

SYLLABUS (NEP)

**H.N.B. GARHWAL UNIVERSITY, SRINAGAR-
GARHWAL**

(A CENTRAL UNIVERSITY)

2025-26 ONWARDS



**DEPARTMENT OF PHARMACEUTICAL CHEMISTRY
MASTER OF SCIENCE**

**PHARMACEUTICAL CHEMISTRY
NEP-2020**

TWO YEARS (IV SEMESTER COURSE)

Admission of the Master's Program in Pharmaceutical Chemistry shall be through entrance examination conducted by the University or merit basis (decide by competent authority of University) and the program shall be based on credit system in which credit defines the quantum of content/ syllabus prescribed for a course system and determines the number of hours of instruction per week.

The student shall be eligible for admission to a Master's Degree Program in Pharmaceutical Chemistry after he/she has successfully completed a three years or four years B. Sc or B.Pharm. undergraduate degree or earned prescribed number of credits or through the examinations conducted by University as equivalent to an undergraduate degree. Core courses prescribed for every Semester shall be mandatory for all students registered for the Master's Program in Pharmaceutical Chemistry. Besides this there shall be skill development courses offered in semester II, III and IV. Each candidate is must to participate in the Hospital Training, industrial training and excursions required for the Laboratory Courses when organized by the Department. Subsequent to that the student would have to present a detailed report of such trainings at the time of Semester Practical examination. The contact hours of seminars, assignments and research work shall be treated as that of practical courses for the purpose of calculating credits. i.e., the contact hours shall be multiplied by 1/2. Similarly, the contact hours of research work presentations and discussions with the supervisor shall be considered as theory course and multiplied by 1. In order to qualify for a two year master's degree, a student must acquire a minimum of 96 credits including a minimum of 24 credits in elective courses by choosing four electives may be (leading to a minimum 06 credits) offered by other departments. Internship/Dissertation (Project) is a major one mandatory for every student. Internship/Dissertation (Project) should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide. The dissertation is to be allotted in the beginning of III Semester and would be submitted during the examination of the IV Semester.

M.Sc. PHARMACEUTICAL CHEMISTRY- I SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (T)	Quantitative Analytical Methods	DSC-1 (Theory)	SOS/PC/C001	5
DSC(T)	Modern Analytical Methods	DSC-2 (Theory)	SOS/PC/C002	5
DSC(T)	Basic Pharmacology	DSC03 (Theory)	SOS/PC/C003	5
DSC(P)	Laboratory- I	DSC-4 (Practical)	SOS/PC/C004	3
DSE(T)	Chemistry of Natural Products	DSE-1(Theory) (Choice -I)	SOS/PC/E001	4
DSE(T)	Cosmeceuticals	DSE-2 (Theory)(Choice -II)	SOS/PC/E002	
DSE (P)	Laboratory-I	DSE-1 (Practical) (Choice -I)	SOS/PC/E003	2
DSE (P)	Laboratory- II	DSE-2 (Practical) (Choice-II)	SOS/PC/E004	
Total Credits				24
Important Note: <ul style="list-style-type: none"> The students will only opt for one paper out of two Discipline Specific Elective (DSE) Theory papers in M.Sc. Ist year (Semester-I) The students will opt for only one Practical out of two Discipline Specific Elective (DSE) Practicals in M.Sc. Ist year (Semester-I) 				

M.Sc. PHARMACEUTICAL CHEMISTRY- II SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (T)	Advance Analytical Methods	DSC-1 (Theory)	SOS/PC/C005	5
DSC(T)	Drug Delivery system and Bio-pharmaceutics	DSC-2 (Theory)	SOS/PC/C006	5
DSC(T)	Medicinal Chemistry	DSC03 (Theory)	SOS/PC/C007	5
DSC(P)	Laboratory- I	DSC-4 (Practical)	SOS/PC/C008	3
DSE (Skill Development)	Internship (Hospital Training, Two months) (A Report and Certificate will be submitted by the students from Govt. Hospitals and Medical Colleges.	DSE-5 (Skill Development Course)	SOS/PC/E005	6
(DSE Skill Development)	Internship (Instrumentation Training of Two months) A training Certificate and report will be submitted by the students.	DSE-6 (Skill Development Course)	SOS/PC/E006	6
Total Credits				24
Important Note: Students will opt for only one choice based course out of two choice based course or elective in M.Sc. Ist year (Semester-II)				

M.Sc. PHARMACEUTICAL CHEMISTRY- III SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (T)	Drug Design	DSC-1 (Theory)	SOS/PC/C009	5
DSC(T)	General Pharmaceutics	DSC-2 (Theory)	SOS/PC/C010	5
DSC(T)	Phytopharmaceuticals and Nutraceuticals	DSC03 (Theory)	SOS/PC/C011	5
DSC(P)	Lab-I	DSC-4 (Practical)	SOS/PC/C012	3
DSE (Skill)	Industrial Training (Two Months)) A training Certificate and report will be submitted by the students	DSE-7(Internship)	SOS/PC/E007	6
DSE (Field Work)	SWAYAM/NPTEL/MOOCs (Relevant to Pharmaceutical Chemistry Course with completion of 6 credits)	DSE-8 (Online Courses)	SOS/PC/E008	6
Total Credits				24
Important Note: The students will opt for either skill development choice or SWAYAM/NPTEL/MOOCs as DSE in M.Sc. IInd year (Semester-III)				

M.Sc. PHARMACEUTICAL CHEMISTRY- IV SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (Research)	Industry internship/ Project from parent institute/industry/ Research Organizations.	DSC-1 (Research Project)	SOS/PC/C013	18
DSE (Field Work)	Traditional Healthcare system of Uttarakhand (Field Work) A training A report and Herbarium will be submitted by the students.	DSE-7 (Field work and Report writing)	SOS/PC/E009	6
DSE (Research)	Minimum Participation in the two National /International LevelSeminar/Conference/ /Symposium/ Training Programs/ minimum three days Workshop and one paper Publication	DSE-8 (Conference/ Seminar)	SOS/PC/E010	6
Total Credits				24
Important Note: The students will opt for either skill development choice or Research based Choice as DSE in M.Sc. IInd year (Semester-IV)				

Grand Total: 96Credits

Industrial Internship/ Dissertation/ Project Work

Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide.

Dissertation is a core one and mandatory for every student. The dissertation is to be allotted in the beginning of III Semester and would be submitted at the time of the examination of IV Semester. The distribution of marks for the Dissertation will be as below:

Periodical presentation	: 20 Marks
Dissertation	: 60 Marks
Viva Voce	: 20 Marks
Total	: 100 Marks

The Dissertation would carry 18 credits in all.

The dissertation/ Project report shall be evaluated jointly by the supervisor and Departmental committee.

Following topics/research fields are proposed to undertake Dissertation/ Project Work.

Traditional Health care System of Uttarakhand

Study of Medicinal plants of Uttarakhand Himalaya

Quality control of herbal drugs, Quality control of Synthetic drugs

Any other current trends / topics suggested by the Departmental committee may also be considered for the dissertation/project work other current problems / topics suggested by the Departmental committee.

Internship: The purpose of Internship is to expose students to real work of environment experience at industry, to gain the knowledge through training on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and others necessary skills. Therefore, the practical training program trained students to relate theoretical knowledge with its application in the pharmaceutical industry.

On completion of this course, the students will be able to understand the various types of industries with learn the procedure of identifying, approaching, applying and getting approval of internship from a leading industry. Witness the entire work area of the industry. Know the nature of job involved in the various sector of the industry. Adapt with the working people.

After the student has completed the internship, the student must submit the final evaluation report of the internship experience and 20 minute presentation to department at conclusion of semester. The Department head will allot the mark for the internship evaluation report.

M.Sc. PHARMACEUTICAL CHEMISTRY- I SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (T)	Quantitative Analytical Methods	DSC-1 (Theory)	SOS/PC/C001	5
DSC(T)	Modern Analytical Methods	DSC-2 (Theory)	SOS/PC/C002	5
DSC(T)	Basic Pharmacology	DSC03 (Theory)	SOS/PC/C003	5
DSC(P)	Laboratory- I	DSC-4 (Practical)	SOS/PC/C004	3
DSE(T)	Chemistry of Natural Products	DSE-1(Theory) (Choice -I)	SOS/PC/E001	4
DSE(T)	Cosmeceuticals	DSE-2 (Theory)(Choice -II)	SOS/PC/E002	
DSE (P)	Laboratory-I	DSE-1 (Practical) (Choice -I)	SOS/PC/E003	2
DSE (P)	Laboratory- II	DSE-2 (Practical) (Choice-II)	SOS/PC/E004	
		Total Credits		24
Important Note:				
<ul style="list-style-type: none">• The students will opt only one paper out of two choice DSE Theory papers in M.Sc. Ist year (Semester-I)• The students will opt only one Practical out of two choice DSE Practicals in M.Sc. Ist year (Semester-I)				

QUANTITATIVE ANALYTICAL METHODS
CORE COURSE: PAPER- I; CODE- (SOS/PC/C001)

Unit I

Fundamental of volumetric analysis: Methods of expressing concentrations, primary and secondary standards.

Neutralization reactions: Theory of indicators and neutralizations indicators.

Unit II

Oxidation-reduction titration: Principle of oxidation reduction Titrations, redox indicators & their use in pharmaceutical analysis.

Precipitation titration : Theory of precipitation titrations and use of adsorption indicators.

Unit III

Gravimetric analysis: Method of gravimetric analysis

Unit IV

Complexometric titrations: Complexometric methods using EDTA, principle of complexometric titrations, chelating agents, indicators, titrations with disodium edetate.

Unit V

Nonaqueous titrations: General discussion and principle of titrations in non-aqueous media, aprotic, protophilic, protogenic and amphiprotic solvents. Titrations with perchloric acid, potassium methoxide and tetrabutyl ammonium hydroxide.

BOOKS SUGGESTED

1. A. H. Becket and J. B. Stenlake, Practical Pharmaceutical Chemistry, Part I, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
2. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5th ed., ELBS, U.K., 1989 .
3. A. Keneth & A. Connors, A Text Book of Pharmaceutical Analysis, 3rd ed., Wiley Interscience Singapore, 1982.

MODERN ANALYTICAL METHODS

CORE COURSE: PAPER-II; CODE- (SOS/PC/C002)

Unit-I

Chromatography, Principles of separation, application of techniques, absorption, partition, paper and thin layer chromatography. HPTLC, HPLC, Gas Chromatography, GLC, Ionexchange Chromatography and Gel Electrophoresis, Colorimetry, theory, methods of colour measurements or comparison, instrumentation.

Spectrofluorimetry, instrumentation, application.

Unit-II

Atomic absorption and flame emission spectroscopy, theory, instrumentation, atomic absorption spectrophotometers, structure determinations.

Principle, techniques, instrumentation & application including interpretation of data of UV spectrophotometry & infrared spectrophotometry.

Unit-III

Optical rotation, its significance, instrumentation.

Optical rotatory dispersion-terminology, plain curve, rotatory dispersion & circular dichroism and octane rule.

BOOKS SUGGESTED

1. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds, 6th ed. John Wiley and Sons-Inc 1998.
2. Comin N. Banwell, Elian M. McCash, Fundamentals of molecular spectroscopy 4th ed. Tata McGraw -Hill Publishing Company Limited New Delhi, 1995.
3. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
4. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

BASIC PHARMACOLOGY

CORE COURSE: PAPER- III; CODE- (SOS/PC/C003)

Unit-I

History of development of Pharmacology, introduction & general principles of route of drug administration, pharmacokinetics (absorption, distribution, metabolism & excretion) & pharmacodynamics (general mechanism of drug action).

Elementary introduction to adverse drug reactions & drug interactions, Drug allergy.

Unit-II

General concepts of toxicity, Acute, subacute & chronic toxicity tests, teratogenicity & carcinogenicity, itrogenic diseases, LD₅₀, ED₅₀, tolerance, habituation & addiction.

Unit-III

Bio-assays :General principles, general methods, biological variations & animal ethics. Bioassays of insulin, heparin, d-tubocurarin, digitalis, acetylcholine, adrenaline, histamine.

BOOKS SUGGESTED

1. Goodman & Gillman, The Pharmacological Basis of Therapeutics 9th ed., McGraw Hill Companies, New York, USA, 1996.
2. Katzung G. Bertram, Basic and Clinical Pharmacology, 8th ed., McGraw Hill Companies, New York, USA, 2001.
3. Rang H.P., Dale M.M., Ritter J.M., Pharmacology, 4th ed., Churchill livingstone, N. Y., 1999.
4. R.S. Satoshkar, Pharmacology and Pharmacotherapeutics, vol. I & II: 16th ed., Mumbai Popular Prakashan, 1999.
5. Laurence & Bennett, Clinical Pharmacology, 8th ed., Churchill Livingstone, N. Y. 1997.
6. S. D. Seth, Text Book of Pharmacology, 2nd ed. Churchill Livingstone Pvt. Ltd., New Delhi.
7. F.S.K. Barar, Essential of Pharmacotherapeutics, 3rd ed. S. Chand and Company Ltd., New Delhi, 1995.
8. K.D. Tripathi, Essentials of Medical Pharmacology, 9th ed., Jaypee Brothers New Delhi, 1995.

LABORATORY I

CORE COURSE: Lab- 1; CODE- (SOS/PC/P001)

Standardization of analytical weights and calibration of volumetric apparatus.

Titrametric analysis including acid base titration, redox titration, precipitation titrations, gravimetric analysis. Chromatography (Paper and Thin layer), Spectroscopic analysis (Assay of drugs by UV Spectroscopy)

BOOKS SUGGESTED

1. A. H. Becket and J. B. Stenlake, Practical Pharmaceutical Chemistry, Part I, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
2. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney Vogel's Text Book of Quantitative Chemical Analysis 5th ed., ELBS, U.K., 1989 .
3. A. Keneth & A. Connors, A Text Book of Pharmaceutical Analysis, 3rd ed., Wiley Interscience Singapore, 1982.

CHEMISTRY OF NATURAL PRODUCTS

ELECTIVE COURSE: PAPER- IV; CODE (SOS/PC/E001)

Unit-I

Heterocyclic Compounds: Five membered heterocycles: Furan, Thiophene, pyrrole, thiazole, pyrazole, oxazole, Six membered: Pyridine, pyrimidine, Quinilene.

Unit-II

Carbohydrate : Introduction, mutarotation, ring structure of glucose, configuration of monosaccharides, structure elucidation of disaccharides, sucrose, maltose, lactose, polysaccharides, starch. Glycosides arbutin, amygdaline.

Unit-III

Alkaloids : General introduction, distribution in plants, isolation & purification. General methods of structure determination. Structural elucidation of atropine, quinine, Nicotine

Unit-IV

Terpenoids : General introduction, isolation, purification, structure elucidation of citral, menthol, camphor,

BOOKS SUGGESTED

1. I.L. Finar, Organic chemistry, Vol. II, 1st Indian ed., Pearson Education Pte Ltd Indian Branch, Delhi, 2002.
2. O.P. Agarwal, Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.

LABORATORY II -CHEMISTRY OF NATURAL PRODUCTS

ELECTIVE COURSE; CODE (SOS/PC/E004)

Laboratory II shall constitute of the following:

Experiments based on the determination of saponification value, acid value, ester value and iodine value of vegetable oils.

Extraction and isolation of compounds from the different plants.

BOOKS SUGGESTED

- 1 I.L. Finar, Organic chemistry, Vol. II, 1st Indian ed., Pearson Education Pte Ltd Indian Branch, Delhi, 2002.
- 2 O.P. Agarwal, Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
3. Pharmacognosy: Trease and Evans
4. Pharmacognosy: C. K Kokate

COSMECEUTICALS

ELECTIVE COURSE: PAPER- V; CODE (SOS/PC/E002)

Unit-1

Introduction: Herbal/natural cosmetics, Classification & Economic aspects.

Unit-2

Cosmetic Products: Commonly used herbal cosmetics, raw materials, preservatives, surfactants, humectants, oils, colors, and some functional herbs, pre-formulation studies, compatibility studies, possible interactions between chemicals and herbs, design of herbal cosmetic formulation.

Unit-3

Herbal Cosmetics : Physiology and chemistry of skin and pigmentation, hairs, scalp, lips and nail, Cleansing cream, Lotions, Face powders, Face packs, Lipsticks, Bath products, soaps and baby product, Preparation and standardisation of the following : Tonic, Bleaches, Dentifrices and Mouth washes & Tooth Pastes, Cosmetics for Nails.

Unit-4

Cosmeceuticals of herbal and natural origin: Hair growth formulations, Shampoos, Conditioners, Colorants & hair oils, Fairness formulations, vanishing & foundation creams, anti-sun burn preparations, moisturizing creams, deodorants. Analysis of Cosmetics, Toxicity screening and test methods: Quality control and toxicity studies as per Drug and Cosmetics Act.

BOOKS SUGESSTED

1. Panda H. Herbal Cosmetics (Hand book), Asia Pacific Business Press Inc, New Delhi.
2. Thomson EG. Modern Cosmetics, Universal Publishing Corporation, Mumbai.
3. P.P.Sharma. Cosmetics - Formulation, Manufacturing & Quality Control, Vandana Publications, New Delhi.
4. Supriya K B. Handbook of Aromatic Plants, Pointer Publishers, Jaipur.
5. Skaria P. Aromatic Plants (Horticulture Science Series), New India Publishing Agency, New Delhi.
6. Kathi Keville and Mindy Green. Aromatheraphy (A Complete Guide to the Healing Art), Sri Satguru Publications, New Delhi.
7. Chattopadhyay PK. Herbal Cosmetics & Ayurvedic Medicines (EOU), National Institute of Industrial Research, Delhi. Balsam MS & Edward Sagarin. Cosmetics Science and Technology, Wiley Interscience, New York.

LABORATORY III - COSMECEUTICALSTICS

ELECTIVE COURSE: LABORATORY-2; CODE (SOS/PC/E002)

1. Formulation techniques: cosmetics creams (cold cream, cleansing cream, vanishing cream), powders, face mask, compacts, sticks ,liquids soap, shampoo, lotions (astringent, complexion, moisturizing), lip- bam, conditioners foam and aerosol cosmetics.
2. Clinical safety testing: Irritation, sensitization, photo irritation, photo-allergy, ocular irritation.
3. Herbal cosmetics: Formulation developments.

BOOKS SUGESSTED

1. C.G.Gebelein, T.C. Cheng and V.C. Yang; Cosmetic and Pharmaceutical applications of polimer; plenum.
2. Dr. Laba, Rheological properties of cosmetics and toiletries, Marcel Dekker.
3. E.G.Thomsson ; Morder Cosmetics; Universal Publishing Corporation.
4. H. R. Moskowitz; Cosmetic Product Testing; Marcel Dekker.
5. J Knolton and S Rearce; Handbook of cosmetic sciences and technology ; Elsevier science publisher.
6. J. B. Wilkinson and RJ Moore; Harry's cosmetology; Longmr, j. Sscience and Technical.
7. Saraf, Swarnlata, and Shailendra Saraf. Cosmetics: A practical manual. Pharma Med Press, 2008.

M.Sc. PHARMACEUTICAL CHEMISTRY- II SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (T)	Advance Analytical Methods	DSC-1 (Theory)	SOS/PC/C005	5
DSC(T)	Drug Delivery system and Bio-pharmaceutics	DSC-2 (Theory)	SOS/PC/C006	5
DSC(T)	Medicinal Chemistry	DSC03 (Theory)	SOS/PC/C007	5
DSC(P)	Laboratory- I	DSC-4 (Practical)	SOS/PC/C008	3
DSE -1	Internship (Hospital Training, Two months)Skill Development(Report and Certificate submission from Govt. Hospitals and Medical Colleges)	DSE-5 (Skill Development)	SOS/PC/E005	6
DSE-2	Internship (Instrumentation Training of Two months) Certificate and report submission from Pharma. Industries	DSE-6 (Skill Development)	SOS/PC/E006	6
		Total Credits		24
Important Note: Students will opt only one choice based course out of two DSE-1 or DSE-2 in M.Sc. I st year (Semester-II)				

ADVANCE ANALYTICAL METHODS

CORE COURSE: PAPER- I; CODE (SOS/PC/C005)

UNIT-I

Molecular Emission Spectroscopy: Principle, molecule exhibiting fluorescence, Factors interfering with fluorescence intensity and Application, Raman Spectroscopy-Principle, Instrumentation and Application

Unit-II

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

Unit-III

Proton Magnetic Resonance, Principle, techniques, instrumentation, ^1H NMR signals, chemical shift, spin-spin coupling, shielding deshielding effect, diamagnetic anisotropy, geminal coupling, AMX, ABX, ABC system, shift reagents & interpretation of spectra. ^{13}C -NMR, introduction and interpretation of data.

Unit-IV

Application of spectroscopic techniques to structural elucidation, introduction aids to spectral interpretation exercises.

Microbiology assays, Principles of microbiological assays, assays of vitamins & antibiotics.

BOOKS SUGGESTED

1. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds, 6th ed. John Wiley and Sons-Inc 1998.
2. Comin N. Banwell, Elian M. McCash, Fundamentals of molecular spectroscopy 4th ed. Tata McGraw -Hill Publishing Company Limited New Delhi, 1995.
3. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
4. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

DRUG DELIVERY SYSTEM & BIOPHARMACEUTICS

CORE COURSE: PAPER- II; CODE- (SOS/PC/C006)

Unit-I

Types, advantages, disadvantages & formulation of oral dosage forms including:

- a) Liquid dosage forms like solution, syrups, suspension & emulsion.
- b) Solid dosage forms like tablets, capsules etc.

Unit-II

Types, advantages, disadvantages & formulation of parenteral. Dosage forms & topical semi-solid dosage forms. Quality control of various dosage forms.

Unit-III

Quality Control of various dosage forms.

Disintegration, Disintegration time, factors affecting disintegration.

Dissolution, Dissolution models, factors affecting dissolution rate, co-rrrelation of dissolution with bioavailability. Factors affecting drug absorption including physicochemical, biological & Pharmaceutical Passive Diffusion, Active Diffusion.

Unit-IV

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

Bioavailability : Concept of bioavailability & comparative bioavailability, methods of estimation of bioavailability, bioequivalence studies.

BOOKS SUGGESTED

1. Hand book of Basic Pharmacokinetics-Ritschel, W.A., Drug Intelligence Publication, M. Hamilton, 1977.
2. Fundamentals of Clinical Pharmacokinetics-Wagner, J.C., Drug Intelligence Publication, M. Hamilton, 1975.
3. Remington's Pharmaceutical Sciences-Gennaro A.R., ed., 19th Edition, Mack Publishing co., Easton, PA. 1995.
4. Clinical Pharmacokinetics-Rowland, M, & Tozer, N., 2nd edition, Lea & Febiger, Philadelphia, 1989.
5. Pharmacokinetics-Gibaldi M. & Perrier, D., 2nd ed., Marcel Dekker, New York, 1982.
6. Pharmacokinetics for the pharmaceutical scientist-Wagner, J.C., Technomic Publishing AG, Switzerland, 1993.
7. Biopharmaceutics and Pharmacokinetics- Notrari, R.E., 2nd ed., marcel Dekker, New York, 1975.
8. Biopharmaceutics and Pharmacokinetics: Bramhankar & Jai

MEDICINAL CHEMISTRY

CORE COURSE: PAPER- IV; CODE (SOS/PC/C008)

The Following topics shell cover –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.

Antiamobic & antiprotozoal

Antihelmintics

Antifungal

Anticancer

Antiviral

BOOKS SUGGESTED

1. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989.
2. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
3. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.
4. Kadam & Mahadik, Bothara, Principles of Medicinal Chemistry vol. I & II, 4th ed. Nirali Prakash Pune, 1997

INTERNSHIP – HOSPITAL TRAINING

ELECTIVE COURSE; CODE (SOS/PC/E005)

The duration period of Hospital Training shall be two months, started at the time of winter vacations, after completion of end of Ist Semester Examination.

Elective courses (Hospital Training) emphasizes the connection between Pharmaceutical Chemistry and entrepreneur skills highlighting how students can apply their scientific knowledge to create and develop Pharmaceutical based businesses and start-ups

BOOKS SUGGESTED

1. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989.
2. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
3. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.

M. Sc. Pharm. Chem. IInd Sem.

INTERNSHIP; INSTRUMENT TRAINING

ELECTIVE COURSES; CODE (SOS/PC/E006)

Instrumental Training will be of Two Months compulsory. The purpose of Internship in the industries is to expose students to real work of environment experience at industry, and at the same time, to gain the knowledge through hands with training on observation with instruments.

BOOKS SUGGESTED

1. British Pharmacopoeia
2. E.A. Rawlins- Text Book of pharmaceuticals, Bailliere Tindall.
3. G. Gun and S.J. Carter, Cooper & Gunn's Tutorial Pharmacy, Pitman Medical Publishing Co. London.
4. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds, 6th ed. John Wiley and Sons-Inc 1998.
5. Comin N. Banwell, Elian M. McCash, Fundamentals of molecular spectroscopy 4th ed. Tata McGraw-Hill Publishing Company Limited New Delhi, 1995.
6. A.H. Becket and J.B. Stenlake, Practical Pharmaceutical Chemistry, part- II, 4th ed., CBS Publishers & Distributors, New Delhi, 1997.
7. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.
8. Pharmacopoeia of India.

M.Sc. PHARMACEUTICAL CHEMISTRY- III SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (T)	Drug Design	DSC-1 (Theory)	SOS/PC/C009	5
DSC(T)	General Pharmaceutics	DSC-2 (Theory)	SOS/PC/C010	5
DSC(T)	Phytopharmaceuticals and Nutraceuticals	DSC03 (Theory)	SOS/PC/C011	5
DSC(P)	Lab-I	DSC-4 (Practical)	SOS/PC/C012	3
DSE (Skill)	Industrial Training (Two Months) Report and Certificate submission with presentation of Training report.	DSE-7(Skill Development)	SOS/PC/E007	6
DSE (Field Work)	Traditional Healthcare system of Uttarakhand (Two Months) Field work Report , presentation and Herbarium submission.	DSE-8 (Field work and Report writing)	SOS/PC/E008	6
		Total Credits		24
Important Note: The students will opt only one skill development choice or Field work DSE in M.Sc. IInd year (Semester-III)				

DRUG DESIGN

CORE COURSE: PAPER- I; CODE- (SOS/PC/C009)

Unit-I

Dose response curve, concept of agonist, partial agonist, antagonist, partial antagonist, competitive & none-competitive antagonism. Drug metabolism.

Unit-II

Specific & non-specific drug action, concept of receptor, drug-receptor interactions. Receptor theories, spare receptor, ion-channels.

Unit-III

Topography receptors, adrenergic, cholinergic, H₁, H₂, steroidal, serotonin, diazepam & opioid receptors.

Unit-IV

Drug metabolism approaches to drug design. Concept of isosterism & bioisosterism, metabolite antagonism, stereochemistry & drug action. Analog design, concept of prodrug.

Unit-V

Introduction to QSAR. Chemical information computing system in drug discovery. Molecular modeling drug action.

BOOKS SUGGESTED

1. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and
2. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
3. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.
4. Kadam & Mahadik, Bothara, Principles of Medicinal Chemistry vol. I & II, 4th ed. Nirali Prakash Pune,

GENERAL PHARMACEUTICS

CORE COURSE: PAPER- II; CODE- (SOS/PC/C010)

Unit I

Extraction Processes: Infusion, decoction, maceration and percolation processes and preparation involving them.

Size Reduction: Objectives , factor affecting, method of size reduction. Construction and working of hammer mill, fluid energy mill, colloid mill.

Size Separation: Official standards for powders, sieving methods.

Unit II

Mixing: Definition, objectives, type of mixtures, types of equipments used in mixing, propeller, turbine paddle, mixer, collide mixer, sigma mixer, arm mixer, tumbler mixer.

Drying: Introduction to drying process, study of tray dryer, fluidized bed dryer , vaccume and freeze dryer.

Unit III

Pharmaceutical Literature and Ethics: Importance of various Pharmacopoeias with special reference to those with are official in India , general introduction to code of Pharmaceuitical ethics.

BOOKS SUGGESTED

1. Hand book of Basic Pharmacokinetics-Ritschel, W.A., Drug Intelligence Publication, M. Hamilton, 1977.
2. Fundamentals of Clinical Pharmacokinetics-Wagner, J.C., Drug Intelligence Publication, M. Hamilton, 1975.
3. Remington's Pharmaceutical Sciences-Gennaro A.R., ed., 19th Edition, Mack Publishing kco., Easton, PA. 1995.
4. Clinical Pharmacokinetics-Rowland, M, & Tozer, N., 2nd edition, Lea & Febiger, Philadelphia, 1989.

CORE COURSE: PAPER- IV; CODE- (SOS/PC/C012)

Unit I

Introduction Definition, historical background present status and future scope of Phytopharmaceuticals.

Unit II

Classification of crude drug: Alphabetical, morphological, pharmacological and chemical classification.

Unit III

Adulteration and evaluation of drugs: Causes and types of Adulteration organoleptic, biological, chemical and physical methods of evaluation.

Unit IV

General principle of formulation of primary and secondary plant metabolites. Biogenesis of carbohydrates, lipids, volatile oils and resins.

Unit V

Plants and their environmental factors influencing the variability in drug activity

Unit VI

General introduction and uses of Nutraceuticals.

Unit VI

An introduction to tissue culture and its scope in production of phytopharmaceuticals

BOOKS SUGGESTED

1. Pharmacognosy: Trease and Evans
2. Pharmacognosy C. K Kokate

1. Exercises based on QSAR
2. Experiments based on disintegration and Dissolution,
3. Qualitative analysis of crude drug: Analysis of alkaloids, volatile oils, fixed oils, fats and waxes, Flavonoids, Terpenoids, Resins, Tannins, Glycosides and Steroids.

BOOKS SUGGESTED

1. William O. Foye, Principles of Medicinal Chemistry, 3rd ed., Varghese Publishing House, Mumbai, 1989. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and
2. Jaime N. Delgado & William A. Remers, Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, 9th ed. J.B. Lippincott Company, Philadelphia, 1991.
3. Manfred E. Wolff, Burger's medicinal Chemistry and Drug Discovery, Vol. I to V, 5th ed., A Wiley-Interscience publication John Wiley & Sons, Inc. (New York), 1995.
4. Kadam & Mahadik, Bothara, Principles of Medicinal Chemistry vol. I & II, 4th ed. Nirali Prakash Pune,
5. Hand book of Basic Pharmacokinetics-Ritschel, W.A., Drug Intelligence Publication, M. Hamilton, 1977.
6. Fundamentals of Clinical Pharmacokinetics-Wagner, J.C., Drug Intelligence Publication, M. Hamilton, 1975.
7. Remington's Pharmaceutical Sciences-Gennaro A.R., ed., 19th Edition, Mack Publishing kco., Easton, PA. 1995.
8. Pharmacognosy: Trease and Evans
9. Pharmacognosy C. K Kokate

M. Sc. Pharm. Chem. IIIrd Sem.

INTERNSHIP; INDUSTRIAL TRAINING

ELECTIVE COURSES; CODE (SOS/PC/E007)

Industrial Training will be of Two Months compulsory. The purpose of Internship in the industries is to expose students to real work of environment experience at industry, and at the same time, to gain the knowledge through hands on observation.

BOOKS SUGGESTED

9. British Pharmacopoeia
10. E.A.Rawlins- Text Book of pharmaceuticals, Bailliere Tindall.
11. G. Gun and S.J. Carter, Cooper & Gunn's Tutorial Pharmacy, Pitman Medical Publishing Co. London.
12. Gilbert S, , Banker and Cristopher T.Rhodes- Modern pharmaceuticals and Pharmaceutical Sciences Series, M.& D. Inc. , New York.
13. Leon Lachman- The Theory and Practice of Industrial Pharmacy, K.M. Verghease Co. Bombay.
14. Pharmacopoeia of India.

M. Sc. Pharm. Chem. IIIrd Sem.

ONLINE COURSES (SWAYAM/NPTEL/ MOOCS)

ELECTIVE COURSES; CODE (SOS/PC/E008)

One online elective course from SWAYAM/NPTEL/MOOCs of 06 credits to be qualified under the supervision of advisor of the Department during the IIIrd Semester. Visit to the University Website - hnbgu.ac.in for online MOOCS courses. Course should be relevant to Pharmaceutical Chemistry.

M.Sc. PHARMACEUTICAL CHEMISTRY- IV SEMESTER

Category	Subject Title	Course Type	Course code	Credits
DSC (Research)	Industry internship/ Project from parent institute/industry/ Research Organizations.	DSC-1 (Research Project)	SOS/PC/C013	18
DSE (Field Work)	Traditional Healthcare system of Uttarakhand (Field Work) A report and Herbarium will be submitted by the students in the Department and evaluation done by faculty.	DSE-7 (Field work and Report writing)	SOS/PC/E009	6
DSE (Research)	Minimum Participation in the two National /International Level Seminar/Conference/ /Symposium/ Training Programs/ minimum three days Workshop/ One paper Publication	DSE-10 (Conference/ Seminar)	SOS/PC/E0010	6
Total Credits				24
Important Note: The students will opt only Field work or Research based Choice DSE in M.Sc. IInd year (Semester-IV)				

M. Sc. Pharm. Chem. IV Sem.
INDUSTRY INTERNSHIP/ PROJECT FROM PARENT INSTITUTE/INDUSTRY/
RESEARCH ORGANIZATIONS.

Industrial Internship/ Dissertation/ Project Work

Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry / research organization one member of that body can also be included as project guide.

Dissertation is a core one and mandatory for every student. The dissertation is to be allotted in the beginning of III Semester and would be submitted at the time of the examination of IV Semester. The distribution of marks for the Dissertation will be as below:

Periodical presentation	: 20 Marks
Dissertation	: 60 Marks
Viva Voce	: 20 Marks
Total	: 100 Marks

The Dissertation would carry 18 credits in all.

The dissertation/ Project report shall be evaluated jointly by the supervisor and Departmental committee.

Following topics/research fields are proposed to undertake Dissertation/ Project Work.

Traditional Health care System of Uttarakhand

Study of Medicinal plants of Uttarakhand Himalaya

Quality control of herbal drugs, Quality control of Synthetic drugs

Any other current trends / topics suggested by the Departmental committee may also be considered for the dissertation/project work other current problems / topics suggested by the Departmental committee.

M. Sc. Pharm. Chem. IV Sem.
FIELD WORK AND REPORTS WRITING

ELECTIVE COURSE; CODE (SOS/PC/E009)

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic, co/extracurricular (Participation in conferences/seminars/ workshops/Training programmes) activities are appreciable.

The contact hours of seminars and assignments hours presentations and discussions with the supervisor shall be considered as practical course.

M. Sc. Pharm. Chem. IV Sem.

CONFERENCE/ SEMINAR/ PAPER PUBLICATION

ELECTIVE COURSE; CODE (SOS/PC/E010)

As per the spirit of National Education Policy is that besides certain quantum of academic work as theory classes, practical classes etc. will be measured in terms of credits. The credit associated with any of the other academic, co/extracurricular (Participation in conferences/seminars/ workshops/Training programmes/ Paper publication) activities are appreciable.

The contact hours of seminars and assignments hours presentations and discussions with the supervisor shall be considered as practical course.

M. Sc. Pharm. Chem. IIIrd Sem.

FIELD WORK; TRADITIONAL HEALTHCARE SYSTEM OF UTTARAKHAND (TWO MONTHS)

ELECTIVE COURSES; CODE (SOS/PC/E008)

Field Visit and Report writing:

The course will be started in the month of July and August due to short time availability of medicinal plants of high altitude Himalayan region. Himalayas have been known to be home to many medicinal plants and herbs since time immemorial. Even the mythical Sanjeevni Booti of the Ramayana which revived Lakshman after he had fallen in battle was claimed to have been brought from the Himalayas. The story reveals that this region as the source as many medicinal plants.

Uttarakhand, a natural environment of the Himalayas also known as ‘Dev Bhoomi’ or “Herbal State” is rich with majestic natural beauty, great wealth of medicinal plants, and traditional medicinal knowledge. People in remote village areas are dependent upon the folk medicines and household remedies to a great extent. Local inhabitants who have lived in the vicinity of forests, due to being close to the nature, possess a deep practical knowledge on indigenous flora, pertaining to curatives, culture, customs, ethos, cults, religion, belief, legends, myths as well as other miscellaneous uses. The prevalent practice of using herbal remedies has passed down from generation to generation and includes the cure of simple ailments to the most complicated ones. Locals still depend on their indigenous healthcare practices to treat various ailments. However, these practices are now declining due to lack of interest in the younger generation who are unable to speak their own language. So it is crucial to document these practices before they vanish.