, Revenue Centre, Profit Centre, Investment Centre.

11- LEGAL ASPECTS OF 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

12- **INTERNATIONAL BUSINESS:**

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.

13- MANAGEMENT OF FINANCIAL SERVICES:

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 FundsA 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.

14- INCOME TAX LAWS AND PRACTICE:

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.

15- FINANCIAL MARKETS AND INSTITUTIONS:

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.

16- SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT:

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

17- MARKETING COMMUNICATION

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.

18- E-COMMERCE :

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

19- RISK MANAGEMENT AND INSURANCE :

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

20-INTERNATIONAL FINANCIAL MANAGEMENT:

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.

21- INTERNATIONAL MARKETING:

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.

SCHOOL OF COMMERCE

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – COMMERCE

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

DEPARTMENT OF COMMERCE
Syllabus for Ph. D Entrance Exam
(Important Contents & Syllabus)

1- Corporate Financial Accounting
2-Management Principles and Practice
3- Business Environment
4-Managerial Economics
5-Computer Applications in Business
6-Financial Management
7-Marketing Management
8-Human Resource Management
9-Research Methods & Statistics
10-Management Accounting
11-Legal Aspects of Business
12-International Business
13-Management of Financial Services
14-Income Tax Laws and Practice
15-Financial Markets and Institutions
16-Security Analysis and Portfolio Management
17-Marketing Communication
18-E-Commerce
19-Risk Management and Insurance
20-International Financial Management
21-International Marketing

1-CORPORATE FINANCIAL ACCOUNTING:

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

2-MANAGEMENT PRINCIPLES AND PRACTICE:

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.

3-BUSINESS ENVIRONMENT:

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.

4- MANAGERIAL ECONOMICS:

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.

5- COMPUTER APPLICATIONS IN BUSINESS:

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.

.

6- FINANCIAL MANAGEMENT:

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**.**

7- MARKETING MANAGEMENT:

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.

8- HUMAN RESOURCE MANAGEMENT:

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 , Promotiondegree, 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.

9- RESEARCH METHODS & STATISTICS:

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.

10-MANAGEMENT ACCOUNTING:

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 AnalysisMaterial, Labour, Overheads, Managerial Use of Variances.

(b) Responsibility Accounting: Concept of Responsibility Accounting, Responsibility Central-Cost Centre, Revenue Centre, Profit Centre, Investment Centre.

11- LEGAL ASPECTS OF 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

12- **INTERNATIONAL BUSINESS:**

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.

13- MANAGEMENT OF FINANCIAL SERVICES:

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 FundsA 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.

14- INCOME TAX LAWS AND PRACTICE:

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.

15- FINANCIAL MARKETS AND INSTITUTIONS:

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.

16- SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT:

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

17- MARKETING COMMUNICATION

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.

18- E-COMMERCE :

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

19- RISK MANAGEMENT AND INSURANCE :

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

20-INTERNATIONAL FINANCIAL MANAGEMENT:

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.

21- INTERNATIONAL MARKETING:

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.

SCHOOL OF EARTH SCIENCES

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

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.

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)

Head
Defence, Strategic and Geo. Political Studies
H. N. B. Garhwal University
Birla Campus, Srinagar (Garhwal)

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – GEOGRAPHY

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

DEPARTMENT OF GEOGRAPHY

School Of Earth Science

HNB GARHWAL UNIVERSITY (A CENTRAL UNIVERSITY),

Srinagar Garhwal, Uttarakhand

SUBJECT- GEOGRAPHY (CODE- 443)

University PhD Entrance Test Syllabus (2025–26)

Section I	**Geomorphology**
Section II	**Climatology and Oceanography**
Section III	**Geography of Environment**
Section IV	**Population and Settlement Geography**
Section V	**Geography of Economic Activities and Regional Development**
Section VI	**Cultural, Social and Political Geography**
Section VII	**Geographic Thought**
Section VIII	**Geographical Techniques**
Section IX	**Geography of India**
Section X	**Geography of the Himalayas and Uttarakhand**

02/04/2026

Prof. M.S. Panwar

HoD

Department of Geography

Section -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).

Section -II

Climatology and Oceanography

a) 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: Evidences and Causes of Climatic Change in the past, Human impact on Global Climate.

b) Oceanography

Relief of Oceans, Composition: Temperature, Density and Salinity, Circulation: Warm and Cold Currents, Waves, Tides, Sea Level Changes, Hazards: Tsunami and Cyclone.

Section -III

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 Ethics and Deep Ecology, 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).

Section -IV

Population and Settlement Geography

a) 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.

b) 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).

Section -V

Geography of Economic Activities and Regional Development

a) Economic Geography

Factors affecting the spatial organisation of economic activities (primary, secondary, tertiary, and quaternary), Natural Resources (classification, distribution, and associated problems), and Natural Resources Management. World Energy Crises in Developed and Developing Countries.

b) 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.

c) 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 the 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.

d) 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.

e) 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.

Section -VI

Cultural, Social and Political

a) 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.

b) 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 the Indian Ocean, Regional Organisations of Cooperation (SAARC, ASEAN, OPEC, EU). Neopolitics of World Natural Resources.

Section -VII

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, man- environment 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).

Section -VIII

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, MakingIndicators 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.

Section -IX

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)

Section -X

Geography of the Himalayas and Uttarakhand

Geo-political setting; Geophysical setting; Geological structure; River systems and river basins; Glaciers and Lakes. Climate; Natural vegetation; Soil; Population distribution and demographic structure; Migration; Tribes. Occupational structure: Agriculture, Animal husbandry, Industrial development, Horticulture, Hydropower projects, Tourism and Pilgrimage. Geographical account of Western, Central and Eastern Himalaya; Mountain Development Planning and Policy; Hazard and

Disasters; Planning regions; Limitations of development; contemporary issues; Protected areas and Biosphere Reserves of the Himalayas; Socio-economic and environmental success stories.

07/04/2026

Prof. M.S. Panwar

HoD
Department of Geography

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – GEOLOGY

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

HNBGU Ph. D. Entrance Exam. 2025

Geology Syllabus

The Ph.D. Entrance Examination of Earth Science Syllabus 2025 includes topics that focus on the study of the Earth, its structure, and natural processes. It covers following Units of Geology. The syllabus helps candidates understand the key concepts and prepares them for the exam. It is designed to test knowledge in both theoretical and practical aspects of Geological science.

Paper 1

Syllabus for Paper 1 includes sections such as:

- **Reasoning**: Analytical reasoning, syllogisms, analogies, directions, coding-decoding, classification, alphabet series, symbols and notations, similarities and differences, number series, and graphical analysis.
- **Quantitative Aptitude** : Simplifications, number system, average, algebra, percentage, time & work, simple & compound interest, time & speed, HCF and LCM problems, area, profit & loss, bar graph, pictorial graph, pie chart, ratio & proportion, permutation & combination.
- **Data Interpretation & Graphical Analysis**: Mean, median, mode, measures of dispersion, graphical analysis including bar graph, line graph, pie-chart, and tabulation.

Paper 2

HNBGU Geology Syllabus 2025: Paper 2	
Part A	**Part B**
UNIT 1: • The Earth and the Solar System • Earth Materials, Processes • Geological agents & Landforms. • Oceans, Atmosphere & Climate **UNIT 2:** • Interior of the Earth • Mountain building Processes • Isostasy & Plate Tectonics,	**UNIT 1:** • Crystallography, Mineralogy, Petrology, • Structural Geology, Sedimentology • Paleontology, and Stratigraphy, **UNIT 2:** • Economic Geology, Mineral Exploration • Hydrogeology, Environmental Geology • Engineering Geology Remote Sensing and GIS,

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – REMOTE SENSING & GIS APPLICATIONS

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

DEPARTMENT OF REMOTE SENSING AND GIS APPLICATION

Syllabus for Ph.D. Admissions Test/ Entrance Test

The Entrance exam will be based on the following topics.

1. **Fundamentals of Remote Sensing**

   Introduction- Components, platforms, applications; Remote sensing of the environment- the remote sensing process; Principles of electro-magnetic radiations-atmospheric windows, energy matter interactions; Fundamentals of aerial photography- classification of aerial photography, scale, resolution, geometric characteristics of aerial photographs, photo recognition elements; Elements of visual interpretation; Sensors; Remote Sensing Data Products; Multi-spectral remote sensing; Thermal infrared remote sensing; Applications of passive, microwave and lidar remote sensing

2. **Fundamentals of Geographic Information Systems**

   Introduction to GIS; Geographic data and data measurement map basics, basic geographic concepts; data models, data structures and data input; Global Positioning Systems; Database management; Data Analysis; GIS Project Design and Management. Overview of database; Database models and modeling; Spatial data and database systems; Introduction to Oracle; Simple queries; PostgreSQL.

3. **Photogrammetry and Digital Image Processing**

   Photogrammetric sensing systems; Introduction to digital image processing-data formats, errors; Image rectification and restoration; Image enhancement techniques; Image classification; Data merging and GIS integration; Hyperspectral Image analysis; Digital change detection; LiDAR & UAV Technology.

4. **Spatial Statistics**

   Data in ecology and environmental sciences; Statistical techniques; Basic elements and tools of statistical analysis; Concepts of probability; Distribution; Contingency tables and $\chi 2$; $\chi 2$ - test of goodness – of – fit and homogeneity; Correlation of measurement; Regression analysis; Introductory Multivariate Statistics and Partial correlation Geostatistics

5. **Spatial analysis**

   Introduction to Spatial analysis; Vector and raster-based spatial analysis; Network analysis; Point pattern analysis; Surface analysis; Spatial modeling, Decision Support System, MCDM Techniques

6. **Applications of remote sensing and GIS**

   Remote sensing and GIS applications in ecosystem studies and conservation, agricultural applications, urban applications, water resources and related applications, health studies, Remote sensing and GIS applications in forest studies, marine sciences, urban mapping, disaster management.

7. **Trends in Geoinformatics**

   Web GIS; ML and DL in Geoinformatics, Programming Applications in Geoinformatics, 3D GIS and visualization, Object-oriented GIS; Mobile GIS; Spatial data warehousing and mining, Open GIS consortium, Customization and automation in GIS.

SCHOOL OF EDUCATION

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – EDUCATION

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

SYLLABUS

PH. D ENTRANCE TEST (2025-2026)

EDUCATION

UNITE-1: PHILOSOPHICAL FOUNDATION OF EDUCATION- Philosophy meaning, Nature and Significance. 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.

UNITE-2: PSYCHOLOGY OF LEARNING AND DEVELOPMENT: Educational Psychology meaning, Methods, 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, theories- (Guilford's Model of Intellect, Multiple Intelligence Theory) and Measurement. Personality, Theories of Personality (Allport, Eysenck, Freud & Erickson, Murray's Need Theory, Humanistic Approach - Carl Rogers, Maslow) and 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.

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. Social Change, Social Mobility, Social Stratification and Education. Group Dynamics & Educational Opportunity. Govt. Policies for the Educational Enhancement of various social groups - Schedule castes, Schedule tribes, other backward classes, Women and minorities. Equality vs. Equity in Education.

UNIT - 4: CURRICULUM- Concept, Components of Curriculum- Objectives, Content, Transaction Mode and Evaluation. Types of Curriculum. Psychological Basis of Humanistic Curriculum. Critical issues in Curriculum Design. 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.

UNIT- 5: TEACHER EDUCATION: 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). NCF 2005 & National Curriculum Framework for Quality Teacher Education 2009. Role of different Agencies in Teacher Education – District Level, State Level, National Level, International Level. Role of NCERT, NCTE, UGC, SCERT, DITEs, Open University.

UNITE -6: INSTITUTIONAL ADMINISTRATION AND MANAGEMENT: Institutional Planning, Management and Evaluation at Secondary & Senior Secondary 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. 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, 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, Guidance and Counselling for gifted, creative, slow learners, socially disadvantaged children, and problem children. Counselling approaches – directive, non-directive. Theories of Guidance and counselling. 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 2025-26

SUBJECT – PHYSICAL EDUCATION

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

Department of Physical Education, Birla Campus, HNBGU Srinagar Garhwal.

Syllabus for Pre Ph. D. Entrance Test -2026

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. 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. Experimental Research – Meaning, Nature and Importance, Meaning and Types of Variables. Experimental Design - Single Group Design, Reverse Group Design, Repeated Measure Design, Static Group Comparison Design, Equated Group Design, Factorial Design. Sampling- Meaning and Definition of Sample and Population. Types of Sampling; Probability Methods; Systematic Sampling, Cluster sampling, Stratified Sampling. Research Proposal and Report Chapterization of Thesis / Dissertation, Front Materials, Body of Thesis – Back materials. Method of Writing Research proposal, Thesis / Dissertation. 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. 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.

UNIT II

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. Cardiovascular System and Exercise Heart Valves and Direction of the Blood Flow – Conduction System of the Heart –Effect of exercises and training on the Cardio vascular system. Respiratory System and Exercise Mechanics of Breathing –. Diffusion of Gases – Exchange of Gases in the Lungs –Exchange of Gases in the Tissues. Oxygen Debt – Lung Volumes and Capacities – Effect of exercises and training on the respiratory system. 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. Climatic conditions and sports performance and ergogenic aids Variation in Temperature and Humidity – Thermoregulation – Sports performance in hot climate, Cool Climate, high altitude.

UNIT III

Physical Fitness Tests Physical Fitness Test: AAHPERD Health Related Fitness Battery (revised in 1984), Roger's physical fitness Index. Cardio vascular test; Harvard step test, 12 minutes run / walk test, Multi-stage fitness test (Beep test). 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. 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. Specific Sports Skill Test: Badminton: Miller Wall Volley Test. Basketball: Johnson Basketball Test, Harrison Basketball Ability Test. Cricket: Sutcliff Cricket test. Hockey: Friedel Field Hockey Test, Harban's Hockey Test, Volleyball, Russell 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.

Unit-IV

Origin, Insertion and action of muscles in human body. Motion and Force. Types of Motion: Linear motion, angular motion, circular motion, uniform motion. Principles related to the law of Inertia, Law of acceleration, and law of counter force. Sources of force - Force components. Force applied at an angle - pressure -friction -Buoyancy, Spin - Centripetal force - Centrifugal force. 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. Normal curve of the spine and its utility, Deviations in posture: Kyphosis, lordosis, flat back, Scoliosis, round shoulders, Knock Knee, Bow leg, Flat foot. 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. 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 massage and different Massage strokes.

Unit-V

Sports training: Definition – Aim, Characteristics, and Principles of Sports Training, Over Load: Definition, Causes of Over Load, Symptoms of Overload, Remedial Measures – Super Compensation – Altitude Training – Cross Training. Strength development. Endurance- its characteristics, types of endurance, factors determining endurance and endurance development. Speed- its characteristics, types of Speed, factors determining Speed and speed development. Flexibility-its characteristics, types of flexibility, factors determining flexibility and flexibility development. Coordinative abilities- its characteristics, types of coordinative abilities, factors determining coordinative abilities and development of coordinative abilities. Technique and skill- its characteristics and importance. Different stages of technique development and technique training. Tactics and strategy.

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. Communicable and Non Communicable Diseases. Nutrients: Ingestion to energy metabolism (Carbohydrate, Protein and Fat), Role of carbohydrates, Fat and protein during exercise. Concept of BMI (Body mass index), Obesity and its hazard, Dieting versus exercise for weight control. Effects of smoking, alcohol, & drugs on health; prevention and rehabilitation.

UNIT-VI

Meaning and Definition, Types of Motivation: Intrinsic, Extrinsic. Achievement Motivation: Meaning, Measuring of Achievement Motivation. Personality: Meaning, Definition, Structure – Measuring Personality Traits. Effects of Personality on Sports Performance. 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. Cognitive process- memory and thinking. Principles of Motor skill learning. Transfer of training and its types with its implication in sports. Long and short term psychological preparation for performance/ competition.

UNIT-VII

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. 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.

SCHOOL OF ENGINEERING AND TECHNOLOGY

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – COMPUTER SCIENCE & APPLICATIONS

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

UNIVERSITY GRANTS COMMISSION
NET BUREAU

NET SYLLABUS

Subject : COMPUTER SCIENCE AND APPLICATIONS

Code No.:(87)

Unit - 1 : Discrete Structures and Optimization

Mathematical Logic: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.

Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering.

Counting, Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction, Probability, Bayes' Theorem.

Group Theory: Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut-Sets.

Boolean Algebra: Boolean Functions and its Representation, Simplifications of Boolean Functions.

Optimization: Linear Programming - Mathematical Model, Graphical Solution, Simplex and Dual Simplex Method, Sensitive Analysis; Integer Programming, Transportation and Assignment Models, PERT-CPM: Diagram Representation, Critical Path Calculations, Resource Levelling, Cost Consideration in Project Scheduling.

Unit - 2 : Computer System Architecture

Digital Logic Circuits and Components: Digital Computers, Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters, Memory Unit.

Data Representation: Data Types, Number Systems and Conversion, Complements, Fixed Point Representation, Floating Point Representation, Error Detection Codes, Computer Arithmetic - Addition, Subtraction, Multiplication and Division Algorithms.

Register Transfer and Microoperations: Register Transfer Language, Bus and Memory Transfers, Arithmetic, Logic and Shift Microoperations.

Basic Computer Organization and Design: Stored Program Organization and Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output, Interrupt.

Programming the Basic Computer: Machine Language, Assembly Language, Assembler, Program Loops, Subroutines, Input-Output Programming.

Microprogrammed Control: Control Memory, Address Sequencing, Design of Control Unit.

Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing Array Processors.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, Serial Communication.

Memory Hierarchy: Main Memory, Auxillary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor Arbitration, Interprocessor Communication and Synchronization, Cache Coherence, Multicore Processors.

Unit - 3 : Programming Languages and Computer Graphics

Language Design and Translation Issues: Programming Language Concepts, Paradigms and Models, Programming Environments, Virtual Computers and Binding Times, Programming Language Syntax, Stages in Translation, Formal Transition Models.

Elementary Data Types: Properties of Types and Objects; Scalar and Composite Data Types.

Programming in C: Tokens, Identifiers, Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Argumaents, Preprocessors.

Object Oriented Programming: Class, Object, Instantiation, Inheritance, Encapsulation, Abstract Class, Polymorphism.

Programming in C++: Tokens, Identifiers, Variables and Constants; Data types, Operators, Control statements, Functions Parameter Passing, Virtual Functions, Class and Objects; Constructors and Destructors; Overloading, Inheritance, Templates, Exception and Event Handling; Streams and Files; Multifile Programs.

Web Programming: HTML, DHTML, XML, Scripting, Java, Servlets, Applets.

Computer Graphics: Video-Display Devices, Raster-Scan and Random-Scan Systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms; Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood-Fill.

2-D Geometrical Transforms and Viewing: Translation, Scaling, Rotation, Reflection and Shear Transformations; Matrix Representations and Homogeneous Coordinates; Composite Transforms, Transformations Between Coordinate Systems, Viewing Pipeline, Viewing Coordinate Reference Frame, Window to View-Port Coordinate Transformation, Viewing Functions, Line and Polygon Clipping Algorithms.

3-D Object Representation, Geometric Transformations and Viewing: Polygon Surfaces, Quadric Surfaces, Spline Representation, Bezier and B-Spline Curves; Bezier and B-Spline Surfaces; Illumination Models, Polygon Rendering Methods, Viewing Pipeline and Coordinates; General Projection Transforms and Cipping.

Unit – 4 : Database Management Systems

Database System Concepts and Architecture: Data Models, Schemas, and Instances; Three-Schema Architecture and Data Independence; Database Languages and Interfaces; Centralized and Client/Server Architectures for DBMS.

Data Modeling: Entity-Relationship Diagram, Relational Model - Constraints, Languages, Design, and Programming, Relational Database Schemas, Update Operations and Dealing with Constraint Violations; Relational Algebra and Relational Calculus; Codd Rules.

SQL: Data Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection.

Normalization for Relational Databases: Functional Dependencies and Normalization; Algorithms for Query Processing and Optimization; Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Object and Object-Relational Databases; Database Security and Authorization.

Enhanced Data Models: Temporal Database Concepts, Multimedia Databases, Deductive Databases, XML and Internet Databases; Mobile Databases, Geographic Information Systems, Genome Data Management, Distributed Databases and Client-Server Architectures.

Data Warehousing and Data Mining: Data Modeling for Data Warehouses, Concept Hierarchy, OLAP and OLTP; Association Rules, Classification, Clustering, Regression,

Support Vector Machine, K-Nearest Neighbour, Hidden Markov Model, Summarization, Dependency Modeling, Link Analysis, Sequencing Analysis, Social Network Analysis.

Big Data Systems: Big Data Characteristics, Types of Big Data, Big Data Architecture, Introduction to Map-Reduce and Hadoop; Distributed File System, HDFS.
NOSQL: NOSQL and Query Optimization; Different NOSQL Products, Querying and Managing NOSQL; Indexing and Ordering Data Sets; NOSQL in Cloud.

Unit – 5 : System Software and Operating System

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers.

Basics of Operating Systems: Operating System Structure, Operations and Services; System Calls, Operating-System Design and Implementation; System Boot.
Process Management: Process Scheduling and Operations; Interprocess Communication, Communication in Client–Server Systems, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization.

Threads: Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.

CPU Scheduling: Scheduling Criteria and Algorithms; Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.

Memory Management: Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

Storage Management: Mass-Storage Structure, Disk Structure, Scheduling and Management, RAID Structure.

File and Input/Output Systems: Access Methods, Directory and Disk Structure; File-System Mounting, File Sharing, File-System Structure and Implementation; Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance; Recovery, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations.

Security: Protection, Access Matrix, Access Control, Revocation of Access Rights, Program Threats, System and Network Threats; Cryptography as a Security Tool, User Authentication, Implementing Security Defenses.

Virtual Machines: Types of Virtual Machines and Implementations; Virtualization.

Linux Operating Systems: Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output; Interprocess Communication, Network Structure.

Windows Operating Systems: Design Principles, System Components, Terminal Services and Fast User Switching; File System, Networking.

Distributed Systems: Types of Network based Operating Systems, Network Structure, Communication Structure and Protocols; Robustness, Design Issues, Distributed File Systems.

Unit – 6 : Software Engineering

Software Process Models: Software Process, Generic Process Model – Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, Component Based Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models – Extreme Programming (XP), Adptive Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering**.**

Software Requirements: Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling; Requirements Review, Software Requirment and Specification (SRS) Document.

Software Design: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling; Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management (RMMM); Software Reliability.

Estimation and Scheduling of Software Projects: Software Sizing, LOC and FP based Estimations; Estimating Cost and Effort; Estimation Models, Constructive Cost Model (COCOMO), Project Scheduling and Staffing; Time-line Charts.

Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Tesing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.

Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

Unit – 7 : Data Structures and Algorithms

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Queues, Priority Queues, Linked Lists, Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Data Structure for Sets, Graphs, Sorting and Searching Algorithms; Hashing.

Performance Analysis of Algorithms and Recurrences: Time and Space Complexities; Asymptotic Notation, Recurrence Relations.

Design Techniques: Divide and Conquer; Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound.

Lower Bound Theory: Comparison Trees, Lower Bounds through Reductions.

Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Maximum Flow, Minimum Spanning Trees.

Complexity Theory: P and NP Class Problems; NP-completeness and Reducibility.

Selected Topics: Number Theoretic Algorithms, Polynomial Arithmetic, Fast Fourier Transform, String Matching Algorithms.

Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

Unit – 8 : Theory of Computation and Compilers

Theory of Computation: Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox.

Regular Language Models: Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis.

Context Free Language: Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Context Free Grammars; Properties of Context Free Language.

Turing Machines (TM): Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis; Recursive and Recursively-Enumerable Languages; Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems.

Unsolvable Problems and Computational Complexity: Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.

Syntax Analysis: Associativity, Precedence, Grammar Transformations, Top Down Parsing, Recursive Descent Predictive Parsing, LL(1) Parsing, Bottom up Parsing, LR Parser, LALR(1) Parser.

Semantic Analysis: Attribute Grammar, Syntax Directed Definitions, Inherited and Synthesized Attributes; Dependency Graph, Evaluation Order, S-attributed and L-attributed Definitions; Type-Checking.

Run Time System: Storage Organization, Activation Tree, Activation Record, Stack Allocation of Activation Records, Parameter Passing Mechanisms, Symbol Table.

Intermediate Code Generation: Intermediate Representations, Translation of Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls.

Code Generation and Code Optimization: Control-flow, Data-flow Analysis, Local Optimization, Global Optimization, Loop Optimization, Peep-Hole Optimization, Instruction Scheduling.

Unit – 9 : Data Communication and Computer Networks

Data Communication: Components of a Data Communication System, Simplex, Half-Duplex and Duplex Modes of Communication; Analog and Digital Signals; Noiseless and Noisy Channels; Bandwidth, Throughput and Latency; Digital and Analog Transmission; Data Encoding and Modulation Techniques; Broadband and Baseband Transmission; Multiplexing, Transmission Media, Transmission Errors, Error Handling Mechanisms.

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, Wide Area Network, Wireless Networks, Internet.

Network Models: Layered Architecture, OSI Reference Model and its Protocols; TCP/IP Protocol Suite, Physical, Logical, Port and Specific Addresses; Switching Techniques.

Functions of OSI and TCP/IP Layers: Framing, Error Detection and Correction; Flow and Error Control; Sliding Window Protocol, HDLC, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, CDMA, TDMA, Network Devices, Backbone Networks, Virtual LANs.
IPv4 Structure and Address Space; Classful and Classless Addressing; Datagram, Fragmentation and Checksum; IPv6 Packet Format, Mapping Logical to Physical Address (ARP), Direct and Indirect Network Layer Delivery; Routing Algorithms, TCP, UDP and SCTP Protocols; Flow Control, Error Control and Congestion Control in TCP and SCTP.

World Wide Web (WWW): Uniform Resource Locator (URL), Domain Name Service (DNS), Resolution - Mapping Names to Addresses and Addresses to Names; Electronic Mail Architecture, SMTP, POP and IMAP; TELNET and FTP.

Network Security: Malwares, Cryptography and Steganography; Secret-Key Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

Mobile Technology: GSM and CDMA; Services and Architecture of GSM and Mobile Computing; Middleware and Gateway for Mobile Computing; Mobile IP and Mobile Communication Protocol; Communication Satellites, Wireless Networks and Topologies; Cellular Topology, Mobile Adhoc Networks, Wireless Transmission and Wireless LANs; Wireless Geolocation Systems, GPRS and SMS.

Cloud Computing and IoT: SaaS, PaaS, IaaS, Public and Private Cloud; Virtualization, Virtual Server, Cloud Storage, Database Storage, Resource Management, Service Level Agreement, Basics of IoT.

Unit – 10 : Artificial Intelligence (AI)

Approaches to AI: Turing Test and Rational Agent Approaches; State Space Representation of Problems, Heuristic Search Techniques, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.

Knowledge Representation: Logic, Semantic Networks, Frames, Rules, Scripts, Conceptual Dependency and Ontologies; Expert Systems, Handling Uncertainty in Knowledge.

Planning: Components of a Planning System, Linear and Non Linear Planning; Goal Stack Planning, Hierarchical Planning, STRIPS, Partial Order Planning.

Natural Language Processing: Grammar and Language; Parsing Techniques, Semantic Analysis and Prgamatics.
Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification; Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.

Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle; Problem Solving using GA.

Artificial Neural Networks (ANN): Supervised, Unsupervised and Reinforcement Learning; Single Perceptron, Multi Layer Perceptron, Self Organizing Maps, Hopfield Network.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

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 2025-26

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 2025-26

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 2025-26

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.

SCHOOL OF ARTS, COMMUNICATION AND LANGUAGES

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – DRAWING & PAINTING

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

SYLLABUS FOR Ph.D. ENTRANCE TEST 2025-26
Drawing and Painting

Unit - 1	**History of Indian Painting**	Pre-historic cave painting, Indus Valley art, Wall Painting tradition Jogimara, Ajanta, Bagh, Sittanvasal, Badami, Elephanta and Ellora. Manuscript and Pat Painting tradition: Pal School, Apbhransha/Jain School. Miniature painting tradition : Rajasthani School, Mughal School, PahariSchool. Patna/Company School, Indigenous schools : Kalighat Painting, Orissa, Nathdwara, Tanjore painting. Raja Ravi Verma. Bengal School/Renaissance period, Six Limbs of Indian painting. A Brief Introduction New Trends in Modern Indian paintings. Some important painters and artist groups: JaminiRoy, Rabindranath Tagore, Gagandranath Tagore, Amrita Shregil, Calcultta Group, PAG ,Delhi Shilpa Chakra. Contemporary Indian Painters: Satish Gujral, M.F.Husain, K.S.Kulkarni, K.K.Habbar, N.S. Bendre, Ram Kumar, Arprna Cour, AnjoliIla Menon, Anupam Sood, Nalani Malani, Arpita Singh, Gogi Sarojpal, Tayb Mehta, A.Ramchandran.
Unit - 2	**History of European Painting**	Primitive cave painting. Greek painting. Roman painting. Early Christian Art.Byzantine Art. Romanesque painting. Gothic painting. Renaissance painting. Brief introduction of early 19thcentury painting, Neo-classicism,Romanticism,Realism.Pre-Raphaelites)Impressionism. Post-Impressionism, Symbolism,Fauvism. Cubism, Expressionism, Surrealism, Abstract Art.
Unit -3	**Philosophy of Art**	Indian Thought: Brief introduction of Mythology and its relationship with art.The Aesthetic concept in India – its sources and development. The theory of Rasa of Acharya Bharat. Later Commentators on the theory of Rasa – Bhatta Lollata, Shri Shankuka and Bhatt Nayaka. Alankara school – Bhamah and his followers – Dandi, Udbhata and Rudrata. Riti & Gun school – Vamana and Dandi. Theory of Dhvani – Ananadvardhana. Abhinavagupta's views on Rasa Dhvani and Sadharnikaran. Shadanga Theory. Western thought : The 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. communist Philosophy of Art, Study of relationship between Aesthetics and actual works of Art
Unit – 4	**Post- Modern trends in art (Since 1970)**	Basic concept and features, prominent artists & art works, Post -Modernism – General meaning of the term, Basic tendencies as reflected in art works. Op and Pop art. Superrealism. Happening, performance art & Installation art. Conceptual art. Feminist art. New- Expressionism. Computer and Video art
Unit - 5	**Art of China & Japan**	China - Neolithic Period- Yang-Shao, Lung- Shan and Hsia-t'an culture, Shang Yin dynasty, Chang Zhan period, Chin period, Han dynasty, Sui dynasty, Tang dynasty, Sung dynasty, Technique of Chinese Painting, Japan – Neolithic Period : Jomon culture, Yayei period, Aasuki period. Nara period, Heian period, Kamakura period, Muromachi (Aashikaga) period, Momoyama period.

Dr. Dhan Singh Bisht
Professor & Head
Drawing & Painting Dept.
HNB Garhwal University
Srinagar-246174 (Garhwal)

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – ENGLISH

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

H.N.B. Garhwal University, Srinagar (Garhwal)

Department of English

Pre-PhD Entrance Examination — Suggested Syllabus

Subject: English

Unit I	English Drama
Unit II	Shakespeare & Renaissance Literature
Unit III	English Poetry
Unit IV	English Fiction and Short Story
Unit V	English Non-fictional Prose
Unit VI	American Literature
Unit VII	African and Afro-American Literature
Unit VIII	Literature and Gender
Unit IX	Popular Literature
Unit X	Commonwealth Literature
Unit XI	World Classics and European Literature in Translation
Unit XII	Indian Writing in English and the Indian Diaspora
Unit XIII	Indian Texts, Poetics, and Literature in Translation
Unit XIV	English in India: History, Evolution and Futures
Unit XV	Classical to Romantic Literary Criticism
Unit XVI	Modern Critical Thought and Literary Theory post-World War II
Unit XVII	Colonial, Postcolonial Literatures and Theory
Unit XVIII	Cultural Studies and Gender Studies
Unit XIX	Language, Linguistics, and Translation Studies
Unit XX	Research Methods and Materials in English

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – HINDI

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

पीएच0 डी0 2025-26

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 2025-26

SUBJECT – SANSKRIT

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

प्रवेश परीक्षा (पी-एच० डी०) 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- पुरूरवा-उर्वशीसंवादः (ऋग्वेद 10.95), सरमा-पणिसंवादः (ऋग्वेद 10.108), विश्वामित्र-नदीसंवादः (ऋग्वेद 3.33),

इन्द्र- मरुत्संवादः

(ऋग्वेद 10.165)।

(ख) अथर्ववेदः- द्वादशकाण्डे पृथ्वीसूक्तम् 1.1-20।

(ग) निरुक्तम्- 1-2 अध्यायौ।

(घ) वैदिकसाहित्यस्य इतिहासः- वेदोत्पत्तिः, वेदानां प्रतिपाद्यविषयाः, वेदानां भाष्यकाराः, संहिताब्राह्मणारण्यक्षोपनिषदां, वेदाङ्गानां च संक्षिप्तः
परिचयः।

वर्गः-2

Unit-2

साहित्यवर्गः-

(क) लौकिकसंस्कृतसाहित्यस्य संक्षिप्त इतिहास, काव्यानि च।

अधोलिखितकवीनां तत्काव्यकर्तृणां च संक्षिप्तः परिचयः-

वाल्मीकिः, व्यासः, भासः, शूद्रकः, कालिदासः, अश्वघोषः, विशाखदत्तः, भट्टिः, भारविः, माघः, दण्डीः, सुबन्धुः, बाणः, हर्षदेवः,

भट्टनारायणः, भवभूतिः, श्रीहर्षः, जयदेवः, कल्हणः, विल्हणः, पण्डितराजजगन्नाथः, अम्बिकादत्तव्यालः, भर्तृहरिः।

(ख) अधोलिखितानां विशेषाध्ययनम्-

कुमारसम्भवम् (प्रथमः सर्गः), किरातार्जुनीयम् (प्रथमः सर्गः), अभिज्ञानशाकुन्तलम्, उत्तररामचरितम्, मेघदूतम्,

शुकनासोपदेशः।

(ग) काव्यशास्त्रम्-

1. साहित्यदर्पणम् (प्रथम, द्वितीय, तृतीय परिच्छेदाः)
2. काव्यप्रकाश (1, 2, 8, 9, 10 उल्लासाः)
3. ध्वन्यालोकः- प्रथम उद्द्योतः।
4. दशरूपकम्, रसगंगाधर (प्रथम आननम्)।
5. काव्यशास्त्रस्य सामान्यपरिचयः।
6. वृत्तरत्नाकरः।

वर्ग-3

Unit-3

दर्शनशास्त्रम्-

(क) सांख्यकारिका, तर्कभाषा (प्रामाण्यवादपर्यन्तम्), वेदान्तसारः,

(ख) दर्शनशास्त्रस्य इतिहासः-

भारतीयास्तिक नास्तिकदर्शनानां सामान्यपरिचयः।

(ग) सर्वदर्शनसंग्रह चार्वाकः, जैनदर्शनम्, बौद्धदर्शनम्।

वर्ग:-4

Unit-4

व्याकरणम्-

(क) वरदराजविरचिता लघुसिद्धान्तकौमुदी-

संज्ञाप्रकरणम्, सन्धिप्रकरणम्, कृदन्तप्रकरणम्, समासप्रकरणम्।

(ख) भट्टोजिदीक्षितविरचिता व्याकरणसिद्धान्तकौमुदी- कारकप्रकरणम्।

(ग) भाषाविज्ञानम्- भाषायाः लक्षणम्, भाषायाः प्रकृतिः, भाषाविज्ञानस्य लक्षणम्, भाषापरिवर्तनस्य कारणानि।

विश्वभाषाणां वर्गीकरणम्- आकृतिमूलकवर्गीकरणम्, पारिवारिकवर्गीकरणञ्च।

(घ) भारोपीयपरिवारस्थानां भाषाणां संक्षिप्त परिचयः, आर्यभाषापरिवारविवरणम्, अर्थविज्ञानम्, ध्वनिविज्ञानम्, रूपविज्ञानम्।

वर्गः-5

Unit-5

धर्मशास्त्रम्-

(क) धर्मशास्त्रस्य सामान्यपरिचयः

विशेषाध्ययनम्- मनुस्मृतिः, याज्ञवल्क्यस्मृतिः, नारदस्मृतिः, पराशरस्मृतिः।

(ख) शुद्धाशुद्धविवेचनम्।

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – JOURNALISM & MASS COMMUNICATION

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

Centre for Journalism & Mass Communication
Hemvati Nandan Bahuguna Garhwal University

Syllabus for Ph.D Enterance in Journalism and Mass Communication

Unit 1: History of Media

Basics of Journalism- Definition, nature, functions and scope of journalism, Types of journalism, Role of journalism in democracy and development

Evolution of Journalism- Global development of journalism (Print, Radio, TV, Digital media), History of journalism in India: Pre-independence & post-independence developments, Print journalism: newspapers, magazines, journals, Broadcast journalism: radio, television

Unit 2: Journalism, Media Systems and Practices

Journalism as a socio-cultural practice and system of knowledge production, Media as institutions, industries, and discursive frameworks, Interdisciplinary approaches: Political economy, cultural studies, sociology of media, News construction: Gatekeeping, framing, agenda-setting, and agenda-building, Transformation from legacy media to digital-first and networked media ecosystems, Media convergence and cross-platform journalism, Platformization of media and role of Big Tech in news dissemination, Algorithmic curation, filter bubbles, and echo chambers, Attention economy, virality, and metrics-driven journalism, Rise of alternative media, independent journalism, and creator economy, Audience fragmentation and personalization of content, Post-truth environment and crisis of media credibility, Features of digital journalism: Immediacy, interactivity, hypertextuality, multimedia, Mobile journalism (MoJo) and real-time reporting practices, Social media as a news ecosystem (platform-based journalism), Participatory journalism and user-generated content (UGC), Data journalism: Data analysis, visualization, and storytelling, Internet of Things (IoT) and sensor-based journalism, Changing media business models: Subscription, paywalls, crowdfunding, platform monetization

Unit-3: Reporting and Editing

News: definition, concept, elements, values, sources, lead writing, kinds; reporting: crime, weather, city life, speech, accident, disaster, election, riots, war/conflict/tensions.

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.

Interviewing-kinds, purposes, techniques; Investigative reporting – purposes, sources, styles, techniques,; columns – development, criticism, reviews, feature writing, news analysis, back grounding.

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: Communication Theories

Nature, scope, and evolution of communication theories, Models of communication: Linear, interactive, transactional, and convergent models

Paradigms of communication theories: Positivist/empirical paradigm, Interpretive/constructivist paradigm, Critical paradigm, Normative and cultural paradigms, Postmodern and post-structural approaches

Schools and approaches of communication theories: American/administrative school (effects tradition), European/critical school (Frankfurt School, political economy), British Cultural Studies (Birmingham School), Semiotic and structuralist approaches, Postcolonial and subaltern perspectives

Classical and mass communication theories: Hypodermic Needle theory, Two-step flow and multi-step flow, Agenda-setting, framing, and priming, Gatekeeping theory, Spiral of Silence, Cultivation theory, Uses and Gratifications theory, Media dependency theory

Critical and cultural theories: Political economy of media, Culture industry (Frankfurt School), Hegemony (Gramsci), Encoding-Decoding (Stuart Hall), Feminist media theory, Postmodern perspectives

Communication in the digital and networked society: Network society (Manuel Castells), Medium theory (McLuhan), Information society and knowledge economy

Communication for Development (C4D) and Social Change: Concepts and paradigms of development communication, Modernization and diffusion of innovations (Everett Rogers), Participatory communication and empowerment approaches, Role of communication in development processes, ICT for Development (ICT4D) and digital inclusion, Behavior Change Communication (BCC) and SBCC

Unit-5: Media Law & Ethics

Meaning, scope, and importance of media law, Constitutional provisions related to freedom of speech and expression, Defamation, Contempt of court, Official Secrets Act, 1923, Press and registration of book Act 1867, Right to Information (RTI) Act, 2005, Copyright Act, 1957, IT Act, 2000 (online content regulation)

Media Ethics: Concept and importance of media ethics, Ethical responsibilities of journalists and media organizations, Codes of conduct: PCI, Editors Guild of India, Online Media Federation, Objectivity, fairness, accuracy, privacy, and sensitivity in reporting, Conflicts of interest and accountability, Ministry of Information and Broadcasting, Broadcast Audience Research Council (BARC), Media and social responsibility

Contemporary Issues in Media Law & Ethics: Censorship vs. freedom of expression, Ethics in digital media: fake news, deep fakes, misinformation, Media and human rights reporting

Unit 6: Strategic Communication and Media Management

Concepts, definitions, role and functions of advertising, Growth and development of advertising (India and global context), Types and classifications of advertising; advertising appeals and message strategies, Surrogate and subliminal advertising

Advertising agencies: Functions, structure, types, pitch process, agency–client relationship, Digital advertising and use of AI; budgeting and financial aspects, Ethical concerns and social critique of advertising, Regulatory framework and institutional mechanisms in advertising (India)

Advertising theories and models: AIDA, DAGMAR, Maslow's hierarchy, Advertising and development; positive and negative dimensions, Advertising and marketing mix; consumer behaviour and market segmentation, Brand positioning, brand image, and market dynamics Gender representation and social issues in advertising

Creative strategy in advertising: Idea generation, creative approaches, copywriting principles, Elements of advertising copy; illustration and layout techniques

Public Relations: Concepts, scope, types, and publics, PR tools and processes: Publicity, propaganda, lobbying, public opinion, influencer communication, PR vs advertising vs marketing, Digital and social media in PR, PR agencies: Structure, types, and functions; traditional vs digital PR

Corporate communication: Concept, scope, and functions, Stakeholder management and corporate identity, Corporate branding, corporate advertising, and CSR, Crisis communication: Types, strategies, planning, and reputation management, Media relations: Press releases, conferences, briefings, media kits, tracking and coverage, Strategic communication in the digital environment

Media management: Meaning, scope, and media as industry and profession, Ownership patterns of media in India, Media economics, market forces, and performance metrics (TRP, BARC, etc.), Content management and manufacturing consent, Structure and organization of media institutions: Roles, hierarchy, workflow, Circulation and management practices, Globalization and media: Foreign investment, global competition, socio-economic and cultural impact

Unit-7: Cinema and Visual Communication

Nature and scope of visual communication and visual culture, Film as a medium of communication and representation

Visual language: Frame, composition, color, lighting, symbolism, **Film narrative and storytelling:** Fiction and non-fiction forms, **Film grammar:** Shot, scene, sequence, mise-en-scène, Cinematography, editing (montage), and sound (diegetic/non-diegetic)

Major film theories and Critical approaches: Formalism, realism, auteur, genre, semiotics, Psychoanalytic, feminist, postmodern, postcolonial

Visual semiotics: Signs, codes, and meaning in visual texts, Representation and ideology in cinema (gender, class, identity), Visual perception, reception, meaning-making

Documentary and non-fiction cinema: Modes and social relevance, **Digital visual media:** OTT platforms, short-form video, mobile production, Visual communication in social media and multimedia environments, Emerging technologies: VR, AR, immersive media, AI-generated visuals, Cinema and visual media as tools of communication and social change

Unit-8: Communication Research

Nature and philosophy of research: Meaning of knowledge; epistemology and ontology, **Research paradigms:** Positivism, interpretivism, critical theory, constructivism, postmodernism, Objectivity vs subjectivity; sources of knowledge; characteristics of scientific research

Communication research: Concepts, scope, and development, **Elements of research:** Variables, hypothesis, induction and deduction, theoretical framework, **Types of research:** Pure and applied; exploratory, descriptive, experimental, historical, action, case study; qualitative and quantitative approaches, **Research problem:** Conceptualization, problem statement, research questions, hypothesis formulation, **Research design and process:** Measurement of variables, research proposal, research planning, **Literature review:** Importance, sources, techniques, writing review, identification of research gaps, **Quantitative methods:** Survey, content analysis, census, **Qualitative methods:** Text and visual analysis, in-depth interviews, ethnography, discourse and narrative analysis, observation, **Sampling:** Population, sample, sampling frame and size; probability and non-probability sampling, **Data collection:** Primary and secondary data; questionnaire, interview schedule, observation, focus group discussion

Media text analysis: Concepts, approaches, and contextual analysis, **Techniques:** Semiotic, rhetorical, and narrative analysis; agenda-setting and framing in media content, **Content analysis:** Definitions, sampling, coding, and interpretation, **Analysis of print media:** Headlines, leads, language, placement, and comparative analysis, **Visual and moving image analysis:** Visual meaning-making, language of images, narrative analysis, placement of visuals and advertisements, **Digital media analysis:** Web content, convergent media, newsroom convergence, netnography, **Data analysis:** Descriptive and inferential statistics; tabulation, coding, measures of central tendency, correlation

Research writing: Structure of research paper, academic writing style, argumentation and presentation, Citation and referencing styles (APA, MLA, Chicago); paraphrasing and plagiarism avoidance, Research ethics: Consent, confidentiality, privacy, ethical issues in media research, Academic integrity, peer review, and publication practices

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.

What is 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.

Prof. MANJULA RANA
Dean
Art, Communication & Language
H.N.B. Garhwal University Srinagar Garhwal

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – ARCHAEOLOGY

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

H.N.B. Garhwal University, Srinagar (Garhwal)
Brief Syllabus for PhD. Entrance Exam 2026 for
Ancient Indian History, Culture and Archaeology

1. **Principles and Methods in Archaeology**

Nature and History of Archaeology: Definition and scope of Archaeology**,** History of Indian Archaeology from the 19th Century till the present. **Methods of data retrieval:** Field discoveries: Aims, objectives and methods of Exploration of archaeological sites.

2. **Environmental Archaeology**

Concept of Environmental Archaeology: Definition and Elements of Environmental Archaeology. Environment and Ecology. **Paleoclimatic Changes:** Basic knowledge of Quaternary geology. **Branches of Environmental archaeology:** Bioarchaeology, Archaeozoology and Palaeobotany, Anthropological Archaeology, Marine archaeology.

3. **Palaeolithic Culture in the Indian Sub-Continent**

Prehistoric Archaeology and scope of prehistory: An introduction to prehistory: features and scope, Salient features of world Prehistory. **Palaeolithic Culture: Lower, Middle and Upper Palaeolithic Cultures.**

4. **Copper Bronze Age in the Indian Sub-Continent**: **Early Chalcolithic and Pre-Harappan Cultures**: Early Chalcolithic Cultures of Afghanistan and Pakistan, Pre and Early Harappan Culture of Afghanistan, Pakistan and India. **Indus–Sarswati Civilisation**: Its Origin, Extent, Chronology and Decline**. Late Survival of Bronze Age Culture:** Late Harappan and Chalcolithic Cultures in India. **Copper-using communities of the Gangetic Plain:** Copper hoard and OCP Cultures and their co-relationship,

5. **Political History of India from c. 600 BCE to c. 650CE**

Janapadas and Mahajanapadas, Towards Empire: Nandas and Mauryas, Post-Mauryan Dynasties and Polity: Sungas and Kanvas: Indo-Greeks, Saka-Pahallava, Satavahanas and Western Kshatrapas.**Guptas, Hunas and Vakatakas. Vardhanas, Chalukya and Pallavas:** Harsha-Polity and administration, Chalukyas and Pallavas.

6. **Documentation and Dating methods in archaeology**

Photography in Archaeology, Dating methods: Relative dating and Absolute dating. Scientific and Analytical Archaeology, History of Science and its application in archaeology

7. **Early Farming Communities-Mesolithic and Neolithic Culture in India**

Early Holocene Hunting-Gathering: Mesolithic stage with climatic changes and technological adaptation.**Mesolithic sites of India:** Baghor; Chopani-Mando; Birbhanpur; Sarai-nahar-rai; Mahdaha; Langhnaj; Bagor; rock shelters; Adamgarh; Bhimbetka; Lahariadih; Morhana-pahar. Neolithic remains in the Belan valley, the Vindhyan foothills, and the Ganga plains; sites in Chhota Nagpur, Orissa, and Assam.

8. **Iron Age in India**

Beginning of the Iron Age in India, Painted Grey Ware (PGW) culture, Northern Black Polished Ware Culture**. Megalithic Cultures**: Megalithic Cultures of North & South India

9. **Ancient Indian Art**

Harppan Art: Stone, Terracotta and Metal Figurines.**Mauryan Art:** Pillars and Capitals; Early Yaksha Figures. **Sunga and Satvahana Art**: Bharhut, Sanchi and Amravati.**Art of**

10. **Palaeography and Epigraphy**

Origin and development of Script: Brahmi and Kharosthi.

Antiquity of Writing in India: Rock Edict XIII of Ashoka, Pillar Edict VII of Ashoka, Sarnath Minor Pillar Edict of Ashoka, Rummandei Pillar inscription of Ashoka, Second Rock Edict of Ashoka. Basenagar Garuda pillar Inscription of Heliodorus. Hathigumpha Inscription of Kanishka-I. Nanaghat Inscription of Queen Naganika. Junagarh Rock inscription of Rudradaman. Allahabad Pillar Inscription of Samudragupta. Banskhera copper plate Inscription of Harsha

11. **Beginning of Indian Coinage**

Early Indian Coins: Punch-marked coins, Cast coins**. Local and Tribal Coins:** Local Coins – Taxila, Kaushambi, Tribal Coins – Yaudheyas, Kunindas, Audumbaras, Arjunayanas

12. Indian Iconography: Sources of iconographic studies and antiquity of image worship**,** Form of Vishnu Image – Incarnatory forms, Vaikunthchatumurti, Anantashayai**,** Siva-An iconic form and mukhlinga, Anugrha murti (Ravananugraha,Arjunanugrah, Chandeshnugrah), Saumyamurti (Uma-Maheshwar, Kalyansundar), Samharmurti.

13. **Ancient Indian Architecture**

Stupa Architecture: Origin and Development of Stupa Architecture: Bharhut, Sanchi and Amravati**, Rock-Cut Architecture:** Origin and Development of Rock-cut architecture, Chaityas and Viharas with special reference to Bhaja, Karle and Ajanta.**Temple Architecture:** Gupta Temples: Dasavatar Temple, Deogarh and Bhitargaon Temple, Orissan Temples, Central Indian Style: Khajuraho, Pallava Architecture: Rock-Cut and Structural Temples

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

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 Economic Theory

Consumer behaviour under certainty and uncertainty; Utility analysis- Cardinal, Ordinal, Expected utility hypothesis; Elasticity, Revealed preference theory; Production functions - Cobb–Douglas and CES; Cost and revenue analysis; Market structures- monopoly, monopolistic competition and oligopoly; Game theory- static and dynamic games; General equilibrium analysis; Welfare economics and social welfare functions; Behavioural microeconomics.

Unit 2: Macro Economic Theory

Classical and Keynesian models of income determination; Consumption theories - life-cycle and permanent income hypotheses; Multiplier; Investment theories- accelerator and Tobin's q; IS–LM–BP framework; Rational expectations and Lucas critique; New Keynesian macroeconomics; Inflation dynamics and Phillips curve; Business cycle theories; Open economy macroeconomics.

Unit 3: Statistics and Quantitative Techniques

Probability theory and probability distributions; Sampling methods and sampling distributions; Estimation and hypothesis testing- Z, t, F and Chi-square tests; Measures of skewness and kurtosis; Index numbers and tests of consistency; Time series components and trend estimation; Correlation and regression analysis; Non-parametric statistical methods.

Unit 4: Econometrics

Classical linear regression model and assumptions; Problems of estimation- heteroscedasticity, autocorrelation and multicollinearity; Model specification and diagnostic testing; Dummy variable regression models; Distributed lag models; Simultaneous equation models and identification problem; Instrumental variable estimation; Introduction to panel data methods.

Unit 5: Mathematical Economics

Functions, limits and continuity; Optimization techniques in single and multivariable cases; Comparative statics analysis; Matrix algebra and determinants; Linear programming and simplex method; Input–Output analysis; Differential and difference equations in economic dynamics.

Unit 6: International Economics and Financial Markets

Classical and modern theories of international trade; Gains from trade and offer curves; Trade policy instruments - tariffs and quotas; Balance of payments adjustment mechanisms; Exchange rate determination theories; Global financial integration and capital mobility; Financial market structure - primary and secondary markets; Risk–return analysis and

portfolio diversification; Fundamental analysis - earnings indicators and valuation ratios; Technical analysis- trend and moving averages; Efficient Market Hypothesis; Behavioural finance in stock markets.

Unit 7: Public Economics

Role of government and market failure; Public goods and externalities; Principles of taxation and tax incidence; Optimal taxation theory; Public expenditure theories - Wagner's law; Fiscal federalism; Budget deficits and public debt sustainability; Public choice theory.

Unit 8: Money, Banking and Financial System

Functions and classification of money; Demand for money theories -classical, Keynesian and Baumol-Tobin approaches; Money supply and credit creation; Central banking and monetary policy instruments; Monetary policy transmission mechanism; Financial inclusion; Digital finance and fintech developments; Regulation of financial institutions.

Unit 9: Growth, Development, Demographyand Environmental Economics

Economic growth models -Harrod–Domar and Solow; Endogenous growth concepts; Poverty and inequality measurement; Human development and capability approach; Gender economics; Demographic transition theory; Fertility, mortality and migration; Urbanization and labour mobility; Sustainable development goals.Economics of climate change; Resource valuation techniques; Sustainable resource management; Pollution control instruments - taxes and tradable permits; Environmental governance and policy.

Unit 10: Indian Economy

Planning experience and economic reforms; Agricultural policy and rural development; Industrial policy and structural transformation; Labour market issues and employment trends; Financial sector reforms; Regional disparities and inclusive growth; Contemporary macroeconomic policy challenges.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – HISTORY

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

H.N.B. Garhwal University, Srinagar (Garhwal)
Brief Syllabus of PhD. Entrance Exam for History

1. **Principles of History:** Subject matter of History, Types of History–social, economic, intellectual, agrarian, urban, art history etc. Use and Misuse of history. Problems of Periodization. History and other Disciplines. Ancillary Sciences: Archeology, Paleography, Epigraphy, Numismatics Auxiliary Sciences: Linguistics, Sociology, Economics, Political Science, (Influences of statistics on historical methods. Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism.

2. **History of World (C. 1775 A.D. 1848 A.D.):** American Revolution (1776), France on the eve of the revolution of 1789 A.D. French revolution. Napoleon. Vienna Settlement – Principles and criticism. France 1815 to 1848.
3. **History of Afro-Asian Nationalism:** Nationalism –Concept, meaning and definition, China – 1911 revolution to People's Republic of China. South East Asia, French Colonization of Indo-China, Liberation of Vietnam. Colonisation of Middle East, Nationalism Arab & Egypt. Colonisation of Africa

4. **Indian National Movement (C.1857-1919AD)**
5. **Women in Indian History: Status of Women in ancient, medieval and modern India: literature and fine art, Indian National movements. Organisations and Feminist Movement Legal and Constitutional Rights,**

6-History Of Uttarakhand (C. 600 BC To 1949AD)

Early History of Uttarakhand, State Formation in Uttarakhand Political History of Uttarakhand during Ancient and Medieval Time. Gorkha invasion and Colonisation of Uttarakhand, Political Awakening and National Movement in Uttarakhand, Tehri Garhwal Princely State

7. **Sources of Indian History:** Ancient, medieval and modern Indian literary and archaeological sources, 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.
8. **History of World (C. 1848 -1914 A.D.):** France, Germany, Italy., Crimean War. Berlin Congress, Young Turk movement 1908 A.D., Balkan Wars, World War I
9. **Constitutional History of India (C. 1858-2000AD):** Act of 1858,1861,1892.1909,1919. Cabinet Mission 1946, The Indian Independence Act of 1947, The Constitution of India, 1950 Constitutional Amendments. Panchayat and Nagar Palika Acts.
10. **Indian National Movement (C.1919-1947 AD)**: Gandhian Era, World War II -Subash Chandra Bose and the INA, Peoples Movement in Indian Princely States; tribal and trade union movement in India, Rise of Communalism and Partition of India,
11. **Ecology and Environment in History:** Environmental consciousness in ancient, Medieval & Modern India and Conservation, . Forest and wild life management in all ages in indian History.
12. Culture of Uttarakhand (from Earliest Times to 1949AD): Sources of Cultural History of Uttarakhand, Society and Economy of Uttarakhand, Religion in Uttarakhand: Folk and Pauranic, Religions in Uttarakhand, Pilgrimage tradition in Uttarakhand, Traditions of Uttarakhand, **Salient** features of art and architecture of Uttarakhand.
13. **Historical Writings: Schools & Historians:** Historical narrative, Greek and Latin Historiography: Church. Chinese tradition: Ssuma-chian. Ancient Indian Historical tradition. Islamic Historical tradition Renaissance: General characteristics, Age of Enlightenment, Romanticism, Voltaire. Rise of Modern Historiography: Empirical, Universalist/Idealist; Positivist tradition: Annales tradition, Marxist Tradition, Subaltern, Orientalism.
13. **Tourism in History:** history of tourism, Cultural and Historical Monuments of tourist, Monuments, Chaar Dham Yatra, Tourism in India

14. **Twentieth Century World (C. 1914-1945AD):** Legacy of the Nineteenth Century, World Order up to 1919, Emergence of Socialist State, World between the Two Wars, Second World War and its Effects
15. **History of Ancient India (From Earliest to 185 BC):** ancient Indian history Bronze Age, first urbanization, Janapadas and Maha-janapadas, Towards empire: Nandas and Mauryas**.**
16. **History of Ancient India (C.B.C. 185 to 650A.D.):** Reconstructing ancient Indian history, *Post* Mauryan Dynasties and Polity, Guptas, Hunas and Vakatakas, Vardhanas, Chalukya and Pallavas
17. **History of Ancient Nothern India (C. AD 650-1200AD):**

Dynasties of Northern, eastern and Western, central India and their Polity & Administartion: Feudalism in Northern India and struggle for Supremacy

18. **History of Delhi Sultanate (C.1192 to 1320AD.): Historiography and Sources: Foundation and consolidation of Delhi Sultanate: Early Turkish Sultans: The Khiljis:**
19. **History of Delhi Sultanate (C. 1320 to 1526 AD.):** The Tughlaqs:The Sayyaid and The Lodhis Administration and other Aspects:
20. **History of Mughal India (C. 1526 to 1627AD.):** ***Historiography and Sources: Foundation of Mughal Empire in India: Consolidation of Mughal Empire, Jahangir Reign.***
21. **History of Modern India (C.1757-1857AD):** Expansion and consolidation of British power, Colonial Construction of India: Structures and Institutions British Paramountcy and Indian states Resistance to Colonial Rule -I and Colonial Rule -II
22. **History of Modern India (C.1858 – 1947AD):** India under the Crown, Lytton, Ripon and Dfferin, Curzon, annexation of Burma, relations with Tibet, relations with Afghanistan. Indian Princely state, (1858-1919), Indian Nationalism, Gandhi and British administration: Gandhi - Irvin agreement. World War II, Post war-politics-Poona pact-third round table. Partition of India. Independence of India.
23. **History of Modern India (C.1947- 2000 AD)**

Independent India, Princely states. Post-Partition refugee problem Land question and industrial policy. Education; health; science; and technology, Women-Hindu Code Bill**,** non-alignment, Pakistan and Kashmir Issue, Indo-China Dispute, War of 1962.Indo-Pak War -1965, Indo-Pak war and liberation of Bangla desh- 1971, Indo-Sri Lanka relations and Tamil Issue. Congress Governments and non-Congress Governments, Popular movements--for Statehood. India and its Neighbors- Nepal- Bhutan- Bangladesh and Sri Lanka (1972-2000):

24. **Twentieth Century World (C.1946-2000AD):** U.N.O. and World Peace; Nationalist Movements and Decolonization in- Asia, Middle East and Africa; Communist Revolution in China. **Cold war and its impact, Disintegration of socialist block and end of cold war** Non-Aligned Movement; - SAARC, OPEC; Emerging new world economic order, G-7, G-15, G-77; European Union; International concerns on terrorism and environment. India and its Neighbours, Indo-China and Indo-Pak relations; other Neighbours.
25. **History of U.S.A. (C.1865-1989AD):** Civil war and its consequences: Emergence of U.S. A. as a world power; Theodore Roosevelt and Woodrow Wilson. world war I and formation of League of Nations Great Depression and New Deal programme into world war II, Harry Truman and beginning of the cold war. D.D. Eisen However. Korean war. F. Kannedy and cold war. Vietnam war, Foreign policy of USA from 1976 to 1989.
26. History of Ancient Southern India (C. 650-1200AD): Historical Sources and Historiographical interpretations: Rastrakutas, Chalukyas of Badami and Kalyani, and Yadavas. Cholas, Pallavas and Pandyas Political structure-central, provincial and local administration. Emergence of feudalism in southern India and struggle for supremacy
27. **Society and Culture in Ancient India (Earliest time to 1200AD)**

Sources for the study of Indian society, primary and secondary sources structure of society-varna system, caste, ashram, purusharthas, sanskaras, position of Shudras, slavery system. Marriage and family life, position of women. Education system in ancient India women education.,

Vedic religion - Shrutis & Smritis, devamandal during Vedic period, Upanishadic, Vaishanavism, Shaivism, Shaktism and other minor sects, Jainism, Buddhism.

28. **Economic life in Ancient India (Earliest time to 1200AD): S**ources-primary & secondary; early stages of economic development. State and ancient Indian economy. Economic progress in Maurya and Gupta period, land ownership, irrigation system Trade and trade routes: internal and external. Credit and Banking System, development of textiles, handicrafts.
29. **History of Mughal India (C. AD. 1627 to 1757A.D.):** Historiography and Contemporary Sources: Abdul Hamid Lahori-Padshahnama Khwafi khan-Muntakhut-ui-lubab Bernier-Travels in the Mughal India Manucci-Storia do mogur (Translated by W. Irvin), Shahjahan Reign, Aurangzeb Reign, The Marathas, Later Mughals Emperors, Administration and advent of Europeans':
30. **Society and Culture in Medieval India (C.1200 to 1757AD.):** Indian society during Sultnate and Mughal periods, Education and Literature: Bhakti Movement. Sufism, Architecture under Sultanate and the Mughals. Mughals and Rajput Painting,
31. **Economy in Medieval India (C.1200 to 1757AD.):** Revenue Administration and Taxation: Trade and Commerce and Monitory system: Industries and Production Technology:
32. **History of Ideas in Modern India:** Colonialism & emergence of new political ideas-utilitarianism, liberalism, nationalism, democracy, socialism, communalism, secularism. **Ideas of dissent & protest: constitutional opposition: Dada Bhai Nauroji; G.K. Gokhale; B.G. Tilak. Anti-caste movements in south and north India. Mahatma Jyotiba Phule, Ambedkar** Gandhian social philosophy, Left Centric Ideas-Naxalism and Maoism
33. **Society and Culture in Modern India (C.1757-1964AD):** British understanding of Indian society, Christian Missionaries, Brahma Samaj, Arya Samaj, Prathana Samaj etc. Theosophical Society & Mrs. Annie Besant, Social reforms policy of East India Company, Dalit movement and B.R. Ambedkar, Rise and growth of the middle Classes., National Cultural policies: national academy and schools- Art, Drama, Dance, Music and Film
34. **Economy in Modern India (C.1757-1964AD):** Indian Economy in the middle of 18^{th} Century. The English East India Company and its rule in Bengal, South India and the Saran tic Debts. The Ryotwari Settlement of Madras Presidency, Ryotwari and the Mahalwari systems, consequence. Trade & Commerce changing nature of external trade. The Railways Imperialism of free trade, economic and political impulse behind Railway construction, economic consequence of railways. 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.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

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 Upaniṣadic WorldView

- Ṛta (cosmic order), the divine and human realms; centrality of yajña (sacrifice); ṛṇa (duty/obligation); theories of creation.
- Ātman (Self) and anātman (notself); states of consciousness — jāgrat, svapna, suṣupti, turīya; Brahman; śreyas and preyas.
- Karma, saṃsāra, mokṣa.

Cārvāka

- Pratyakṣa as the only pramāṇa; critique of anumāna and śabda; rejection of nonmaterial entities, dharma, and mokṣa.

Jainism

- Concept of reality — sat, dravya, guṇa, paryāya; jīva and ajīva; anekāntavāda, syādvāda, nayavāda; theory of knowledge; bondage and liberation.

Buddhism

- Ćār Ārya Satya (Four Noble Truths), Aṣṭāṅgika Mārga, Nirvāṇa, Madhyamā Pratipad, Pratītyasamutpāda, Kṣaṇabhaṅgavāda, Anātmavāda.
- Schools: Vaibhāṣika, Sautrāntika, Yogācāra, and Mādhyamika.

Nyāya

- Pramā and Aprama; pramāṇas — pratyakṣa (nirvikalpaka and savikalpaka, laukika and alaukika), anumāna (vyāpti, liṅgaparamarśa, hetvābhāsa), upamāna, śabda; concept of God and arguments for God's existence; adṛṣṭa and niḥśreyasa.

Vaiśeṣika

- Categories (padārthas) — dravya, guṇa, karma, sāmānya, samavāya, viśeṣa, abhāva; causation (asatkāryavāda, samavāyi, asamavāyi, nimitta kāraṇa); paramāṇuvāda; adṛṣṭa and niḥśreyasa.

Sāṃkhya

- Satkāryavāda; Prakṛti and its evolutes; arguments for Prakṛti; nature of Puruṣa; arguments for existence and plurality of Puruṣa; relationship between Puruṣa and Prakṛti; kaivalya; atheism.

Yoga

- Patañjali's concept of citta and cittavṛtti; eightfold path (aṣṭāṅga yoga); role of God in Yoga.

Pūrva Mīmāṃsā

- Importance of Śruti; atheism in Pūrva Mīmāṃsā; classification of śruti vākyas (vidhi, niṣedha, arthavāda); dharma; bhāvanā; śabdanityavāda.
- Major differences between Kumārila and Prabhākara schools; key concepts like triputisaṃvit, jñātatā, abhāva/anupalabdhi, anvitābhidhānavāda, abhihitānvayavāda.

Vedānta

- **Advaita**: Rejection of difference; adhyāsa, māyā; three grades of satta; jīva; jīvanmukti; vivartavāda.
- **Viśiṣṭādvaita**: Saguṇa Brahman; refutation of māyā; aprthaksiddhi; pariṇāmavāda; jīva; bhakti and prapatti.
- **Dvaita**: Rejection of nirguṇa Brahman and māyā; bheda; sākṣī; bhakti.

SECTION-II
WESTERN PHILOSOPHY

Plato

- Theory of knowledge — episteme (knowledge) vs. doxa (opinion); theory of Ideas/Forms; dialectic method; soul and God.

Aristotle

- Classification of sciences (theoretical, practical, productive — theoria, praxis, techne); logic as organon; critique of Plato's theory of Ideas; causation (four causes); 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; proofs for the existence of God.

Rationalism

- Descartes: Method and need for method; clarity and distinctness as criterion of truth; methodological doubt; cogito; innate ideas; real distinction between mind and body; proofs for God's existence; role of God; mind-body interaction.
- Spinoza: Substance, attribute, mode; God or Nature; pantheism; mind-body problem; three orders of knowing.

- Leibniz: Monadology; truths of reason vs. truths of fact; proofs for God's existence; principles of non-contradiction, sufficient reason, identity of indiscernibles; pre-established harmony; freedom.

Empiricism

- Locke: Ideas and classification; refutation of innate ideas; theory of knowledge (three degrees); substance; primary vs. secondary qualities.
- **Berkeley**: Rejection of primarysecondary distinction; immaterialism; esse est percipi; critique of abstract ideas; God and self; problem of solipsism.
- **Hume**: Impressions and ideas; relations of ideas vs. matters of fact; induction and causality; external world and self; personal identity; scepticism; rejection of metaphysics; reason and passions.

Critical Philosophy

- **Kant**: Synthetic a priori judgments; Copernican revolution; forms of sensibility and categories of understanding; transcendental deduction; phenomenon and noumenon; ideas of reason (soul, God, world); freedom, immortality; rejection of speculative metaphysics.

SECTION III
INDIAN & WESTERN ETHICS

1. Ṛṇa and Ṛta
2. Puruṣārthas and svadharma
3. Varnadharma and āśramadharma
4. Niṣkāmakarma, svadharma, and sthitaprajña
5. Pañcaśīla, Triratna, and eightfold path (Buddhist ethics)
6. Psychological hedonism and Utilitarianism
7. Kant's ethical theory (categorical imperative, duty)
8. Problem of free will
9. Concepts of good, right, and justice
10. Duty and obligation
11. Cardinal virtues
12. Eudaimonism
13. Freedom and responsibility
14. Crime and punishment
15. Ethical cognitivism and non-cognitivism
16. Ethical realism and intuitionism

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – POLITICAL SCIENCE

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

UNIVERSITY GRANTS COMMISSION
NET BUREAU

Subject : POLITICAL SCIENCE **Code No.: 02**

SYLLABUS

Unit - 1 : Political Theory

Concepts
Liberty, Equality, Justice, Rights, Democracy, Power, Citizenship,

Political Traditions
Liberalism
Conservatism
Socialism
Marxism
Feminism
Ecologism
Multiculturalism
Postmodernism

Unit - 2 : Political Thought

Confucius, Plato, Aristotle, Machiavelli, Hobbes, Locke, Rousseau, Hegel, Mary Wollstonecraft, John Stuart Mill, Karl Marx, Gramsci, Hannah Arendt, Frantz Fanon, Mao Zedong, John Rawls

Unit - 3 : Indian Political Thought

Dharamshastra, Kautilya, Aggannasutta, Barani, Kabir, Pandita Ramabai, Bal Gangadhar Tilak, Swami Vivekanand, Rabindranath Tagore, M.K Gandhi, Sri Aurobindo, Periyar E. V. Ramasamy, Muhammad Iqbal, M.N.Roy, V D Savarkar, Dr. B.R.Ambedkar, J L Nehru, Ram Manohar Lohia, Jaya Prakash Narayan, Deendayal Upadhyaya

Unit - 4 : Comparative Political Analysis

Approaches: Institutional, Political Culture, Political Economy and New Institutionalism; Comparative Methods

Colonialism and decolonization: forms of colonialism, anti-colonial struggles and decolonization

Nationalism: European and non-European.

State theory: debate over the nature of state in capitalist and socialist societies; post-colonial state; welfare state; globalization and nations-states

Political regimes: democratic (Electoral, Liberal, Majoritarian and Participatory) and non-democratic regimes (Patrimonialism, Bureaucratic authoritarianism, Military dictatorship, Totalitarianism, and fascist).

Constitutions and Constitutionalism: forms of constitutions, rule of law, judicial independence and liberal constitutionalism; emergency powers and crisis of constitutionalism.

Democratisation: democratic transition and consolidation.

Development: Underdevelopment, Dependency, Modernization, World Systems Theory, development and democracy.

Structures of Power: ruling class, power elites, democratic elitism

Actor and Processes: Electoral Systems, Political Parties and Party System, Interest groups, Social movements, new social movements, Non Governmental Organisations (NGOs) and civil society campaigns; Revolutions.

Unit - 5 : International Relations

Approaches to the study of International relations: Idealism, Realism, Structural Marxism, Neoliberalism, Neorealism, Social Constructivism, Critical International Theory, Feminism, Postmodernism.

Concepts: State, state system and non-state actors, Power, Sovereignty, Security: traditional and non- traditional.

Conflict and Peace: Changing Nature of Warfare; Weapons of mass destruction; deterrence; conflict resolution, conflict transformation.

United Nations: Aims, Objectives, Structure and Evaluation of the Working of UN; Peace and Development perspectives; Humanitarian intervention. International law; International Criminal Court

Political Economy of IR; Globalisation; Global governance and Bretton Woods system, North-South Dialogue, WTO, G-20, BRICS.

Regional Organisations: European Union, African Union, Shanghai Cooperation Organisation, ASEAN.

Contemporary Challenges: International terrorism, Climate change and Environmental Concerns, Human Rights, Migration and Refugees; Poverty and Development; Role of Religion, Culture and Identity Politics.

Unit - 6 : India's Foreign Policy

Perspectives on India's Foreign Policy: India's Identity as postcolonial, development, rising power and as emerging political economy

Continuity and change in India's Foreign Policy: Principles and determinants; Non-Alignment movement: historical background and relevance of Non Aligned Movement; India's Nuclear Policy

India's relations with major powers: USA, USSR/Russia, People's Republic of China

India’s Engagement with multipolar world: India’s relations with European Union, BRICS, ASEAN, Shanghai Cooperation Organisation, African Union, Southern African Development Community, Gulf Cooperation Council

India’s relations with neighbourhood: SAARC, Gujaral doctrine, Look Eas t/ Act East, Look West.

India’s Negotiation Strategies in International Regimes: The United Nations, World Trade Organisation, International Monetary Fund, Intergovernmental Panel on Climate Change

Contemporary challenges: maritime security, energy security, environmental security, migrants and refugees, water resources, international terrorism, cyber security

Unit - 7 : Political Institutions in India

Making of the Indian Constitution: Colonialism heritage and the contribution Indian National Movement to the making of the Indian Constitution

Constituent Assembly: Composition, Ideological Moorings, Constitutional Debates

Philosophy of the Constitution: Preamble, Fundamental Rights, Directive Principles

Constitutionalism in India: Democracy, Social Change, National Unity, Checks and Balances, Basic Structure Debate, Constitutional Amendments

Union Executive: President, Prime Minister and Council of Ministers

Union Parliament: Structure, Role and Functioning, Parliamentary Committees

Judiciary: Supreme Court, High Court, Judicial Review, Judicial Activism, Judicial Reform.

Executive and Legislature in the States: Governor, Chief Minister, State Legislature

Federalism in India: Strong Centre Framework, Asymmetrical Federal Provisions and Adaption, Role of Intergovernmental Coordination Mechanisms, Inter-State Council, Emerging Trends.

Electoral Process and Election Commission of India: Conduct of Elections, Rules, Electoral Reforms.

Local Government Institutions: Functioning and reforms.

Constitutional and Statutory Bodies: Comptroller and Auditor General, National Commission for Scheduled Castes, National Commission for Scheduled Tribes, National Commission for Human Rights, National Commission for Women, National Commission for Minorities.

Unit - 8 : Political Processes in India

State, Economy and Development: Nature of Indian State, Development Planning model, New Economic Policy, Growth and Human Development.

Process of globalisation: social and economic implications.

Identity Politics: Religion, Tribe, Caste, Region, Language.

Social Movements: Dalit, Tribal, Women, Farmers, labour

Civil Society Groups: Non-Party Social Formations, Non-Governmental Organisations, Social Action Groups.

Regionalisation of Indian Politics: Reorganisation of Indian States, States as Political and Economic Units, Sub-State Regions, Regional disparities, Demand for New States,

Gender and Politics in India: Issues of Equality and Representation.

Ideology and Social basis of Political Parties: National Parties, State Parties.

Electoral Politics: Participation, Contestation, Representation, Emerging trends.

Unit - 9 : Public Administration

Public Administration: meaning and evolution; public and private administration Approaches: System Theory, Decision Making, Ecological Approach

Public administration theories and concepts: Scientific Management Theory, Rational Choice theory, New Public Administration, Development Administration,

Comparative Public Administration, New Public Management, changing nature of Public Administration in the era of liberalisation and Globalisation

Theories and Principles of Organization: Scientific Management Theory, Bureaucratic Theory, Human Relations Theory

Managing the organization: Theories of leadership and motivation.

Organisational Communication: Theories and Principles, Chester Bernard Principles of Communication, Information Management in the organization

Managing Conflict in the Organization: Mary Parker Follett

Management by Objectives- Peter Drucker

Unit – 10 : Governance and Public Policy in India

Governance, good governance and democratic governance, role of state, civil society and individuals.

Accountability and control: Institutional mechanism for checks and balances, legislative control over executive, administrative and budgetary control, control through parliamentary committees, judicial control over legislature and executive, administrative culture, corruption and administrative reforms

Institutional mechanisms for good governance: Right to Information, Consumer Protection Act, Citizen Charter; Grievance redress system: Ombudsman, Lokpal, Lokayukta

Grassroots Governance: Panchayati Raj Institutions and their functioning

Planning and Development: Decentralised planning, planning for development, sustainable development, participatory development, e-governance; NITI Aayog

Public policy as an instrument of socio-economic development: public policies with special reference to housing, health, drinking water, food security, MNREGA, NHRM, RTE

Monitoring and evaluation of public policy; mechanisms of making governance process accountable: jansunwai, social audit.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – PSYCHOLOGY

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

SYLLABUS FOR Ph.D. ENTRANCE EXAMINATION 2025-26

Paper-1 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.

Paper-2: Cognitive Psychology

1. **Introduction to Cognitive Psychology:-**

Concept of cognitive psychology.

Emergence of cognitive psychology.

a) Early role of psychology
b) The early twentieth century.

Research methods in cognitive psychology.

a) Laboratory or other controlled experiments.
b) Psychological research
c) Self report, case study& Naturalistic observation

Applications of cognitive psychology

2. **Attention and Perception:-**

Attention:-

a) Divided and Selective attention.
b) Vigilance.
c) Signal detection.

Approaches to the study of perception :-

a) Gestalt
b) Physiological(Hebb)
c) Information processing approach.

Theories of attention process.

iv. Applications of:-

a) Subliminal perception.

b) Perceptual defense.

c) Extrasensory 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.

Paper-3: 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.

Paper-4: HEALTHPSYCHOLOGY:

1. HealthPsychology

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, Bio-psychosocial perspectives. Eastern approaches: Zen Buddhism, Concept of sthita projana (Bhagvad Gita), Behavioral 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 behavior; smoking, diet, and sedentary lifestyle), Development of health habits and/or reduction of unhealthy behavior.

4. **Stress, Personality and Social support as Psycho-Social Link ages 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.

Paper-5 : 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.

Paper-6: 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.

Paper-7: Psychological statistics-II

1. Parametric and nonparametric 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

Paper-8: 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 and existential.

Paper-9: PERSONALITY

I. Introduction:

i. Concept and Basic issues of Personality.

ii. Approaches to the study of personality-psychoanalytic approach

3. Determinants of personality- Biological, Psychological and Socio-cultural factors.
4. Personality Assessment–Subjective and projective techniques, self report, personality inventories.

Paper-10: 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

Paper-11: SOCIAL PSYCHOLOGY

(A) Definition of Social Psychology social Psychology as Science

i. Special methods of Social Psychology-

ii. Experimental Method

iii. Participant 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 dissonance theory

Paper-12: 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.

Paper-13: 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.

Paper-14: APPLIED SOCIAL PSYCHOLOGY

UNIT-I: Social perception:

1. Meaning & Nature of social perception
2. Perceptual Accentuation
3. Role of Nonverbal 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.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

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.

.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – SOCIAL WORK

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

Syllabus: Social Work

Unit—I: Basic Concepts of Society

Primary Concepts: Society, Community, Association, Institution, Culture; Basic Social processes: Co-operation, Competition, Conflict, Accommodation, Assimilation, Social Institutions: Marriage, family, Social Groups: Concept and Types, Social Control: Concept, forms, means and Agencies; Socialization: Concept, Theories and Agencies. Social Stratification: Caste and Class.

Unit—II: Dynamics of Personality & Human Behaviour

Personality: Concept, Stages of Development and Types, Determinants; Heredity and Environment theories of Personality: Sigmund Freud, Carl Jung, Alfred Alder, Allport; Socio-Psychological processes: Sensation, Perception, Learning and Socialization. Motivation, Attitudes, Belief, Prejudices; Human Behaviour: Concept and Determinants. Behavioural problems in different stages of personality development. Leadership: Concept, Types and Functions; Concept of Normalcy and Abnormalcy. Etiology of Abnormal Behaviour. Symptoms and Types of Abnormal Behaviour. Psychosis and Psychoneurosis. Management of Mental Disorders.

Unit—III: Theory and Practice of Social Work

Social Work: Concept, Objectives, Nature, Scope & Characteristic; Basic Concepts of Social Work: Social Security, Social Reform, Social Service and Social Development. Social Work and Other Social Sciences; History of Social Work in U.K. History of Social Work in U.S.A. History of Social Work in India; Motives, Principles, Philosophy and Basic Values of Social Work. Social Work as a Profession. Social Work Education, Training and Knowledge; Models Applied in Social Work. Role of Voluntary Social Agencies in Social Work. Radical Social Work

Unit—IV: Social Welfare Services

Concept of Social Welfare. Growth and Development of Social Welfare Services in India; Social Welfare Services Under the Five-Year Plans. Social Welfare Agencies: Government and Non-Government Organizations; Central Social Welfare Board: Structure and Functioning. Administration of Social Welfare Services in India; Social Welfare and Development Programmes: Child Development, Women's Empowerment, Welfare of the Aged. Government measures related to the social welfare of deprived sections of society.

Unit—V: Social Disorganization and Contemporary Social Problems

Social Disorganization: Concept, Causes, Approaches & Types; Concept of Social Problems. Contemporary Indian Social Problems; Alcoholism and Drug Addiction Dowry, Prostitution, Casteism, Communalism, Corruption, Poverty and Unemployment; Juvenile delinquency and Crime; Concept, Theories, Prevention and Control. Changing factors of Crime, White-Collar Crime and Organized Crime. Cyber Crime, Gender based Crime, Crime Against Women; Violence; Forms, Theories and Control Strategies. Social defense; Concept and Scope.

Unit—VI: Methods of Social Work Intervention

Historical Development of Social Case Work. Social Case Work: Meaning, Components, Objectives, Principles, Techniques, Processes, Elements & Recording. Steps & Basic Assumption of Social Case Work. Worker-Client Relationship in Social Case Work & Principles. Approach to Theories of Social Case Work; Historical Development of Social Group Work. Social Group Work: Meaning, Objectives, Principles, Processes, Skill and Role of Group Worker; Programme, Planning and Development, Recording & Evaluation; Community Organization: Meaning, Objectives, Steps, Assumption, Principles, Models and Strategies. Community Organization at different levels. Professional Organizer Role and Skills; Development of Democratic leadership.

Unit—VII: Basic Principles of Social Research

Introduction. Concept, Scope and Types of Social Research. Selection and Formulation of Research Problem; Research Design: Concept, Significance and Types. Concepts, types and significance of Data. Types of research studies. Sampling: Concept, Types and Techniques; Methods of Data Collection. Case Study. Focus Group Discussion. Social Survey, Types and Importance; Processing of Data. Analysis and Interpretation of Data; Report

Writing.

Unit—VIII: Communication and Social Work Practice

Communication: Concept and Definition. Principles and Skills. 7Cs of Effective Communication. Models/Theories of Communication; Forms of Communication; Directions in Communication. Role of communication in social work. Tools and techniques of communication. Communication for assessment and impact. Social Work and Social Sites; Effective writing for the Media. Role of Media in the perception of crisis; Communication Management. Other modes of communication & their role: puppets, songs, folklore, street theatre, posters, exhibitions.

Unit—IX: Social Policy, Planning and Development

Social Policy; Concept, Aims, Objectives and fields. Inter relation between Social Policy, planning and Development. Social Policy and Indian Constitution. Approaches and Models of Social Policy. The Process of Social Policy Formulation. Social Planning; Concept, Objectives, Scope, Models, Interrelationship between Social and Economic Planning. Social Planning in India: Five Years Plans. NITI Aayog. Social Planning and Social Change. Factors to Development of Planning in India. Development; Positive and Negative Dimensions. 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, Thoughts of Gandhi, Vinoba and Jai Prakash Narayan. Gandhi and Professional Social Work. Approaches to Social Development; Similarities and Differences.

Unit—X: Social Welfare Administration and Social Action

Social Welfare Administration; Concept, Nature, Objectives, Characteristics and Principles. Social Welfare Administration; Policy Making and Planning; Problems of Social Welfare Administration in India. Function of Social Welfare Administration. Central Social Welfare Board. Panchayati Raj System; Social Action; Concept, Objectives, Principles, Strategies. Model of Social Action. Forms of Social Action. Eradication of Major Social evils – Dowry, Child Marriage, Child Prostitution, Child Labour, Domestic Violence; Mobilization and Organization of People; Problems and Approaches. Levels, Methods and Importance of Social Action. Social Advocacy and Use of Social Action in Social Work.; Similarities and Differences.

Unit—XI: Social Statistics and Computer Application

Introduction. Statistics: Meaning, Uses and Limitations, Use of Statistics in Social Work Research. Measures of Central Tendency. Sampling. Data Summarization & Analysis. Use of Computers in Research. Use of AI in Social Work. Introduction to software used in social science research; Uses of SPSS Package in Data Analysis for Social Work.

Unit—XII: Rural Development

Characteristics Features of Indian Rural Community. Rural Institution: Family, Marriage and Caste, Caste Panchayat. Panchayati Raj Institution: Village Panchayat, Kshetra Panchayat & Zila Panchayat.; Managerial Economic and Rural Marketing. NGO, Project Management and Local Governance. Rural Entrepreneurship Development, Rural Financing, Cooperative Management, Strategic Growth Perspective; Natural Resource Management, Environment & Right to Information Act; People's Participation in Rural Development. Role of District Rural Development Agency (D.R.D.A.). Role of District Planning & Development Committee (D.P.D.C.). Role of Co-Operative, Commercial Bank. National Bank for Agriculture and Rural Development (N.A.B.A.R.D.). Role and Function of Block Development Officer; Rural Development Programs. Land Ownership and Land reforms in India. Rural Planning and Reconstruction.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – ANTHROPOLOGY

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

Department of Anthropology
HNB Garhwal University, Srinagar (Garhwal)

Syllabus for PhD Entrance Examination 2026

Biological Anthropology
Unit I: Biological/Physical Anthropology: Meaning and Scope. Difference in the Approaches of Modern and Traditional Biological Anthropology with Emphasis on Human Evolution.The Rise of Evolutionary Biology: Meaning of Evolution, A Short History of Evolutionary Biology: Evolution before Darwin, Charles Darwinian and Natural Selection, The Modern Synthesis.
Unit II: Mechanism (forces) of Evolution: Natural Selection, Genetic Drift, Gene Flow, Mutation, Non-random Mating; Evidence of Evolution: Fossil Record, Comparative Anatomy, Embryology, Biogeography, Molecular Biology.
Unit III: Processes of Evolution: Speciation, Adaptation, Convergent Evolution, Divergent Evolution, Coevolution; Levels of Evolutionary Study: Microevolution, Macroevolution, Developmental Biology, Population Genetics, Phylogenetics

Social-cultural Anthropology
Unit I: Meaning of social and cultural anthropology; nature of the domain of social and cultural anthropology; Relationship of social-cultural anthropology with history, economics, psychology, linguistic, political science & sociology.
Unit II: Define & distinguish: Material & Non-material Culture, Ethnocentrism & Cultural Relativism, Etic and Emic Perspectives;Social Change: meaning, factors of social change, theories of social change.
Unit III: Approaches to the study of Indian society, culture and civilization: Indological, Anthropological and Historical; Indian Caste System; Social Groups-primary, secondary and tertiary; Communities-rural and urban.
Unit IV: Social Organization of Jaunsaris/Tharus/Bhotias/Buxsas/Rajis (One from the tribes of Uttarakhand).

Archaeological Anthropology
Unit-I: Introduction to archaeological anthropology. Definition, Scope and relationship with other allied branches.
Unit-II: Dating methods: Principles of Archaeology-Stratigraphy, Typology and Technology, Associated finds and State of Preservation.
Unit-III: Geological Time-Scale, Archaeological Sites, Relative and Chronometric dating. Tool typology and salient features of Lower, Middle and Upper Palaeolithic culture. Neolithic Culture of India.

Palaeoanthropology
UnitI: Introduction to Palaeoanthropology -Definition, aim and scope. Relation of Palaeoanthropology with other disciplines. Geological Time Scale with stress on Cenozoic era.
UnitII: Rules of Taxonomy and nomenclature. Siwaliks nomenclature, Stratigraphy, fauna and flora and Palaeoanthropological significance of Siwaliks.
Unit III: Mio-Pliocene Hominoids. Diagnosis, description and distribution through time and, *Sivaladapis*, *Sivapithecus* and *Gigantopithecus*.

Human Genetics
Unit I: Human Genetics: Definition and Scope; Genes and Genomes; Levels of Genetics and Genomics; Application of Genetics and Genomics. Cell Structure and Organelles, Cell Division.
Unit II: Structural and Chemical Basis of Genetics: Chromosome, DNA, RNA and Genes. Molecular

and Mendelian Inheritance: Inheritance by DNA, Mechanism of Information Inheritance by DNA
Unit III: Mendelian Inheritance of Genes; Single and Multiple Gene Inheritance, Universality of Mendelian Principles in Man, Dominant and Recessive Inheritance; Non-Mendelian Inheritance, Sex-limited, Sex-influenced Inheritance.Chromosomal Aberration and Anomalies. Methods of Genetic Study

Tribal Cultures of India
Unit I: Concepts of tribe and debates centering around the various concepts of tribe, general and specific characteristics of tribes, tribes in India: antiquity, historical, academic, administrative and anthropological importance, de-notified tribes.
Unit II: Tribe-caste continuum, constitutional safeguard/provisions, regional and linguistic distribution of tribes in India.
Unit III: Classification of tribes based on their economy, occupation and religion, racial elements among the tribes, scheduled and non-scheduled categories of tribes.
Unit IV: Forest policies and tribes, migration and occupational shift, tribal arts and aesthetics, displacement, rehabilitation and social change, globalization among Indian tribes.

Human Evolution
UnitI: Primate: emergence and evolution, erect posture and bipedalism. Early pre-homonids-classification distribution and diagnosis of- *Sahelanthropus tchadensis*, *Orrorintugenensis*, and *Ardipithecus ramidus*. Distribution and general features of *Australopithecus africanus*.
UnitII: Early Homo - *Homo habilis*, *Homo erectus* (Africa, Java, Peking). Distribution and characteristic feature of Narmada Man (Asia)
Unit III: Emergence of *Homo neanderthalensis* distribution and salient features. Emergence of modern humans distribution and general characteristic features.

Anthropological Theories
Unit I: History of Anthropological Thought: Classical Schools, Pioneers in Anthropology, Evolutionism- Herbert Spencer, Lewis Henry Morgan, Edward Burnett Tylor; Neo-evolutionism- V. Gordon Childe, Leslie White, Julian Steward.
Unit-II: Historical Particularism: Franz Boas, Clarke Wissler; Diffusionism: British School- Elliot Smith, W.H.R. Rivers; German School-Wilhem Schmidt, Fritz Graebner; American School- Clark Wissler, Alfred Kroeber.
Unit III: Functionalism: Conceptual, Theoretical and Methodological Contributions of Bronislaw Malinowski, Robert K. Merton; Structural-functionalism- Radcliffe Brown, Evans Pritchard, Raymond Firth; Structuralism- Levi-Strauss, Edmund Leach.
Unit IV: Culture and Personality Studies: Abram Kardiner, Ruth Benedict, Cora-du-Bois, Margaret Mead, Melford E. Spiro, Mary Douglas, Stephen Taylor.

SCHOOL OF LIFE SCIENCES

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – BIOTECHNOLOGY

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

PhD Entrance Examination Syllabus (Biotechnology)

(Based on M.Sc. Biotechnology Curriculum)

Biochemistry

Biomolecules (carbohydrates, proteins, lipids, nucleic acids); Structure and function of biomolecules; Enzymes – classification, kinetics, Michaelis-Menten equation, enzyme inhibition and regulation; Bioenergetics and thermodynamics; Metabolism of carbohydrates (glycolysis, gluconeogenesis, glycogen metabolism, TCA cycle, pentose phosphate pathway); Lipid metabolism (β-oxidation, fatty acid synthesis, cholesterol metabolism); Amino acid metabolism and urea cycle; Nucleotide metabolism (purine and pyrimidine biosynthesis and degradation); Oxidative phosphorylation and electron transport chain.

Cell Biology

Structure and function of biological membranes; Membrane transport (active, passive, ion channels, pumps); Cell organelles (nucleus, mitochondria, ER, Golgi, lysosome, peroxisome); Cytoskeleton (microtubules, microfilaments, intermediate filaments); Cell signaling pathways (GPCR, receptor tyrosine kinase); Cell cycle and its regulation; Mitosis and meiosis; Apoptosis; Cancer biology (oncogenes, tumor suppressor genes); Membrane biophysics (diffusion, osmotic pressure, electrochemical gradients, action potential).

Molecular Biology & Genetics

DNA structure and topology; DNA replication (prokaryotic and eukaryotic); Transcription and RNA processing; Translation and genetic code; Gene regulation (lac operon, trp operon); DNA damage and repair mechanisms; Mendelian genetics and inheritance patterns; Linkage, recombination and gene mapping; Chromosomal organization (euchromatin, heterochromatin); Chromosomal aberrations; Sex determination.

Immunology

Innate and adaptive immunity; Cells and organs of immune system; Antigens and antibodies; Immunoglobulin structure and diversity; Major Histocompatibility Complex (MHC); Antigen processing and presentation; Cytokines and complement system; Cell-mediated and humoral immune response; Hypersensitivity and autoimmunity; Vaccines and immunization; Monoclonal antibodies and hybridoma technology; Immunological techniques (ELISA, Western blot, immunofluorescence).

Microbiology & Microbial Genetics

Classification of microorganisms (bacteria, fungi, viruses); Microbial structure and function; Growth kinetics and factors affecting growth; Culture, types of media and sterilization techniques; Microbial metabolism and nutrition; Nitrogen fixation; Genetic recombination in bacteria (conjugation, transformation, transduction); Bacteriophage genetics (lytic and lysogenic cycles).Microbial growth kinetics; Fermentation types (batch, fed-batch,

continuous); Bioreactors and their design; Sterilization in bioprocess; Downstream processing (filtration, centrifugation, extraction, chromatography); Industrial production of enzymes, antibiotics and biomolecules.

Genetic Engineering & Biotechnology Tools

Recombinant DNA technology; Cloning vectors (plasmids, phages, cosmids, BAC, YAC); Restriction enzymes and ligases; Gene cloning strategies; PCR and real-time PCR; DNA sequencing methods; Blotting techniques (Southern, Northern, Western); DNA fingerprinting and profiling; Site-directed mutagenesis; Transgenic organisms; Gene therapy; Genome editing technologies (CRISPR-Cas).

Bioanalytical Techniques

Chromatography (paper, TLC, HPLC, affinity, ion-exchange, gel filtration); Electrophoresis (PAGE, SDS-PAGE, IEF); Centrifugation (differential, density gradient); Microscopy (light, fluorescence, electron, confocal); Spectroscopy (UV-visible, IR, NMR, ESR); X-ray crystallography; Radioisotope techniques.

Plant Biotechnology

Plant tissue culture techniques (callus culture, organogenesis, somatic embryogenesis); Micropropagation; Totipotency; Protoplast fusion; Production of secondary metabolites; Genetic transformation in plants; Transgenic plants; Germplasm conservation. Applications of plant biotechnology for crop improvement.

Environmental Biotechnology

Bioremediation; Wastewater treatment; Environmental pollution control; Microbial applications in environment; Biogeochemical cycles.

Biostatistics & Bioinformatics

Statistical methods (mean, median, standard deviation, variance); Probability, Biological databases (GenBank, EMBL, PDB, UniProt); Sequence alignment (BLAST, FASTA); Phylogenetic analysis; Protein structure prediction and molecular modeling; Bioinformatics tools and applications.

Advanced & Interdisciplinary Topics

Epigenetics (DNA methylation, histone modification); Cancer biology; Genomics and proteomics; Nanobiotechnology; Immunotechnology; Molecular virology; Vaccines and drug development; Bioethics and intellectual property rights;

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – BOTANY

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

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

University Entrance Examination
[Ph.D. 2025-26]
Syllabus
Botany

Cryptogamic botany

Algal Classification, Importance of Flagellation, Pigmentation, and storage products in classification, General characteristics of Major algal classes, Evolutionary tendencies, Comparative account of reproduction and life history types of algal classes: Chlorophyceae, Phaeophyceae, Rhodophyceae and Cyanophyceae

Fungal classification, General characteristics of Major classes of Fungi, Comparative account of structure, reproduction and life cycle types of major fungal classes., Parasexuality in Fungi, Fungal Hormone and Economic importance of Fungi, Symbiotic associations: Biology and Significance of Lichens and Mycorrhiza

General Characteristics and Classification of Bryophyta, Life histories of bryophytes with reference to *Cyathodium*, *Notothylus*, *Sphagnum* and *Polytrichum*, Evolutionary significance of sporophytes in Bryophyta, Significance of anhydrobiosis in bryophytes, Ethnomedicinal values of bryophytes

General Characteristics and Classification of Pteridophyta, Life history of *Psilotum*, *Lycopodium*, *Isoetes*, *Adiantum* and *Marsilea*, General account on stelar evolution in Pteridophyta, Telome theory and evolutionary significance of heterospory, Palaeobotany: types of fossils and the importance of Palaeobotany

Phanerogams

Salient features of Gymnosperms, General account of morphology and reproduction of the following: *Cycas, Pinus*, *Zamia*, *Ginkgo*, *Taxus* and *Gnetum,* General account of *Williamsonia* and *Pentoxylon,* Phylogenetic trends in Gymnosperms*,* Distribution of living Gymnosperms in India

Classification of Angiosperms (Bentham and Hooker and Hutchinson) and general account of numerical taxonomy and chemotaxonomy, ii. Distinguishing characters of the following families and their economic importance: Ranunculaceae, Brassicaceae, Solanaceae, Meliaceae, Combretaceae, Rubiaceae, Convolvulaceae, Scrophulariaceae, Verbenaceae, Polygonaceae, Lauraceae, Zingiberaceae, Arecaceae, Cyperaceae, Poaceae, Embryology: General account of polyembryony, apomixis and experimental embryology with reference to anther and embryo culture

Reproductive Biology, Morphogenesis and Tissue Culture

Microsporogenesis; Cytoplasmic reorganisation during microsporogenesis, Pollen wall and Pollen morphogenesis, Development of male gametophyte, ultrastructure, abnormal male gametophyte, Pollen germination, Megasporogenesis: Development of the embryo sac, subcellular details of constituent cells and their function, major types, Pollen-pistil interaction: Role of pollen wall proteins and stigma surface proteins, pollen tube growth in pistil, fertilization and apomixes; Endosperms functions; Dicot and Monocot embryo, Polyembryony; Embryology in relation to Taxonomy

Morphogenetic phenomenon: Symmetry and polarity, concepts of cell differentiation and totipotency; Plant cell and tissue culture: General introduction, history and scope; Tissue culture techniques and culture media; Experimental embryology, anther, ovary and endosperm culture; somatic embryogenesis and androgenesis

Somatic hybridization: Protoplast isolation, culture and regeneration, Somatic hybridization and hybrid selection; Possibilities, achievements and limitations of protoplast research; Applications of plant tissue culture: clonal propagation, artificial seed, production of hybrids and soma clones, production of secondary metabolites/ natural products; Cryopreservation and germplasm storage

Basic principles of plant breeding, basics of plant health management: Modes of infection, Host-pathogen interaction: toxins and enzymes, Defence mechanisms in plants Environmental variables regulating disease development, transmission and spread of plant diseases. Principles of plant disease control: cultural control, chemical control, biological control and integrated disease management. Molecular aspects of host-pathogen interactions - PR proteins, degradation of phytoalexins, systemic resistance mechanism.

Plant Ecology and Environmental Studies

Biotic and abiotic components of the environment, primary productivity, trophic levels, ecological niche, ecological pyramids and ecological energetics. Biogeochemical cycles: Carbon, nitrogen and phosphorous cycles. Population ecology: Definition, population characteristics, growth curves, carrying capacity and population fluctuation. Community ecology: Structure and community characteristics, quantitative, qualitative and synthetic features, life forms, biological spectrum and ecological succession. Basic concepts environment and issues, global environmental problems - Ozone depletion, UV-B, greenhouse effect and acid rain due to anthropogenic activities, their impact and biotechnological approaches for management. Environmental pollution - types of pollution, sources of pollution, measurement of pollution, methods of measurement of pollution, fate of pollutants in the environment, bioconcentration, bio/geo magnification.

Plant Physiology

Concept of water potential, diffusion, osmosis and imbibition. Life-giving unique properties of water. 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. Energy flow: Principles of thermodynamics, free energy and chemical potential, redox reactions, structure and functions of ATP.
Fundamentals of enzymology: General aspects of enzymes, allosteric mechanism, regulatory and active sites, isozymes, kinetic catalysis, Michaelis-Menton equation and its significance.

Photosynthesis: General Concepts, photosynthetic pigments and light-harvesting complexes, photolysis of water, light reaction, Z scheme and photophosphorylation, mechanism of electron transport, carbon assimilation – the Calvin cycle, photorespiration and its significance, the C4 cycle, the CAM pathway, and factors of photosynthesis.
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, and photorespiration.

Nitrogen and sulphur metabolism: Overview, biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and assimilation, sulfur uptake, transport and assimilation.
Secondary metabolites and plant defence: Cutin, Waxes and Suberin; Secondary metabolites: Terpenes, Phenolic compounds, and Nitrogen-containing compounds

History of the 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.

Principles of plant Response to Environment, Plant stress, Abiotic and Biotic stress, Drought stress, Heat stress and heat shock, Chilling and freezing, Salinity stress, and Oxidative stress

Plant Biochemistry and Plant Molecular Biology

Basics of biochemistry, Structure and properties of water; pH and buffers.

Biomolecules: carbohudrates, Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides. Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quarternary; Protein denaturation and biological roles of proteins. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of DNA; Types of RNA; Structure of tRNA. Enzyme structure and classification, mechanism of action, Michaelis-Menten equation, and factors affecting enzyme activity. Nucleic acids: Carriers of genetic information, Types of DNA, Types of genetic material, The Nucleosome Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin. Mechanism of

Transcription: Translation, transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing, Gene expression, Regulation of gene expression: Lac operon and Tryptophan operon. The replication of DNA, Chemistry of DNA synthesis, semi-conservative and semi-discontinuous replication, RNA priming, replication of linear ds-DNA, replication of the 5’end of linear chromosome, Enzymes involved in DNA replication. Adaptor hypothesis and discovery of mRNA template, Principles of transcriptional regulation. Ribozymes; RNA editing and mRNA transport.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – MICROBIOLOGY

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

Microbiology

- **Microbial Diversity:** History and scope of Microbiology, Diversity of Microbial World, Archaebacteria and Eubacteria, Gram positive and Gram-negative bacteria. Study of Fungi, Microalgae, Protozoans and Viruses. Microbial growth phases, measurement of growth, Microbial growth kinetics.
- **Microbial and Molecular biology techniques:** Bacterial enumeration; Colony counter, Spectrophotometer, Sterilisation; Autoclave, Hot Air Oven, Laminar Air Flow, Light and Electron Microscopy, Centrifugation, Chromatography, Electrophoresis (Agarose, PAGE: types and application, Spectrometric techniques. Cloning and expression vectors, Enzymes used for recombinant DNA technology, Cloning strategies, DNA polymerases, PCR, DNA sequencing methods (Sanger's method, Maxim-Gilbert's method, NGS methods), preparation of genomic libraries, genetic markers and marker-assisted selection, RDT-based products; Insulin, Streptokinase.
- **Biochemistry of Microbes-** Carbohydrates, Proteins, Lipids, Nucleic acids, Genetic code, Vitamins, Enzymes, Enzyme kinetics, Enzyme assays.
- **Microbial Physiology:** Water relations, Cell Membrane, Oxygenic and Anoxygenic Photosynthesis, Respiration: Aerobic, anaerobic and fermentation, Alcoholic, and Lactic acid fermentation. Stress response in microbes.
- **Food Microbiology:** Food preservation methods; High temperatures, drying, Canning, food additives, chemicals and radiation. Preservation of milk; maintenance of food hygiene. Fermented food products: Cheese, Yogurt, Sauerkraut, Kemchi, Ketchup, Idli, Dosa.
- **Microbial interactions:** Mutualism, Synergism, Commensalism, Competition, Ammensalism, parasitism; Microbe-Plant interaction: positive-negative interaction; Microbe-Animal interaction: positive-negative interaction.
- **Biogeochemical cycles:** Nitrogen, Sulphur, Carbon and Phosphorus cycles. Microbial Bioremediation and Bioleaching. Biofertilizer: Bacterial, Fungal, Phosphate solubiliser, BGA & associative, Mycorrhiza (types and its applications).
- **Air, Water, and Food borne microorganisms:** *Staphylococcus aureus*, *Clostridium botulinum*, *Vibrio cholerae*, *Escherichia coli*, *Salmonella*, *Mycobacterium, SARS and Hepatitis* infections. Toxins of food-borne pathogenic bacteria and fungi.
- **Microbial Genetics:** Elements of microbial genetics and various horizontal gene transfer mechanisms; Transformation; Conjugation; Transduction, Modern concept of gene structure and gene regulation in Prokaryotes. Mutations, mutagens, and Mutation Repair Mechanisms, Transposition, Prokaryotic Vs Eukaryotic – Replication, Transcription, Translation, and Gene regulation,
- **Cell Biology:** Ultrastructure of microbial cell (Bacteria, fungi, and viruses), Structure, function and composition of biological membranes, Cell cytoskeleton, cell-cell junctions, cell signaling and cellular transport, vesicular transport, cell cycle and its control, programmed cell death and its different types
- **Genomics and Proteomics:** Genome size and complexity; Repetitive DNA content of genome; Introduction to gene networks and epigenetic analysis, transcriptomics and Techniques used for transcript mapping, protein PTM analysis, protein-protein interactions.

- **Industrial Microbiology:** Basic design of fermenter, different types of fermenters/bioreactors, types of fermentation processes, microbial strain improvement, scale-up and scale down, upstream and downstream processing.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – BIOCHEMISTRY

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

Department of Biochemistry
School of Life Sciences

Basic Biochemistry

Fundamental principles governing life, including the organization of biomolecules into supramolecular structures and the significance of weak non-covalent interactions such as hydrogen bonding, van der Waals forces, ionic interactions, and hydrophobic interactions in biological systems. Structure and physicochemical properties of water, ionization of water, acid–base concepts, pH, and biological buffer systems. Structure–function relationships in biomolecules.Thermodynamic principles in biological systems, including laws of thermodynamics, free energy, entropy, and equilibrium.Structure, classification, properties, and biological functions of carbohydrates, amino acids, proteins, lipids, and nucleic acids.

Intermediary Metabolism

The living cell as a dynamic chemical system, including biochemical reaction types, bioenergetics, nutrient bioavailability, membrane transport mechanisms, and signal transduction pathways. Concepts of catabolism and anabolism, compartmentalisation of metabolic pathways, and metabolic specialisation of major organs.

Carbohydrate metabolism, including glycolysis, gluconeogenesis, the TCA cycle, and glycogen metabolism, along with their regulation. Mechanisms of energy transduction, electron transport chain, oxidative phosphorylation, and ATP synthesis.

Lipid metabolism, including fatty acid oxidation, ketone body metabolism, fatty acid biosynthesis, and cholesterol metabolism. Amino acid metabolism, including transamination, deamination, the urea cycle, and biosynthetic pathways, along with their role as metabolic precursors.

Nucleotide metabolism involving biosynthesis and degradation of purine and pyrimidine nucleotides. Integration and hormonal regulation of metabolism, along with metabolic disorders and inborn errors of metabolism.

Enzymology

General properties, classification, and nomenclature of enzymes, including ribozymes, isozymes, and abzymes, along with enzyme compartmentalization in cells. Methods for extraction, purification, and assay of enzymes, including measurement of enzyme activity.

Mechanisms of enzyme action, enzyme specificity, catalytic strategies, and enzyme promiscuity. Role of cofactors and coenzymes, metalloenzymes, and active site architecture including binding and catalytic sites.

Enzyme kinetics including Michaelis–Menten kinetics, Lineweaver–Burk and Eadie–Hofstee plots, and analysis of kinetic data. Reversible and irreversible inhibition and their applications.

Allosteric enzymes and regulatory mechanisms, feedback inhibition, and covalent modification. Industrial and clinical applications of enzymes, including immobilization and large-scale production.

Molecular Biology

Structure and physicochemical properties of nucleic acids, DNA supercoiling, and genome organization in prokaryotes and eukaryotes, including chromatin structure and repetitive DNA.

DNA replication, enzymes involved, replisome organization, inhibitors, and DNA repair mechanisms. Transcription including initiation, elongation, termination, RNA processing, RNA interference, and RNA editing.

Translation including ribosome structure, genetic code, aminoacyl-tRNA synthetases, and stages of protein synthesis, along with inhibitors. Post-translational modifications, protein targeting, and turnover.

Regulation of gene expression in prokaryotic and eukaryotic systems. Recombinant DNA technology including cloning vectors, gene cloning, mutagenesis, and transgenesis. DNA sequencing (Sanger and high-throughput methods) and molecular techniques such as PCR and electrophoresis.

Techniques in Biochemistry

Principles and applications of chromatographic techniques including TLC, HPLC, GC, ion-exchange, affinity, and gel filtration chromatography. Electrophoretic techniques including SDS-PAGE, native PAGE, and 2D electrophoresis.Centrifugation techniques including differential and density gradient centrifugation. Spectroscopic methods including UV-Vis, fluorescence, IR, NMR, ESR, and X-ray crystallography.Mass spectrometry techniques including LC-MS, GC-MS, MALDI-TOF, and their applications in proteomics and metabolomics. Microscopy techniques including light, fluorescence, confocal, and electron microscopy, along with flow cytometry.Tracer techniques involving radioisotopes, autoradiography, and scintillation counting. General molecular and analytical techniques including PCR and cryopreservation.

Plant Biochemistry

Structure and function of plant cells and organelles, including chloroplast structure and photosynthetic pigments. Light reactions and carbon fixation pathways (C3, C4, CAM), photorespiration, and carbohydrate interconversion.Phytohormones and their mechanisms of action. Plant secondary metabolites, including phenolics, terpenoids, and alkaloids. Plant responses to biotic and abiotic stress and defence mechanisms.

Nutritional Biochemistry

Principles of human nutrition, balanced diet, and composition of foods. Digestion, absorption, and metabolism of nutrients, along with gastrointestinal physiology and

microbiota.Biochemical roles of macronutrients and micronutrients, including vitamins, minerals, and phytonutrients. Nutraceuticals, probiotics, prebiotics, and antinutritional factors.Bioavailability of nutrients, protein quality, and effects of processing and storage. Malnutrition including protein-energy malnutrition and micronutrient deficiencies.

Clinical Biochemistry

Principles of clinical laboratory practice including quality control, sample handling, and interpretation of biochemical data.Disorders of carbohydrate metabolism including diabetes mellitus and diagnostic markers such as glucose tolerance tests and HbA1c. Lipid disorders and cardiovascular risk assessment.Liver and kidney function tests, protein metabolism disorders, and enzymology in diagnosis. Hormonal regulation and endocrine disorders. Acid–base balance, electrolyte homeostasis, and related disorders. Inborn errors of metabolism and cancer biomarkers.Clinical immunodiagnostics including ELISA, RIA, and chemiluminescence assays.

Microbiology

Classification and diversity of microorganisms including bacteria, viruses, fungi, and protozoa. Microbial structure, growth kinetics, and metabolism.Sterilization, disinfection, and aseptic techniques. Bacterial genetics and gene transfer mechanisms. Virology including structure, replication, and host interactions.Host–microbe interactions, pathogenicity, and antimicrobial resistance.

Biotechnology

Principles and applications of biotechnology, including genetic engineering and recombinant DNA technology.Gene cloning, vectors, gene libraries, and expression systems. Protein expression and purification.Genomics, proteomics, and high-throughput technologies. Genome editing using CRISPR/Cas systems (basic concepts).Bioprocess technology, including fermentation and downstream processing. Applications in medicine, agriculture, industry, and the environment.Biosafety, bioethics, and intellectual property rights.

Immunology

Organisation of the immune system, including innate and adaptive immunity. Structure and function of antigens and antibodies, antigen–antibody interactions, affinity, and avidity.Major Histocompatibility Complex (MHC) and antigen presentation. Humoral and cell-mediated immune responses, cytokines, and immune signalling.Hypersensitivity, autoimmunity, and immunodeficiency disorders. Vaccines, immunisation strategies, monoclonal antibodies, and therapeutic immunology.Immunological techniques include precipitation and agglutination reactions, immunodiffusion, immunoelectrophoresis, ELISA, RIA, Western blotting, immunofluorescence, flow cytometry, and immunohistochemistry.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – HIMALAYAN AQUATIC BIODIVERSITY

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

DEPARTMENT OF HIMALAYAN AQUATIC BIODIVERSITY
Hemvati Nandan Bahuguna Garhwal University, Srinagar (Garhwal), Uttarakhand
Ph.D. Entrance Examination Syllabus (2025-26)

UNIT 1: ECOLOGY AND BIODIVERSITY

I. Fundamentals of Ecology

- Definition, scope, and principles of ecosystem stability.
- Resistance and resilience in aquatic systems.
- Ecological Law: Liebig's Law of the Minimum and Shelford's Law of Tolerance.
- Ecological amplitude, phenotypic plasticity, and ecotypes.

II. Population Ecology

- Concepts of populations and metapopulations.
- Population growth models: Geometric, exponential, and logistic.
- Selection strategies: r- and K-selection.
- Life tables, age-specific survival, and fecundity.

III. Community Ecology and Biodiversity

- Species composition, diversity, and biomass.
- Community interactions: Mutualism, symbiosis, predation, and competition.
- Keystone species and their role in aquatic habitats.
- Ecological succession: Primary and secondary succession in aquatic systems.
- Biodiversity levels: Genetic, species, and ecosystem diversity.

UNIT 2: ENVIRONMENTAL SCIENCE AND POLLUTION

I. Atmospheric and Climate Science

- Atmospheric structure and global temperature patterns.
- Global energy budget and radiative forcing.
- Greenhouse effect and Global Warming Potential (GWP).
- Atmospheric circulation: Coriolis force and pressure gradients.

II. Aquatic Pollution and Ecotoxicology

- Classification of pollutants: Heavy metals, pesticides, and microplastics.

- Fate and transport of pollutants in aquatic food chains.
- Principles of bioaccumulation, bioconcentration, and biomagnification.
- Toxicology basics: Dose-response relationships, LD50, and LC50.

III. Environmental Impact and Assessment

- Ozone layer depletion: The Chapman cycle and the Montreal Protocol.
- Ecotoxicological risk assessment and sentinel species.
- Bioindicators of aquatic pollution.

UNIT 3: AQUATIC ECOSYSTEM AND BIODIVERSITY

I. Freshwater Systems (Lentic and Lotic)

- Lentic systems: Lake morphometry, thermal stratification, and seasonal mixing.
- Lotic systems: River geomorphology, stream order, and the River Continuum Concept.
- Zonation: Littoral, limnetic, and profundal zones in lakes.

II. Aquatic Biological Communities

- Plankton: Phytoplankton and zooplankton diversity and dynamics in Himalaya.
- Benthos: Classification and role in the food web.
- Nekton: Fish diversity and adaptations to aquatic life.
- Wetland ecosystems: Classification (riverine, lacustrine, palustrine).

III. Aquatic Microbiology

- Classification and zonation of microbiota in fresh and marine water.
- Role of microbes in biogeochemical cycles (Carbon, Nitrogen, Phosphorus, Sulphur).
- Microbial biofilms and their ecological significance.

UNIT 4: GLOBAL ENVIRONMENTAL ISSUES AND POLICIES

I. Global Environmental Challenges

- Climate change evidence: Paleoclimatology and isotopic records.
- Impacts of climate change on aquatic biodiversity and water security.
- Carbon sequestration and the role of aquatic ecosystems.

II. International Policies and Mechanisms

- The Role of IPCC and international climate agreements.
- Kyoto Protocol, REDD+, and the Clean Development Mechanism (CDM).
- Global initiatives for biodiversity conservation.

III. National Regulatory Framework (India)

- Water (Prevention and Control of Pollution) Act.
- Biological Diversity Act (2002) and Plastic Waste Management Rules.
- Environmental Impact Assessment (EIA) for hydropower and aquatic projects.

UNIT 5: HIMALAYAN AQUATIC ECOSYSTEM AND BIODIVERSITY

I. Geomorphology and Hydrology of the Himalayas

- Origin and tectonic history of the Himalayas.
- Inventory of Himalayan glaciers.

II. Freshwater Fish and Invertebrate Faunaof Himalaya

- Benthic Macro-invertebrates: Taxonomy of Ephemeroptera (Mayflies), Plecoptera (Stoneflies), and Trichoptera (Caddisflies) in Himalayan streams.
- Taxonomy and ecology of Himalayan Fresh Water Fish
- Spawning grounds and migratory pathways of fish in Himalayan rivers.

III. Regional Biodiversity and Biogeography

- Biogeographic zones of the Himalayas.
- Endemism and characteristic flora/fauna of Himalayan rivers and lakes.
- High-altitude wetlands and glacial lakes: Ecology and importance.

IV. Threats and Conservation in the Himalayas

- Anthropogenic impacts: Dams, river valley projects, and water diversion.
- Geo-ecological problems: Landslides, flash floods, and their impact on biodiversity.
- Conservation strategies: Habitat restoration and community-based management in Uttarakhand.
- Impact of climate change specifically on Himalayan aquatic biota.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – ZOOLOGY

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

- Animal Diversity
- Cell Biology
- Molecular Biology
- Animal Physiology
- Biochemistry
- Applied Zoology
- Ecology
- Wild Life Conservation
- Genetics
- Evolution
- Taxonomy
- Animal Behaviour
- Endocrinology
- Developmental Biology
- Biotechniques
- Immunology
- Microbiology

ZOOLOGY

Animal Diversity:

Non-chordates: General characters, salient features and classification of Protozoa, Porifera, Coelenterate, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca & Echinodermata. Locomotion & nutrition in Protozoa. Canal system & skeletal elements in Porifera. Polymorphism in coelenterates. Morphology, reproduction (life cycle) and parasitic adaptation in *Taenia,* Ascaris and Hirudinaria. Coelom and Segmental organs in annelids. Organization and Affinities of Onychophora. Torsion, Pearl formation in mollusca. Water vascular system in Echinodermata. Larval forms in Crustacea, Molusca & Echinodermata

Chordates: General characters and outline classification of chordates. General characters and classification of protochordates, Pisces, Amphibians, Reptiles, Aves and Mammals up to order level. Affinities of Hemichordata, Urochordata & Cephalochordata. Retrogressive metamorphosis in urochordates. Comparision between Chondrichthyes and Osteichthyes; Dipnoi; Scales and fins of fishes. Parental care in amphibians. General features of poisonous and non-poisonous snakes. Adaptive radiation in reptiles and mammals. Arial adaptations in birds. Migration in Birds. Characters and affinities of Ratitae. Palate in birds. Aquatic and Flying adaption in Mammals

Cell Biology:

Comparison of a generalized Pro- & Eukaryote cell. Structure & function of plasma membrane, Liposomes. Cell organelles constituting endo-membrane system (Endoplasmic reticulum, Golgi complex, Lysosome, Peroxisome); Nucleus & Nucleolus; Ribosome; Mitochondria; Introduction to cytoskeleton. Cell cycle and its regulation; Mitosis & Meiosis. Signal transduction, Cell signaling-types of signaling. Apoptosis

Molecular Biology:

Structure and types of DNA; Replication of DNA in prokaryotes and eukaryotes: DNA polymerases; primosome, replisome, Rolling circle replication, Eukaryotic chromosome replication DNA damage and repair: Causes and types of DNA damage, mechanism of DNA repair: Structure and types of RNA: Transcription in prokaryotes and eukaryotes**.** Regulation of gene expression and translation in prokaryotes. Operon concept, Genetic code and its characteristics.

Animal Physiology:

Physiology of respiration-Exchange of respiratory gases at the pulmonary surface. Transport of respiratory gases by blood. Factors affecting oxyhaemoglobin dissociation; Neural & Chemical Control of Respiration, Physiology of Digestion & Absorption- Functional anatomy of gastrointestinal tract. Gastrointestinal motility and its regulation. Secretions of the gastrointestinal tract. Liver and biliary system. Mechanical & chemical digestion and absorption of food; Structure and types of neurons. Ultra-structure of skeletal muscle; Physiology of muscle contraction. Functional anatomy of Kidney and mechanism of urine formation; Functions of aldosterone, antidiuretic hormone and renin-angiotensin system in renal physiology. Osmoregulation. Thermoregulation, Aestivation & Hibernation; Physiology of Cardiovascular System, Heart structure, Origin and conduction of cardiac impulse, cardiac cycle; Physiology of blood; Composition of Blood and lymph; blood coagulation. Nervous system: Physiologic anatomy of the synapse. Mechanism of synaptic transmission

Biochemistry:

Structure, types and function of Biomolecules- Carbohydrates, Proteins, Lipids. Mechanism of enzyme action- Kinetics, inhibition and regulation; Metabolism of Carbohydrate, Protein, Lipids and Nucleic Acids: Glycolysis, Kreb's cycle, pentose phosphate pathway, glycogen metabolism, electron transport chain, transamination, deamination, urea cycle, β- oxidation in fatty acids. Cholesterol biosynthesis and regulation.

Applied Zoology:

Host-parasite Relationship, Parasitism, Symbiosis, Commensalism, Zoonosis; Transmission, Prevention and control of Tuberculosis, Typhoid, Covid-19; Life history and pathogenicity of *Entamoeba, Plasmodium*, *Leishmania, Trypanosoma*; *Schistosoma and Wuchereria;* Biology, Control and damage caused by *Helicoverpa*, *Pyrilla, Papilio, Sitophilus* and *Tribolium*; Safe storage of stored grains; Life cycle, medical importance and control of *Pediculus*, *Anopheles, Culex and Aedes;* Domestic animals of economic importance; Preservation and artificial insemination in cattle. Poultry Farming, Indian poultry breed, Management of Poultry Farm. Apiculture- Honey bee species, Economic importance of Honey bee, Harvesting, processing and preservation of Honey. Sericulture, Aquaculture- types of farming system, Fish ponds, their types and management. Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed.

Ecology:

Biotic & abiotic components. Ecosystems types: terrestrial & aquatic. Energy flow & mineral cycling (CNP). Ecological laws (Shelford's & Liebig' laws); food chain, food web, & ecological pyramids. Attributes of population: natality, mortality, immigration, emigration, life tables & survivorship curves. Population growth, Community characteristics: dominance, diversity, species richness, abundance, stratification. Biotic interactions: intra-specific & inter-specific. Ecological succession: types & mechanisms: concept of climax community. Ecology niche: concept, types and examples

Wild life Conservation:

Values, ethics and importance of wild life conservation; Causes of depletion; Wild life conservation strategies; Pug marks and census method; Wildlife Protection Act - 1972, its amendments and implementation; IUCN Red Data Book; Management planning of wild life in protected areas; Estimation of carrying capacity; Concept of climax persistence; Zoogeographic areas of Indian Subcontinent; Protected Areas: National Parks/ Sanctuaries/Biosphere Reserves of Indian subcontinent; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.

Genetics:

Mendel's law; Exceptions to Mendel's law; Chromosomal theory of Inheritance; Lethal alleles, Multiple Alleles, Sex-linked inheritance & genetic disorders; Linkage & Crossing Over; Chromosome structure; Euchromatin; Heterochromatin; Polytene and lamp brush chromosomes. Chromosome banding, Karyotyping; Pedigree analysis; Fine structure of gene; Gene interactions: complementary and supplementary genes; Sex determination and Sex Linkage; Cytoplasmic Inheritance, Polygenic Inheritance, Mutation, population and evolution genetics, Hardy- Weinberg Principle.

Evolution

Theories of organic evolution -Lamarckism; Darwinism (Neo- Darwinism); Modern synthetic theory.

Evidences in favour of evolution from Comparative anatomy, Comparative Embryology, Palaeontology, Biochemistry & Genetics; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection: Biological species concept; Allopatric and Sympatric speciation; Fossils and fossilization Dating and Significance of fossil record; Zoogeographical distribution of animals; Causes of mass extinction, Role of extinction in evolution; Evolution of Horse

Taxonomy

Theories of biological classification, Linnaean hierarchy. Nomenclature: ICZN, Taxon, Rank and Categories, Biological Species Concepts (Polytypic and monotypic species, Subspecies). Taxonomic characters and taxonomic keys. Preservation of collected material and curating

Animal Behaviour:

Proximate and ultimate causes of behaviour. Instinct & Learning Behaviour; Biological rhythms; Biological Clock. Circadian rhythms and their synchronisation. Photoperiodism; Communication behaviour- Visual, olfactory, acoustic (bird songs, amphibian calls); 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 and hormonal control of behaviour**.**

Endocrinology:

Endocrine messengers- hormones, neurohormones, hormone like substances (neuronal peptides, autocoids, pheromones, neurosecretion). Hormones and Physiological actions of the endocrine glands in mammals- Pituitary, Thyroid, Parathyroid, Pancreas, Gastro-intestinal tract, Adrenal cortex and Medulla, Thymus and Pineal. Hormone biosynthesis of Protein, peptide hormones (gonadotropins, thyrotropin, corticotropin,) steroids and catecholamines. Mechanism of action of Protein and Steroid hormones; membrane bound receptors, G-protein and control of adynelate cyclase, Cyclic nucleotide cascade. Organisation & physiological actions of the Testis**:** Androgen binding protein (ABP), Inhibin. Neuro-endocrine control of testicular functions. Organization & physiological actions of the Ovary- Folliculogensis, Ovulation, Luteinization, Ovarian cycles; Seasonal reproductive cycles; sexual dysfunctions in man.

Developmental Biology:

Development and differentiation of sperm and oocytes: Gametogenesis: Events in spermatogenesis. Morphology of mature mammalian spermatozoon; Events in Oogenesis, Significance of oogenesis. Vitellogenesis in birds; Comparison between Spermatogenesis & Oogenesis; Mechanism of fertilization; Capacitation; acrosomal reaction, cortical reaction and fertilization membrane. Blocks to polyspermy, parthenogenesis. Types of eggs and cleavage. Role of yolk during cleavage; Fate map: fate map of early blastula of Frog, Types of morphogenetic movements. Gastrulation, Extra Embryonic Foetal Membranes (Chick). Development in Drosophila, Types, formation and function of Placenta in mammals. Insect and Amphibian metamorphosis. Concept of organiser and embryonic inductions. primary, secondary & tertiary cellular interactions Eye & Limb morphogenesis; Totipotency; Regeneration, Teratogenesis.

Biotechniques:

Microscopy: Light, phase contrast and Electron microscopy (TEM & SEM); Micrometry- Measuring microscopic organism and cell size in permanent slide preparation. Colorimeter.Spectrophotometer

Centrifugation, various types of centrifuges and rotors, various modes of chromatography (paper, thin layer, column), preparative and analytical applications, Electrophoresis- PAGE, SDS-PAGE. Museum preparation- Preserving macroscopic organisms (invertebrate and vertebrate specimen). Permanent slide preparation: basic histological and histochemical techniques. Laboratory safety, storage of chemicals and glassware. Maintenance of Laboratory equipment (microscopes, centrifuge, incubators, analytical and electronic balances, electrophoretic units, pH meter, turbidity meter etc.); Animal Cloning, Transgenesis, Genetic manipulation at cellular and molecular level, transfection technologies, Cell fusion and hybridoma techniques. Gene cloning, C-DNA library. cloning vectors, blotting techniques, DNA-sequencing, polymerase chain reaction. Gene therapy, DNA finger printing, Transgenic animals and plants. Recombinant DNA technology.

Immunology:

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. Cytokines. The Complement System. Cell mediated cytotoxicity: Mechanism of T cell & NK cell mediated lysis. Hypersensititivity and Autoimmunity. 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.

Microbiology :

Bacteria - classification, staining techniques, pathological significance. Physiology, genetics & reproduction of viruses of plants and animals, Bacteriophage, Microbial culture techniques & media enrichment techniques, Microbial fermentation, Microbes as pathological agents in plants, animals and man. Culture media for animal cell culture, Primary culture, cell lines and cloning, Application of animal cell culture.

SCHOOL OF MANAGEMENT

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – BUSINESS MANAGEMENT

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

DEPARTMENT OF BUSINESS MANAGEMENT
SCHOOL OF MANAGEMENT
HNBGU (A Central University), Srinagar Garhwal (Uttrakhand)

PhD entrance syllabus for the subject-Management

Unit–I

Management – Concept, Process, Theories and Approaches, Management Roles and Skills. Functions–Planning,Organizing,Staffing,CoordinatingandControlling. Communication – Types, Process and Barriers.DecisionMaking–Concept,Process,TechniquesandTools. OrganisationStructure.

ManagerialEconomics–Concept&Importance, Demandanalysis–UtilityAnalysis,IndifferenceCurve,Elasticity&Forecasting Market Structures – Market Classification & Price Determination. Inflation – Concept, Types and Measurement Business Ethics & CSR.

Unit–II

OrganisationalBehaviour–Significance&Theories. Individual Behaviour – Personality, Perception, Values, Attitude, Learning and Motivation

HumanResourceManagement–Concept,Perspectives,InfluencesandRecent Trends. HumanResourcePlanning,RecruitmentandSelection,Induction,Training and Development, JobAnalysis,JobEvaluation.

Unit–III

Industrial Relations: Disputes & Grievance Management, Labour Welfare and Social Security, TradeUnion&CollectiveBargaining, GreenHRM.

Unit– IV

AccountingPrinciplesandStandards,FinancialStatementAnalysis–RatioAnalysis,FundsFlowandCashFlow Analysis, DuPont Analysis. MarginalCosting,CostVolumeProfitAnalysis Standard Costing & Variance Analysis.

FinancialManagement,Concept&Functions- Capital Structure – Theories, Cost of Capital, Sources and Finance Budgeting and Budgetary Control, ZerobaseBudgeting.Leverages–Operating,Financialand Combined Leverages.

Unit–V

Value & Returns – Time Preference for Money, Valuation of Bonds and Shares, Risk and Returns;Capital Budgeting –Evaluation, Comparison of Methods. Dividend–Theoriesand Determination. MergersandAcquisition– Leveraged Buyouts, Takeover.

PortfolioManagement–CAPM,APT

Derivatives–Options,,ForwardContracts&Future Contracts

Working Capital Management – Determinants, Cash, Inventory, Receivables and Payables Management.

Unit-VI

Strategic Analysis – External Analysis, PEST, Porter's Approach to industry analysis, Strategy Formulation – SWOT Analysis, Corporate Strategy – Growth, Stability, Retrenchment,IntegrationandDiversification,BusinessPortfolioAnalysis-BCG, GE Business Model, Ansoff's Product Market Growth Matrix, Mckinsey 7s Framework

Marketing – MarketSegmentation,PositioningandTargeting, Product and PricingDecision – Product Mix, Product Life Cycle, New Product development, Pricing – Types and Strategies. Place and promotion decision – Marketing channels.

Unit–VII

Consumer and Industrial Buying Behaviour: Theories and Models of Consumer Behaviour

Brand Management – Role of Brands, Brand Equity, Equity Models, Developinga Branding Strategy; Brand Name Decisions, Brand Extensions and Loyalty. Service Marketing – Managing Service Quality and Brands, Marketing Strategies of Service Firms

InternationalMarketing–EntryModeDecisions,PlanningMarketingMixforInternational Markets

Unit–VIII

StatisticsforManagement: Concept,Measures ofCentralTendencyandDispersion, Probability Distribution – Binominal, Poison, Normal and Exponential. Data Collection & Questionnaire Design Sampling–Concept,ProcessandTechniques. HypothesisTesting–Procedure;T,Z,F,Chi-squaretests Correlation and Regression Analysis.

OperationsManagement–RoleandScopeFacility Location and Layout – Site Selection and Analysis, Layout – Design and ProcessQualityManagementand Statistical QualityControl, QualityCircles, Total Quality Management – KAIZEN, Benchmarking, Six Sigma; ISO 9000 Series Standards

OperationResearch–Transportation,QueuingDecisionTheory,PERT/ CPM

Unit–IX

InternationalBusiness–ManagingBusinessinGlobalizationEra;Theoriesof International Trade; Balance of payment, ForeignDirectInvestment–Benefitsand CostsMultilateral regulation of Trade and Investment under WTO.

Information Technology – Use of Computers in Management Applications; MIS, DSSArtificialIntelligenceand Big Data.

EntrepreneurshipDevelopment–Concept,Types,TheoriesandProcess,Developing Entrepreneurial Competencies; Intrapreneurship–ConceptandProcess.

Unit–X

Teaching Aptitude, Research Aptitude, Reading Comprehension, Communication, Reasoning (including Maths), Logical Reasoning, Data Interpretation, Information & Communication Technology (ICT), People & Environment and Higher Education System: Governance, Polity & Administration.

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – TOURISM

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

Ph.D. ENTRANCE EXAMINATION SYLLABUS
PH.D. ENTRANCE EXAMINATION 2025-26
SUBJECT: TOURISM

Unit – I:

Tourist/ visitor/ traveller/ excursionist – Definitions and Differences, Early and Medieval Period of Travel, Renaissance and its Effects on Tourism, Birth of Mass Tourism, Old and New Age Tourism, Forms of Tourism – Inbound, Outbound, National, International, Nature, Scope and Characteristics of Tourism. Need for Measurement of Tourism, Interdisciplinary Approaches, Different Tourism Systems- Leiper's Geo-spatial Model, Mill-Morrison, Mathieson & Wall, Butler's Tourism Area Life Cycle (TALC) - Doxey's Irridex Index – Demonstration Effect – Crompton's Push and Pull Theory, Stanley Plog's Model, Gunn's Model

Meaning and Nature of Tourism Industry, Input and Output of Tourism Industry, Tourism Industry Network- Direct, Indirect and Support Services, Basic Components of Tourism -Transport- Accommodation- Facilities & Amenities, Horizontal and Vertical Integration in Tourism Business, Tourism Business during Liberalization & Globalizations, Tourism Impacts: Economic Social, Cultural, and Environmental; Positive & Negative Impacts of Tourism, Factors affecting the future of tourism business; Seasonality & tourism, Sociology of tourism, Travel motivators.

Role and functions of Important Tourism Organizations in development and promotion of Tourism - UNWTO, IATA, ICAO, UFTAA, ASTA, PATA, WTTC, IHA, TAAI, IATO, FHRAI, ITDC, ICPB, State Tourism Development Corporations, Airport Authority of India, Archeological Survey of India, Ministry of Tourism, Culture, Railways , Civil Aviation of Government of India.

Unit – II:

Earth's movement; Latitude, Longitude; Areas, Sub Areas and Sub Regions as per International Air Transport Organization (IATA), IATA Three Letter City Code, Two Letter Airlines and Airport Code, International Date Line, Time Zones, Greenwich Mean Time, Calculation of Local Time, Flying Time, Grounding Time, Elapsed Time, Daylight Saving Time.

World Geography - Climate & Vegetation of North, South and Central America – Europe – Africa - Asia & Australasia, Elements of weather and climate, Impact of weather and climate on tourist destinations, Climate and Vegetation of India, Physical Geography of India - Distribution of Rivers, Mountains, Plateaus & Plain area, Coastal area, Deccan, major lakes, deserts.

Tourists Movement - Demand and origin factors; destinations and resource factors; Contemporary trends in international tourists movements, Environment Act – Environment rules – Environmental Impact Assessment (EIA), Environmental Information System (EIS), Environmental Management System (EMS) & Carrying capacity, Forest Act – Forest Conservation Act – Wild life Protection Act.

Unit – III:

Nature and Characteristic of Tourism Products of India - Seasonality and Diversities, Tourist attraction – Concept & Classification, Heritage – Indigenous; Colonial, Handicrafts of India; Fairs and Festivals of Social & Religious importance, Forms & Types of Performing Art, Classical Dances, Folk Dances of different Regions & Folk Culture, Indian Music - Different Schools, Status of Indian Vocal & Instrumental Music,

Indian Music abroad, Indian Museums, Art Galleries, Libraries & their Location, Indian cuisine - Regional variations, Historical monuments of India – Ancient temples, caves, stupas, monasteries, forts, palaces, Islamic and colonial art and architecture, Indian rituals, dresses. World heritage sites of India, Major religious centers of India – holy places connected with Hinduism, Buddhism, Jainism, Sikhism, Islamism, Christianity, Zoroastrianism and other religious sects, places associated with the work and life of legendary figures – Mahatma Gandhi, Pt. Jawaharlal Nehru, Dr. B.R. Ambedkar, Swami Vivekananda, Rabindranath Tagore, Subhash Chandra Bose & Sardar Vallabhai Patel. Important places related to India's freedom struggle.

Major National Parks, Wildlife Sanctuaries and Biosphere reserves of India and their Locations - Accessibility, Facilities, Amenities, Uniqueness of Dachigam, Corbett, Ranthambore, Hazaribag, Similipal, Bhitarkanika, Kanha, Bandhavgarh, Mudumalai, Periyar, Gir, Sunderbans, Manas, Valley of flowers, Hill Stations - Locations, Accessibility, Facilities, Amenities, Uniqueness of Gulmarg, Kullu & Manali, Shimla, Mussoorie, Nainital, Panchmarahi, Mahabaleshwar, Chikmangulaur, Coorg, Munnar, Ooty, Kodiakanal, Arakku, Darjeeling, Gangtok, Shillong, etc.,Tourist potential of Himalayas.

Beach Resorts of India - Locations, Accessibility, Facilities, Amenities, Uniqueness of important Beaches of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Puducherry, Andhra Pradesh, Odisha, West Bengal, Lakshadweep, Andaman & Nicobar Islands. Emerging attractions for Medical Tourism, Ecotourism, Rural Tourism, Agri Tourism, Farm Tourism, Green Tourism, Wilderness Tourism, Film Tourism, MICE tourism, Countryside Tourism, Caravan Tourism, Adventure tourism, Golf tourism, Lighthouse tourism, Fort tourism, Buddhist tourism, Sufi tourism, Special interest tourism, Textile tourism, Aqua based tourism , wellness and spa tourism, culinary tourism, shopping tourism, indigenous tourism, industrial & Mining Tourism.

Unit – IV:

Transportation - Evolution and importance of Transportation Systems; Role of Transportation in Tourism; Major transport systems – Rail, Road, Air and Water transport; Road Transport Network in North America, South America, Europe, South Africa, Asia and the Middle-East, Austria and New Zealand, Major Railway Transport Network in the World, Modes of transportations in India – Past & Present.

Licensing of air carriers; Limitations of weights and capacities; Scheduled and non-scheduled airlines services; No-frill airlines; Open sky policy; International conventions; Functions of IATA, ICAO, DGCA, AAI; GDS in air transportation. Types of air journey, MPM, TPM, Extra Mileage Allowance, One-way, Return Trip and Circle Trip Journey, Higher Intermediate Fare Check Point, Add-on and Open Jaw Fare, Excursion Fare , Components in International Air Tickets, Airline Business in the World, Major Air Carriers and Major Low-cost Airlines, Domestic Air Transport Business, Distribution of Sales of Airlines Tickets, Baggage and Travel Documents, Air Charter Services, Miscellaneous Charges order (MCO) - Multiple Purpose Document (MPD) - Billing and Settlement Plan.

Surface Transport System - Approved tourist transport, car hire companies including car rental scheme and tourist-coach companies, Documents connected with road transport viz. Regional Transport Authority, transport and insurance documents, road taxies, fitness certificate, contact carriage, state carriage, All India permits, maxi car, motor car etc. Railway System of world, British Rail, Euro Rail, Amtrak, Orient express, Trans-Siberian railway and luxury train of the world. Indian Railways - types of tours available in Indian Rail, Indrail pass, special schemes and packages available, palace on wheels, royal orient, fairy queen and toy trains. Planning itineraries on Indian Railways,

reservation and cancellation procedures, Water Transport System - Historical past, cruise ships, ferries, hovercraft, river canal boats. Prospects and future growth of water transport in India. Major cruise lines of the world and their packages.

Unit – V:

Historical Background of Travel Trade, Significance of Travel Agency Business, Types of Travel Agent- Full Service Agency, Commercial Agency, Implant Agency, Group / Incentive Agency, Skills and Competencies for Running Travel Agency Business, Wholesale and Retail Agents, Future of Travel Wholesaling & Retailing. Types of Tour Operator- Inbound, Outbound , Domestic, Ground and Specialized, Types of Tour- Independent Tour, Escorted Tour, Hosted Tour, Incentivized Tour, Tour Wholesalers and Retailers, Diversified Role of Tour Operators, Distribution Networks of Tour Operation Business, Special Services for Charter Tour Operators, Meeting & Incentive Planners and Activities of Meeting Planners, Convention & Conference Tourism Business, Trade Fairs & Exhibitions, Essential Requirements for Starting Travel Agency & Tour Operation Business, Procedures for Obtaining Recognition, Travel Agency Organization Structure, Sources of Revenue, Use of Information Technology in Travel Agency Business.

Types of Itinerary - Resources and Steps for Itinerary Planning, Tour Costing: Tariffs, FIT & GIT, Confirmation of Tour, Creation of Docket/File, Issue of Tour Vouchers, Reconfirmation with Airlines, Hotel & Ground Service Providers, Distributing Customized Itinerary to Tour Leader, Guide, Driver & Transporter, Standard Procedures for Pickup and Drop, Preparation of Feedback or Guest Comment Sheet, Analysis of Comments of Guest, Tour Guides & Escorts, WATA guidelines; Relation with service suppliers; Travel agency appointments; International regulations.

Familiarization with TIM (Travel Information Manual), Passport & VISA- Meaning, Types, Procedures, Validity, Necessary Information to fill the Passport and VISA Form for Issuance, Health Certificates, Currency, Travel Insurance, Credit & Debit Card, Customs, Currency, Baggage and Airport information, Citizenship – Passport - Visa - FEMA – Foreigners Registration Act – Customs – RBI guidelines - Criminal Law - Registration of cases, Cargo handling - Baggage allowance, free access baggage, Weigh and piece concept, Accountability of lost baggage, Dangerous goods, Cargo rates and valuation charges Automation and airport procedures, Tour Brochures - element and importance of brochure.

Unit – VI:

Distinctive characteristics of Hospitality Industry - Inflexibility, Intangibility, Perishability, fixed location, relatively large financial investment etc.; Concepts of Atithi Devo Bhava; Hotel and the other lodging facilities; types of hotels and hotel departments; classification of hotels; chain operations; E- Hospitality. Types of accommodation; Activities in Accommodation Management – Front office – Housekeeping – Bar and Restaurant - Supporting services; Fiscal and non-fiscal incentives offered to hotel industry in India, ethical and regulatory aspects in a hotel, international hotel regulations.

Duties and responsibilities of front office staff; Reservation & registration- Types of Room, Types of Bedding, Meal plans, room assignments, check-in, methods of payment, type of hotel guests. Factors affecting the price of accommodation, important functions of Housekeeping Management, liaison with other departments, room supplies, Bed making and related types of service; Housekeeping department-Hierarchy, duties & responsibilities of housekeeping staff.

Food Production Organization, Kitchen, Buffets, Beverages Operation, Functions, Outlets of F&B, Types of Meal Plans, Types of Restaurant-Menu, Room Service,

Catering Services-Food Service for the Airlines, Banquette, Corporate, MICE, Retail Food Market, Business/Industrial Food Service, Healthcare Food Service, club food services - Trends in lodging and food services. Food & Beverage Department of a hotel: Hierarchy, duties & responsibilities of staff.

Unit – VII:

Concept of Goods & Services; Characteristics of Service; Salient features of Marketing Services: Services Marketing – Concept, Need & Significance, Types of Tourism Services, Tourism Marketing Environment, Strategic Planning and Marketing Process, Organizing and Implementing marketing in the Tourism Organization. Service Quality, Gap Model of Service Quality. Marketing Research. Market Segmentation - Targeting and positioning for competitive advantage; Relationship Marketing; Familiarization Trip.

P's of Tourism Marketing- Product, Place, Price, Promotion, Physical Evidence, People, Process & Packaging, Designing Tourism Product – Branding and Packaging, Product Development – Product Life Cycle & Its Various Stages, Pricing Strategies and Approaches, Advertising – Sales Promotion – Publicity – Personal Selling, Tourism Distribution Channels, Cooperation and conflict Management. Global Marketing, Direct Marketing, Social Media & Digital Marketing, Green Marketing, Corporate Social Responsibility, Marketing Ethics & Consumerism.

Destination Image Development - Attributes of Destinations, Destination resource analysis, measurement of destination image - Destination branding perspectives and challenges- Creating the Unique Destination Proposition - Place branding and destination image - Destination image formation process; unstructured image -Product development and packaging - Institutional Support & Public Private Partnership in Destination Marketing.

Unit – VIII:

Tourism planning - Role of Govt. public and private sectors in formulation of tourism policy; Roles of international, national, state and local tourism organizations in carrying out tourism policies. Tourism planning for thrust areas, special tourism areas & zones identified by Ministry of Tourism, Government of India. Sustainable tourism development, Pro-poor Tourism and Community Participation; Responsible tourism.

Tourism Policy - Factors influencing tourism policy; National Tourism Policy, Levels of Tourism planning - International, national, regional, state and local, the traditional, approach and PASLOP method of tourism planning; important feature of five year tourism plans in India; Elements Agents, Processes and typologies of tourism development; State tourism policies. National Planning Policies for Destination Development- WTO Guidelines for Planners - Role of urban civic bodies: Town planning -Characteristics of rural tourism planning.

Economic System and Its Impact on Tourism Development, Macro & Micro Economic System, Demand & Supply, Determinants , Measurement of Tourism Demand, Forecasting, Methods of Demand Forecasting, Inflation, Recession, Savings & Investment, Export & Import, Multiplier Effects & Its Types, Displacement Effect, Costs and Benefits of Tourism, Monetary Policy- Repo Rate, Reverse Repo Rate, Cash Reserve Ratio(CRR).

Unit – IX:

Statistics: Measures of central tendency- mean, median, mode; measures of dispersion-range, standard deviation, variance, etc.; skewness and kurtosis; correlation and

regression- scatter plots, lines of best fit, Pearson and Spearman correlation coefficients; Regression- bivariate and multivariate. Distributions- discrete and continuous; Normal distribution, sampling distribution. hypothesis testing – parametric vs. non-parametric tests, t-tests, ANOVA, Chi-square tests, run Test, sign tests, Wald- Wolfowitz Test, Kruskal Wallis Test, Kolmogorov- Smirnov Test.

Research and theory, types and methods of research; review of literature; variables and measurement, concepts, constructs and formulation of hypothesis; Sampling, methods of data collection, development of schedules and questionnaires, scales and fieldwork. Qualitative research: quantitative vs. qualitative research; techniques- Grounded Theory, Ethnography, Case method of research, Content Analysis, Phenomenology, Narrative research, mixed methods.

Analysis, tools- Factor analysis, discriminant analysis, conjoint analysis, multiple regression, etc. Report writing, types of report.

Unit – X:

Managerial processes, functions, skills, and roles in organization, Systems, contingency and operational approaches to management. External and internal environment affecting managerial decisions – social responsibilities of business – evolution of management thought; functions of planning, organizing, staffing, directing and controlling.

Understanding & Managing Individual & Group Behaviour – Personality, Perception, Learning, Values & attitudes, persuasion, Theories of Motivation, Factors affecting group behaviour, group & individual dimensions, understanding work team, Communication, Leadership & influence process, Organization structure, centralization vs decentralization, strategy & structure, flat & tall structures, work specialization, departmentalization, chain of command, span of control and formalization, Common organizational designs - Simple, bureaucratic, matrix, virtual, boundaryless, feminine – Organization as an open system & influence of environment over organizational dynamics with reference to technological innovations.

Basic Accounting Records and Books of Accounts, Double Entry System, Journal, Ledger, Trial Balance, Cash Book, Depreciation Accounting, Final Accounts with Adjustments. Hotel Accounting, Financial management, Concept of raising funds, capital structure, capital budgeting, Internal financial control- meaning, problems unique to hospitality industry, Establishing cost standard, Types of budget, preparation of budget, and zero based budgeting, working capital Management, cash management, Opportunities and challenges for investments in hotel, aviation & Tourism related sectors, Role of TFCI and other financial organizations. Elements of Contract Act – Breach of Contract – Performance of Contract – Indemnity & Guarantee – Bailment - Consumer Protection Act.

SCHOOL OF LAW

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION

SESSION 2025-26

SUBJECT – LAW

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

SYLLABUS FOR PH.D. ENTRANCE EXAMINATION 2025-26

SUBJECT: LAW

UNIT I: FOUNDATIONS OF LAW AND CONTEMPORARY JURISPRUDENCE

1. Nature, Sources and Functions of Law
2. Classical and Modern Schools of Jurisprudence
3. Law and Morality: Interface and Conflict
4. Concepts of Rights, Duties, and Justice
5. Legal Personality
6. Property, Ownership, and Possession
7. Concept and Theories of Liability
8. Law, Poverty, and Social Justice
9. Global Justice
10. Contemporary Legal Theories: Feminist Jurisprudence, Critical Legal Studies, Post-modernism

UNIT II: CONSTITUTIONAL AND ADMINISTRATIVE LAW

1. Basic Structure Doctrine: Evolution and Scope
2. Preamble, Fundamental Rights, DPSPs, and Duties
3. Parliamentary and Presidential Systems: A Comparative Analysis
4. Centre-State Relations and Federalism
5. Emergency Provisions and Constitutional Safeguards
6. Judicial Review, Judicial Activism, and Public Interest Litigation
7. Rule of Law, Natural Justice, and Delegated Legislation
8. Constitutional Amendments
9. Transparency and Accountability: RTI Act, 2005
10. Access to Justice and free legal aid

UNIT III: PUBLIC INTERNATIONAL LAW AND INTERNATIONAL INSTITUTIONS

1. Nature, Sources and Subjects of International Law
2. Relationship Between International Law and Municipal Law
3. State Sovereignty, Recognition, and Jurisdiction
4. Law of Treaties and Treaty Interpretation
5. Refugees, Statelessness, and IDPs
6. Law of the Sea
7. International Dispute Settlement and Arbitration
8. International Organisations: UN, WTO, ICJ, ICC
9. International Humanitarian Law
10. Challenges in Enforcement of International Law

UNIT IV: CRIMINAL LAW AND CRIMINOLOGY

1. General Principles of Criminal Liability: Actus Reus & Mens Rea
2. Inchoate Crimes – Abetment, Criminal Conspiracy, and Attempt
3. General Exceptions and Doctrines of Culpability
4. Major Offences: Offences against Body, Property, and State
5. Crimes against Women, Children and Vulnerable Groups
6. White Collar Crimes, Corporate Crimes and Money Laundering
7. Terrorism, Sedition, and National Security Laws
8. Victimology and Compensation Schemes
9. Sentencing Policies and Prison Reforms
10. Contemporary Challenges: Cybercrime, AI, and Criminal Justice

UNIT V: FAMILY LAW

1. Sources and Schools of Personal Laws in India
2. Marriage and Divorce: Legal Frameworks and Theories
3. Maintenance, Guardianship

4. Adoption and Inheritance
5. Live-in Relationships
6. Uniform Civil Code and Secularism
7. Succession
8. Will and Gift
9. Wakf
10. Intersection of Religion, Custom, and State Regulation

UNIT VI: ENVIRONMENT, CLIMATE CHANGE AND HUMAN RIGHTS LAW

1. Environmental Protection: International and National Frameworks
2. Constitutional Framework relating to Environment Protection
3. Principles of Environmental Law – Polluter Pays, Precautionary, Sustainable Development
4. Climate Change Law and Climate Justice
5. Environmental Impact Assessment
6. National Green Tribunal and Other Regulatory Bodies
7. Concept and Evolution of Human Rights
8. International Human Rights Instruments and Enforcement
9. Human Rights and Marginalized Groups
10. NHRC, NCW, SC/ST/OBC Commissions

UNIT VII: INTELLECTUAL PROPERTY AND TECHNOLOGY LAW

1. Concept, Evolution and Theories of IP Law
2. International Frameworks: TRIPS, WIPO Conventions
3. Patents, Trademarks, Copyrights: Rights, Limitations and Enforcement
4. Emerging IP Issues: AI-generated works, Genetic Patents
5. Geographical Indications and Traditional Knowledge
6. Trade Secrets and Competition Interface
7. Information Technology Act: Cyber Regulation and Governance
8. Data Protection and Privacy Laws
9. Artificial Intelligence and Legal Regulation
10. Cybercrime, Dark Web, and Blockchain Legal Issues