

SHRI GURU RAM RAI UNIVERSITY

(Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017)



Syllabus

For

M. Sc. (PHARMACEUTICAL CHEMISTRY)

(Under CBCS Pattern)

School of Basic & Applied Sciences

(w.e.f. 2024-2025)

Shri Guru Ram Rai University, Patel Nagar, Dehradun-248001 Uttarakhand, India

Master of Science (Pharmaceutical Chemistry)-Two Year Programme (As per CBCS)

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

The student shall be eligible for admission to a Master's Degree Program in Pharmaceutical Chemistry after he/she has successfully completed a three year undergraduate degree or earned prescribed number of credits through the examinations conducted by University as equivalent to an undergraduate degree with minimum 45% marks in undergraduate course.

Core courses prescribed for every Semester shall be mandatory for all students registered for the Master's Program in Pharmaceutical Chemistry and shall carry minimum 86 credits. There shall be Elective courses offered in semester III and IV including dissertation and shall carry a minimum of 24 credits. A self-study course would comprise of maximum 06 credits of which minimum 03 credits shall be mandatory which shall not be included while calculating grades. The student may choose self-study course either only in one of the two semesters (III/IV). The self study course shall be based on advanced topics. As a mandate student should undergo 5 week industrial training during summer break after 2nd semester to boost up the academic knowledge and gain the industrial exposure. The industrial training would comprise of 03 credits that shall be mandatory, which shall not be included while calculating grades but will be mentioned in award sheet.

In order to qualify for a two year master's degree, a student must acquire a minimum of 86 credits including a minimum of 24 credits in electives choosing at least two electives in Semester III/IV offered either by the parent department or other departments and one qualifying self-study course and industrial training of minimum 03 credits each.

The dissertation is a semester long elective course of 09 credits and is mandatory for every student. The dissertation would be allotted in the beginning of III Semester and candidate would submit the thesis/report during IV Semester examination. The dissertation may be in the form of a field based minor research work/ project work/ practical training. The students may complete the dissertation work in the department/ other research institutes/ industries/ hospitals etc.

A candidate has to secure a minimum of 40 percent marks in individual paper in university examination as well as mid-term exam and 50% marks in aggregate (Two Sessional Tests marks plus End-Term Examination marks) to pass.

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

- 1) Core course: Minimum 62 credits.
- 2) Elective course: Minimum 24 credits(including dissertation)
- 3) Dissertation: 09 credits (elective) in IV Semester.
- 4) Self study course: Maximum 06 credits (one minimum 03 credits shall be mandatory but not to be included while calculating grades).
- 5) Industrial training: 03 credits (Shall be mandatory but not to be included while calculating grades).
- 6) Journal club: 1 credit.

M.Sc. Pharmaceutical Chemistry

I Semester

Sl.	Code	Paper	Credits			MM
			L	P	C	
1	MPCC101	Analytical Techniques	3	0	3	100
2	MPCC102	Introduction To Pharmaceutics	3	0	3	100
3	MPCC103	Introduction To Basic Pharmacology	3	0	3	100
4	MPCC104	Advanced Organic Chemistry	3	0	3	100
5	MPCL105	Laboratory- I (Pharmaceutical Analysis)	0	4	4	100
6	MPCL106	Laboratory- II (Pharmaceutical Chemistry)	0	4	4	100
			Core Credit		20	600

II Semester

Sl.	Code	Paper	Credits			MM
			L	P	C	
1	MPCC201	Advance Analytical Techniques	3	0	3	100
2	MPCC202	Stereochemistry and Reaction Mechanism	3	0	3	100
3	MPCC203	Chemistry of Natural Products	3	0	3	100
4	MPCC204	Medicinal Chemistry-I	3	0	3	100
5	MPCL205	Laboratory-I (Medicinal Chemistry)	0	4	4	100
6	MPCL206	Laboratory-II (Chemistry of Natural Products).	0	4	4	100
			Core Credit		22	600

* 4-5 Week Industrial Training in Summer Break (June-July) and submission of report and presentation in III semester.

III Semester

Sl.	Code	Paper	Credits			MM
			L	P	C	
1	MPCC301	Introduction to Pharmaceutical Technology and Biopharmaceutics	3	0	3	100
2	MPCC302	Medicinal Chemistry –II	3	0	3	100
3	MPCE303	Elective – I (a) Phytoceuticals & Nutraceuticals (b) Biochemistry & Metabolism (c) Computers & Biostatistics	3	0	3	100

4	MPCE304	Elective – II a) Drug Design b) Standardization of Herbal Drug c) Cosmeticology	3	0	3	100
5	MPCL305	Laboratory-I (Pharmaceutical Technology & Biopharmaceutics)	0	4	4	100
6	MPCL306	Laboratory-II (Based on electives)	0	4	4	100
7	MPCS307	Self Study a) Traditional Health Care System Uttarakhand Including Ayurvedic Medicine b) Forensic Pharmacy	3	0	3	100
8	MPCI308	Industrial Training Report/Presentation.	03		3	
						600

Core Credit = 11 + Elective Credit = 11 Total Credit = 22 with additional 3 credits of self study & 3 credits of Industrial Training.

IV Semester

Sl.	Code	Paper	Credits			MM
			L	P	C	
1	MPCE401	DISSERTATION	0	0	20	300
2	MPCC402	Drug Regulatory Affairs	3	0	3	100
3	MPCE403	a. Herbal Drug Technology b. Essentials of Traditional Medicines c. Advance Drug Delivery	3	0	3	100
4	MPCL404	Laboratory-I (Pharmaceutical Drug Analysis)	0	0	4	100
5	MPCJ405	Journal Club	0	0		
6	MPCS406	Self Study a) Pharmaceutical Industrial Management Including Marketing b) Environment Chemistry	3	0	3	100
						600

Core Credit 07 + Elective Credit 13, Total Credit = 20 with additional 3 credits of self study and 01 credit of journal club.

#Journal club will include the reading, presentation and develop writing skills in view of thesis writing/research article writing.

The thesis evaluation will be of 180 marks and 60 marks of academic performance and 60 marks for viva-voce.

Master of Science (Pharmaceutical Chemistry)-As per CBCS
M. Sc. Pharm. Chem. 1st Sem.
ANALYTICAL TECHNIQUES, PAPER CODE- MPCC101

Lecture: 3hrs/week

Max. Marks: 100

Unit I

- a. **GENERAL CONCEPT OF ANALYSIS:** Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, precision and accuracy, primary and secondary standards . Fundamental of volumetric analysis, methods of expressing concentrations, primary and secondary standards.
- b. **ACID BASE TITRATION:** Acid-base concepts, role of solvent, relative strengths of acids and bases, ionization, law of mass action, common-ion effect, ionic product of water, pH, hydrolysis of salts, Henderson-Hasselbach equation, buffer solution, neutralization curves, acid-base indicators, theory of indicators, choice of indicators, mixed indicators, polyprotic system.
- c. **OXIDATION REDUCTION TITRATIONS:** Concepts of oxidation and reduction, redox reactions, strengths and equivalent weights of oxidizing and reducing agents, theory of redox titrations, redox indicators, oxidation reduction curves, iodimetry and iodometry.

Unit II

- a. **PRECIPITATION TITRATIONS:** Precipitation reactions, solubility products; effect of acids, temperature and solvent upon the solubility of precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate indicators, Gaylussac methods, Mohr's method, Volhard's method and Fajan's methods.
- b. **GRAVIMETRIC ANALYSIS:** Precipitation techniques, Solubility products; the colloidal state, Supersaturation co-precipitation, Post-precipitation, Digestional washing of the precipitate, filtration, Filter papers and crucibles, Ignition, Organic precipitants.
- c. Theoretical considerations and application in drug analysis of Non-aqueous titration and Complexometric titration

Unit III

- a. **CHROMATOGRAPHY:** Adsorption: Freundlich and Gibb's adsorption, isotherms, Langmuir theory of adsorption. Absorption, Chemisorption
- b. **PRINCIPLES, INSTRUMENTATION AND APPLICATION OF FOLLOWING SEPARATION TECHNIQUES**
 1. Paper chromatography
 2. Thin layer chromatography
 3. Column chromatography

Recommended Books: (Latest Editions)

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.

4. Willard, H. H., Merrit, L.L., Dean, J. A., Settle P. A., Instrumental Methods of Analysis, VonNostrand.

M. Sc. Pharm. Chem. 1st Sem.
INTRODUCTION TO PHARMACEUTICS, PAPER CODE- MPCC102

Lecture: 3hrs/week

Max. Marks: 100

Unit I

Introduction of Pharmaceutical Dosage Forms: Definition, classification method of preparation, uses, advantages also including illustrative examples of equivalent Indian marketed formulations of the following- solutions, aromatic waters, mixtures, spirits, syrups, elixirs, powders, lotions, liniments, pastes, mucilage, glycerin, paints, , mouth washes, and inhalations.

Unit II

a. Pharmaceutical Literature and Ethics: Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.

b. Pharmaceutical Calculations: Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.

Unit III

Pre-formulation Studies: Study of physical properties of drug like physical form, polymorphism, particle size, shape, density, wetting, dielectric constant, dissociation constant, distribution coefficient, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability.

Unit IV

a. Tablets: Formulation of different types of tablets, granulation technology on large scale by various techniques, physics of tablets making, machinery and tooling and the equipments employed, evaluation of tablets including stability testing as per ICH guidelines

b. Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating process, and defect of coating.

c. Capsules: Introduction to capsules as a dosage form, hard and soft gelatin capsules, formulation and evaluation, machinery, packaging, stability testing and storage.

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBSpublishers,New Delhi.
3. Indian and British pharmacopoeia.
4. Remington: The Science and Practice of Pharmacy, 20th edition PharmaceuticalScience (RPS).
5. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
6. Pharmaceutics- The science of dosage form design by M.E. Aulton, Churchill livingstone

M. Sc. Pharm. Chem. 1st Sem.
INTRODUCTION TO BASIC PHARMACOLOGY, PAPER CODE-MPCC103

Lecture: 3hrs/week

Max. Marks: 100

Unit-I

General Pharmacology

- a.** Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.
- b.** Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination
- c.** Pharmacodynamic- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. Drug receptors interactions, signal transduction mechanisms, G-protein-coupled receptors, ion channel receptor,

Unit-II

- a.** General concepts of toxicity, Acute, subacute & chronic toxicity tests
- b.** Teratogenicity & carcinogenicity, itrogenic diseases
- c.** LD₅₀, ED₅₀, side effects, tolerance, habituation & addiction.

Unit-III

- a.** General concept of *in-vitro* and *in vivo* study, Bio-assays: General principles, general methods, biological variations & animal ethics.
- b.** Bioassays of insulin, heparin, d-tubocurarin, digitalis, acetylcholine, adrenaline, histamine.

Recommended Books: (Latest Editions)

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. Munson L. Paul, Principles of Pharmacology, Chapman & Hill, N. Y. 1995.
5. S. K. Kulkarni & P.C. Dandiya, Introduction to Pharmacology, 5th ed. Vallabh Prakasha, 1998.
6. Laurence & Bennett, Clinical Pharmacology, 8th ed., Churchill Livingstone, N. Y. 1997.
7. S. D. Seth, Text Book of Pharmacology, 2nd ed. Churchill Livingstone Pvt. Ltd., New Dlhi.
8. F.S.K. Barar, Essential of Pharmacotherapeutics, 3rd ed. S. Chand and Company Ltd., New Delhi, 1995.
9. K.D. Tripathi, Essentials of Medical Pharmacology, 9th ed., Jaypee Brothers New Delhi, 1995.

M. Sc. Pharm. Chem. 1st Sem.
ADVANCED ORGANIC CHEMISTRY PAPER CODE- MPCC104

Lecture: 3hrs/week

Max. Marks: 100

UNIT-1.

Structure, formation, reaction, stereochemistry and stability of Carbocation, Carbanions, free radicals, carbene, and nitrene. Mechanism involving free radical, nucleophile & electrophile mediated reactions and methods of determining them.

UNIT-2.

S_N1, S_N2 and mixed S_N1 and S_N2 mechanism and its stereochemical aspects. Factor influencing nucleophilic substitution reactions, Reactivity effects of substrate structure, attacking nucleophilic group, leaving group and reaction medium, ambient nucleophile.

UNIT-3.

Mechanisms involving Aromatic electrophilic reaction, Aromatic nucleophilic reactions, free radical reactions and elimination mechanism.

UNIT-4.

Mechanism and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemo selectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration, Sharpless asymmetric epoxidation.

Recommended Books:

1. Advanced Organic Chemistry- Reaction, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.

M. Sc. Pharm. Chem. 1st Sem.
LABORATORY- I (PHARMACEUTICAL ANALYSIS)
PAPER CODE: MPCL105

Lecture: 8hrs/ Week

Max. Marks: 100

The practical's shall be based on theory syllabus of Analytical Techniques. The following is the list of proposed practicals.

1. Preparation and standardization of
 - Sodium hydroxide
 - Sulphuric acid
 - Sodium thiosulfate
 - Potassium permanganate
 - Ceric ammonium sulphate
2. Assay of the following compounds along with Standardization of Titrant
 - Ammonium chloride by acid base titration
 - Ferrous sulphate by Cerimetry
 - Copper sulphate by Iodometry
 - Calcium gluconate by complexometry
 - Hydrogen peroxide by Permanganometry
 - Sodium benzoate by non-aqueous titration
 - Sodium Chloride by precipitation titration
3. Separation & Identification of compounds
 - Separation of amino acids by paper chromatography
 - Separation of sugars by thin layer chromatography
 - Separation of plant pigments by column chromatography

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

M. Sc. Pharm. Chem. 1st Sem.
LABORATORY- II (PHARMACEUTICAL CHEMISTRY)
PAPER CODE: MPCL106

Lecture: 8hrs/ Week

Max. Marks: 100

1. Systematic qualitative analysis of unknown organic compounds like
 - Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
 - Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
 - Solubility test
 - Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
 - Identification of the unknown compound from the literature using melting point/ boiling point.
 - Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.

2. Preparation/ synthesis of suitable solid derivatives from organic compounds.

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwalia/Chatwal.

IInd SEMESTER

M. Sc. Pharm. Chem. IInd Sem.
ADVANCED ANALYTICAL TECHNIQUES
PAPER CODE- MPCC201

Lecture: 3hrs/week

Max. Marks: 100

UNIT-I

- a. **UV-Visible spectroscopy:** Theory, absorption law, Colorimetric Methods, Chromophore and auxochrome concept, Solvent effect, Instrumentation and applications, Woodward's Fieser, Fieser Kuhn and Nelson rule, Spectral correlation with structures.
- b. **Fluorimetric Analysis-**Principle, Theory, molecules exhibiting fluorescence, factors interfering with fluorescence intensity, Instrumentation and applications.

Unit-II

- c. **Atomic spectrophotometry:** Atomic emission & Atomic absorption spectrophotometry: principle, instrumentation, interferences and applications.
- d. **Infrared spectroscopy:** Introduction, basic principles, vibrational modes, characteristic regions of the spectrum, Factors affecting vibrational frequency, instrumentation, sampling techniques and applications. Interpretation of IR, spectra of simple compounds.

Unit-III

- a. **Proton Magnetic Resonance (¹HNMR):** Principle, theory, instrumentation, applications, Splitting of signals, chemical shift, spin-spin coupling, shielding desheilding effect, factors affecting chemical shift, coupling constant & interpretation of spectra.
- b. **¹³C-NMR:** Principle and Applications.

Unit-IV

- a. **Mass Spectrometry:** Principle, ionization techniques, instrumentation, fragmentation pattern & applications.
- b. **GC-MS and LC-MS:** Principle, Instrumentation and Applications.

Unit-V

- a. **Chromatographic Techniques:** HPLC, GC, HPTLC, Electrophoresis, Ion exchange and Gel filtration chromatography- Principle, Instrumentation and Applications

Recommended Books (Latest Editions)

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. W. Kemp, Organic Spectroscopy, 1st ed. ELBS/Macmillan, London, 1975.

M. Sc. Pharm. Chem. IInd Sem.
STEREOCHEMISTRY AND REACTION MACHANISM
PAPER CODE- MPCC202

Lecture: 3hrs/week

Max. Marks: 100

Unit-I

Optical isomerism, configuration, Cahn-Ingold-Prelog rule for designation of configuration. Stereochemistry of carbon compounds with no chiral atom, Biphenyls, Allenes,. Geometrical isomerism & stereochemistry of olefins.

Unit-II

Stereoisomerism of rings, stability of rings, ease of ring formation, Actual shape of six membered rings & its relation to properties & reactivity.

Unit-III Optical rotation, its significance, instrumentation. Optical rotatory dispersion-terminology, plain curve, rotatory dispersion & circular dichroism and octane rule.

Unit-IV

Study of Name Reactions such as: Fries Rearrangement, Beckmann rearrangement, Hofmann rearrangement & Hoffmann's degradation, Curtius reaction, Schmidt Reaction, Claisen's Condensation, Wittig Reaction, Oppenauer oxidation, Meerwein Ponderoff Valery Reduction, Clemmensen reduction, Reimer-Tiemann Reaction, Wolf Kishner's Reduction, Pinacol-Pinacolone Rearrangement, Cannizaro's Reaction, Knoevenagel, Claisen, Mannich, Perkin and Stobbe reactions, Aldol Condensation, Benzoin Condensation.

Recommended Books (Latest Editions)

1. E.L. Eliel Stereochemistry of carbon compounds, Tata McGra Hill Publishing Company New Delhi 1975.
2. Jerry March, Advance organic Chemistry 4th ed.. A Wiley-Interscience Publication, 1999.

M. Sc. Pharm. Chem. IInd Sem.
CHEMISTRY OF NATURAL PRODUCTS
PAPER CODE- MPCC203

Lecture: 3hrs/week

Max. Marks: 100

Unit-I

Heterocyclic Compounds: General Introduction, classification and nomenclature,

Methods of preparation, physical & chemical properties of the following-

Five membered heterocycles: Furan, thiophene, pyrrole, thiazole, pyrazole, oxazole,

Six membered: Pyridine, pyrimidine, quinilene.

Unit-II

Carbohydrate : Introduction, classification, mutarotation, constituent of glucose, 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, classification, isolation & purification. General methods of structure determination. Structural elucidation of atropine, quinine, Nicotine

Unit-IV

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

Recommended Books (Latest Editions)

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.

M. Sc. Pharm. Chem. IInd Sem.
Medical Chemistry I (Chemotherapeutic Agents)
PAPER CODE- MPCC204

Lecture: 3hrs/week

Max. Marks: 100

Chemical Classifications, SAR Studies, Mode of actions and Therapeutic uses.

Unit-I Beta lactam antibiotics: Penicillins, Cephalosprins including their semi-synthetic products. Monobactams.

Unit-II Tetracyclines, Semi-synthetic tetracyclines, Gentamycins, Neomycins, Kanamycins, Fluoroquinolones type of antibacterials.

Unit-III Sulfonamides, Antileprotics, Antimycobacterials, Antifungals.

Unit-IV Antiprotozoal includes – Antimalarials, Antiamoebics, Antihelminths.

Unit-V Anticancer, Antivirals

Synthesis of following drugs .

5-Fluorouracil, 6-Mercaptopurine, Amoxicillin, Busulfan, Chloroquine, Ciprofloxacin, Cyclophosphamide, Dapsone, Deoxycycline, Ethionamide, Idoxuridine, Isoniazid, Ketoconazole, Metronidazole, Penicillins G, Proguanil, Pyrimethamine, Sulfadioxime, Sulfasalazine, Trimethoprin.

Recommended Books (Latest Editions)

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 & Drug Discovery, 5th ed., Wiley Interscience, New York, 1995.
4. H. Singh and V.K. Kapoor, Medicinal and Pharmaceutical Chemistry, 1st ed., Vallabh Prakashan, Delhi, 1996.
5. Ashutosh Kar, Medicinal Chemistry, New Age International (P) Limited, New Delhi, 1993.

M. Sc. Pharm. Chem. IInd Sem.
Laboratory-I (Medicinal Chemistry)
PAPER CODE- MPCL205

8hrs/ Week

MM:100

1. Preparation and establishment of pharmacopoeial standards of following drugs and intermediates;
 - Sulphanilamide
 - 7-Hydroxy, 4-methyl coumarin
 - Chlorobutanol
 - Triphenyl imidazole
 - Tolbutamide
 - Hexamine
 - Isoniazid
 - Isonicotinic acid hydrazide
 - Chloroquine
 - Metronidazole
 - Dapsone
 - Chlorpheniramine maleate
 - Benzyl penicillin

2. Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

3. Drawing chemical structures and reactions using chem draw/ other software.

Recommended Books (Latest Editions)

1. Text book of practical organic chemistry- A.I.Vogel.
2. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
3. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
4. Organic Chemistry by I.L. Finar, Vol. II.
5. Foye's Principles of Medicinal Chemistry

M. Sc. Pharm. Chem. IInd Sem.
Laboratory-II (Chemistry Of Natural Products)
PAPER CODE- MPCL206

8hrs/ Week

MM:100

1. Phytoconstituents tests of various classes of natural products
2. Isolation of natural organic compounds from medicinal plants
 - Isolation of caffeine from Tea leaves
 - Isolation of piperine from Black Pepper
 - Isolation of Hesperidin from Orange Peel
 - Isolation of Clove oil from clove
 - Isolation of Caraway oil from caraway
 - Isolation of cumin oil from cumin.
2. Extraction of essential oils
3. Analysis of fixed oils
 - Acid value,
 - Saponification value
 - Ester value
 - Iodine value)

Recommended Books (Latest Editions)

1. Manitto, Biosynthesis of Natural Products, Wiley India
2. Finar I.L, Organic chemistry, Vol. II, Pearson Education Pvt Ltd, New Delhi,2002.
3. Agarwal O.P., Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
4. Indian Pharmacopoeia (Latest Edition)
5. Morrison, R.T., and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt. Ltd, New Delhi.14

IIIrd SEMESTER

M. Sc. Pharm. Chem. IIIrd Sem.
INTRODUCTION TO PHARMACEUTICAL TECHNOLOGY AND BIOPHARMACEUTICS
PAPER CODE- MPCC301

Lecture: 3hrs/week

Max. Marks: 100

UNIT-I

Liquid orals: Formulation and manufacturing consideration of solutions, suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia

UNIT-II

- A. Parenteral Products:** Preformulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation and evaluation, equipments, containers and closures and their selection.
- B. Ophthalmic Preparations:** Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-III

Biopharmaceutical classification system

Drug Absorption: Mechanism of drug absorption through GIT (Passive diffusion, Active transport)

Factor influencing drug absorption through GIT (Physicochemical, Pharmaco-Technical and Biological factors).

UNIT-IV

Drug Disposition:

Distribution of drugs, binding of drugs, apparent volume of drug distribution, protein binding of drugs and kinetics of protein binding.

Biotransformation and Excretion of drugs

UNIT-V

Bioavailability and Bioequivalence:

Objective of bioavailability studies, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro, in-vivo correlations, bioequivalence studies protocol and regulatory requirements.

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
2. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.
3. Pharmaceutics- The science of dosage form design by M.E. Aulton, Churchill Livingstone
4. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
5. Bio pharmaceuticals and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B. Jaiswal, Vallabh Prakashan Pitampura, Delhi
6. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebert F Notari Marcel Dekker Inn, New York and Basel, 1987.

M. Sc. Pharm. Chem. IIIrd Sem.
MEDICINAL CHEMISTRY-II (PHARMACODYNAMIC AGENTS)
PAPER CODE- MPCC302

Lecture: 3hrs/week

Max. Marks: 100

Chemical Classifications, SAR Studies, Mode of actions and Therapeutic uses of the following classes of drugs.

Unit-I Drugs acting on CVS – Antianginals, Antihypertensives, Antilipidemics, Antiarrhythmics, Diuretics.

Unit-II Analgesics – Narcotic and NSAIDs, Antipyretics, Uricosurics (Antigouts).

Unit-III Drug acting on CNS – Hypnotic, Sedative drugs, Antiepileptics, General & local anaesthetics, Antiparkinsonian drugs

Unit-IV Psychotherapeutics – Antipsychotics, Anxiolytic drugs, Antidepressants and Antidiabetics.

Unit-V H₁-blockers (Anti-histaminics), H₂-blockers (Anti-ulcers), Carbohydrate based drugs, Oligonucleotides.

Synthesis of following drugs: Acetazolamide, Amantidine HCl, Chloropheniramine, Chlorpromazine, Chlorothiazide, Clofibrate, Clonidine HCl, Diphenhydramine, Ethacrynic acid, Felodipine, Ibuprofen, Isosorbide dinitrate, Labetolol, Nalorphine, Phenobarbital, Phenytoin, Procainamide, Propranolol, Ranitidine, Verampil, Fluoxetine, Metformin, Benzocaine, Ketamine, levodopa,

Recommended Books: (Latest Editions)

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 & Drug Discovery, 5th ed., Wiley Interscience, New York, 1995.
4. H. Singh and V.K. Kapoor, Medicinal and Pharmaceutical Chemistry, 1st ed., Vallabh Prakashan, Delhi, 1996.
5. Ashutosh Kar, Medicinal Chemistry, New Age International (P) Limited, New Delhi, 1993.

M. Sc. Pharm. Chem. IIIrd Sem.

ELECTIVE PAPER-I PHYTOPHARMACEUTICALS AND NUTRACEUTICALS PAPER CODE- MPCE303 (A)

Lecture: 3hrs/week

Max. Marks: 100

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

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Text Book of Pharmacognosy by T.E. Wallis
3. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
4. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
5. Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.
6. Essentials of Pharmacognosy, Dr.SH.Ansari, 2nd edition, Birla publications, New Delhi, 2007

M. Sc. Pharm. Chem. IIIrd Sem.

ELECTIVE PAPER-I BIOCHEMISTRY AND METABOLISM PAPER CODE- MPCE303 (B)

Lecture: 3hrs/week

Max. Marks: 100

Unit I Enzymes: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzyme action; Coenzymes and their biochemical role.

Unit II

Energy metabolism, bioenergetics, introduction to intermediary metabolism,

- Carbohydrate metabolism:** Glycolysis, Citric acid cycle (TCA cycle) Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases);
- Lipid metabolism:** Oxidation of saturated (β -oxidation); Ketogenesis and ketolysis; Defective metabolism of lipids (Atherosclerosis, fatty liver, hypercholesterolemia).
- Protein and amino acid metabolism:** protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; hyperbilirubinemia, porphoria, jaundice.
- Nucleic acid metabolism:** Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.

Unit III

Brief introduction of kidney function tests, Liver function test, Lipid profile tests.

Recommended Books: (Latest Editions)

- Robert K. Murray, Daryl K. Grapper, Pater A. Mayes, Victor, W. Rodwell, Harper's Biochemistry, 25th ed., MCGraw Hill health Professions Division, New York, USA, 1998.
- A.V.S.S. Rama Rao, Text Book of Biochemistry, 6th ed., L.K. & S. Publishers. Visakhapatnam, 1991.
- Melson David L. Lehninger Principles of Biochemistry, 3rd ed., Macmillan worth publishers. N. Y. USA, 2001.
- Stryer Lubert, Berg Jeremy M., Tymoezko Johan L., Biochemistry, 5th ed., W. H. Freeman & Company, New York, 2002.
- M.C. Pant, Essentials of Biochemistry, 8th ed., Kedar nath Ram Nath & Co publishers, Meerut, 1996.
- E. David Metzler, Carol M. Metzler, David J. Sauke, Biochemistry the chemical reactions of living cells, 2nd ed., Har court/Academic Press, New York.

M. Sc. Pharm. Chem. IIIrd Sem.

ELECTIVE PAPER-I BIostatISTICS AND COMPUTERS PAPER CODE- MPCE303 (C)

Lecture: 3hrs/week

Max. Marks: 100

Unit I Introduction and scope of Biostatistics Presentation of data: classification of data, Methods of collection of data (primary and secondary), frequency distribution, and graphical representation of data by histogram, frequency polygon, frequency curve and cumulative frequency curve. Central tendency and measures of dispersion, mean, median, mode and their properties, partition value, standard deviation and coefficient of variation, simple correlation coefficient and regression coefficient, regression lines, tests of significance: t-test, z-test, chi-square tests, F-test, heterogeneity and independence of attributes.

Unit II Testing of hypothesis Types of errors, power of test, test of significance based on normal distribution T-test for mean of population, difference of means of two normal population, chi-square test of goodness of fit, independent test, test of variance of normal population F-test for variance ratio, correlation and regression, latest square methods and its application, significance of coefficient of correlation, rank correlation curve fitting and sign test.

Unit III Computer fundamentals Sample model of computer and its working, input-output devices, computer languages and their hierarchy (low level and high level), Introduction to microcomputers, concept of operating system, computer networking, Introduction of software (MS-Word, MS-Excel & Power point etc.)

Unit IV Introduction of C++ Programming Difference between C and C++, concept of OOP'S, basic data types and operators, sample programs, conditional statements(IF-ELSE ,NESTED IF),concept of looping(for, while and do-while),Introduction to subscripted variables(single and double), classes and objects, function & function overloading, constructor and destructor, pointers.

UNIT V Internet and its working, uniform resource locator (URL), World wide web, HTTP, Internet explorer. Role of computers in pharmaceutical sciences.

Recommended Books: (Latest Editions)

1. Information technology-D.P.Curtin, Tata McGraw Hill,New Delhi.
2. Guide to Medical Informatics, The Internet & Telemedicine-E Coiera, Arnold Publishers, USA.
3. Biostatistics-Arora & Malhan, Himalaya Publishing House, Bombay.
4. Statistical Methods in Biology-Baidy, Cambridge University press.
5. P. K. Sinha, B.P.B Publication New Delhi.

M. Sc. Pharm. Chem. IIIrd Sem.

ELECTIVE PAPER-II DRUG DESIGN PAPER CODE- MPCE304 (A)

Lecture: 3hrs/week

Max. Marks: 100

Unit-I Specific and non-specific drug action , Drug receptors, Basic concept and classification of receptors, Forces involved in drug receptors- interactions , Receptor agonism and antagonism , Concept of Spare receptors , Simple kinetics of drug- receptor interaction , Receptor theories: Clark's occupancy theory, Ariens-Stephenson modification, Induced fit and macromolecular perturbation theories , Ion Channel receptors

Unit-II Topographical study of the following receptors includes only preferred conformations, pharmacophores and modes of bindings/interactions , Adrenergic, Cholinergic, Opioid receptors , H-1 & H-2 receptors, Diazepine, Serotonin

Unit-III Concept of isosterism and bioisosterism and their applications in drug design, Antimetabolite approach to drug design, Analog drug design, Prodrugs and drug latention – Carrier-linked prodrugs – Bioprecursors – Role of functional groups in prodrug design, General pathways of drug metabolism

Unit-IV Stereochemical aspects of drug action – Stereoselectivity of optical isomers – Role of planarity in drug action – Stereoselectivity of conformational isomers, QSAR including – Types of QSAR models, Classification of parameters utilized in QSAR studies , Statistical concept of QSAR, Hansch model of QSAR, De Novo model of QSAR, Hammett and Taft model of QSAR equations , Applications of QSAR in drug design

Unit-V Basics of combinatorial chemistry, Rational approach to drug design , Basic strategies of drug discovery , Role of molecular docking/modeling in drug design, computer assisted drug design

Recommended Books: (Latest Editions)

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

M. Sc. Pharm. Chem. IIIrd Sem.

ELECTIVE PAPER-II STANDARDIZATION OF HERBAL DRUG PAPER CODE- MPCE304 (B)

Lecture: 3hrs/week

Max. Marks: 100

Unit I:

General Introduction to Medicinal Plants, Phytomedicine and Herbal Therapeutics, Role of Herbal Medicine in Health Care

Unit II:

Safety of Herbal Drugs, Contaminants in Herbal Drugs, Development of monitoring systems for safety of herbal drugs, Assessment of toxicity of herbal drugs, risk assessment and challenges with safety of herbal drugs, Assessment of Efficacy of Herbal Drugs – Methods, tools and application.

Unit III:

Overview of Standardization of Herbal Drugs and Plant Extracts. Need and scope of Standardization, Protocols for standardization of herbal drugs, Challenges with standardization of herbal drugs, validation techniques for herbal products.

Recommended Books (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007

M. Sc. Pharm. Chem. IIIrd Sem.

ELECTIVE PAPER-II COSMETICOLOGY PAPER CODE- MPCE304 (C)

Lecture: 3hrs/week

Max. Marks: 100

Unit I:

General Physiology of skin, hair, nails and eye with reference to cosmetic application. Principles of cosmetic technology. Various additives like preservatives, antioxidants, colours and stabilizers used in cosmetics, Rheology of cosmetics

Unit II:

Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens, cosmetic creams, powders, compacts, sticks, liquids, foam and aerosol cosmetics.

Unit III:

Quality control of cosmetics, evaluation of quality, safety and efficacy of cosmetics. Testing of creams, deodorants, antiperspirants, powders.

Unit IV:

Clinical safety testing: Irritation, sensitization, photo irritation, photo-allergy, ocular irritation and protocols for the same. Regulatory requirements: Manufacturing and sale of cosmetics.

Unit V:

Formulation development of herbal cosmetics, packaging of cosmetics, and advances in cosmetics in respect to liposomes and contact lenses

Recommended Books (Latest Editions)

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. L. Appell; The formulation and preparation of cosmetics, fragrances and flavours; Micelle Press.

M. Sc. Pharm. Chem. IIIrd Sem.

Laboratory-I (Pharmaceutical Technology) PAPER CODE- MPCL305

8hrs/ Week

MM:100

1. Formulation of Tablets

- a. Ordinary compressed tablet-wet granulation
- b. Tablets prepared by direct compression.
- c. Fast dissolving tablet tablet.

2. Formulation and filling of hard gelatin capsules

3. Formulation of parenterals

- a. Ascorbic acid injection
- b. Dextrose and Sodium chloride injection/ infusion.

4. Evaluation of Pharmaceutical formulations (QC tests)

- a. Tablets
- b. Capsules
- c. Injections

5. Formulation of two liquid oral preparations and evaluation by assay

- a. Paracetamol Suspension
- b. Antacid suspensions
- c. Liquid paraffin emulsion

6. Formulation of semisolids and evaluation by assay

- a. Salicylic acid ointment
- b. Gel formulation Diclofenac gel

7. Experiments designed for the estimation of various pharmacokinetic parameters with given data.

8. In *vitro* evaluation of different dosage forms for drug release.

9. Absorption studies – in vitro.

10. Bioavailability and Bioequivalence studies

11. Statistical treatment of pharmaceutical data.

M. Sc. Pharm. Chem. IIIrd Sem.

**Laboratory-II (based on electives)
PAPER CODE- MPCL306**

8hrs/ Week

MM:100

M. Sc. Pharm. Chem. IIIrd Sem.
TRADITIONAL DRUGS INCLUDING AYURVEDIC MEDICINE
(Self study Course)
PAPER CODE- MPC307 (A)

MM:100

UNIT-1

Classification of drugs

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

UNIT-II

General introduction, composition, chemistry & chemical classes, general methods of extraction & analysis, biosources, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III

Introduction to Ayurvedic Dosage Forms Preparation and Standardization of Ayurvedic Preparation such as Asavas, Arishta, Avaleha, Churna.

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
1. Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.
2. Essentials of Pharmacognosy, Dr.SH.Ansari, 1st edition, Birla publications, New Delhi, 2007

M. Sc. Pharm. Chem. IIIrd Sem.
FORENSIC PHARMACY
(Self study Course)
PAPER CODE- MPC307 (B)

MM:100

UNIT-I

Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; its constitution and functions, Registration of Pharmacists, Offences and

UNIT-II

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the act and rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT III

Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV

Study of Salient Features of Drugs and magic remedies Act and its rules: Objectives, Definition Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalti

Medical Termination of pregnancy act

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh 124
2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M.L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Drugs and Magic Remedies act by Govt. of India publication

IVth SEMESTER

M. Sc. Pharm. Chem. IVth Sem.
PROJECT
PAPER CODE –MPCE401

20 Credits

MM:300

Project from parent institute/industry/Research Organizations. 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.

1. The project shall be submitted in the Department.
2. Pre submission presentation is compulsory; pre-presentation should be done in the presence of staff members of the department

M. Sc. Pharm. Chem. IVth Sem.
DRUG REGULATORY AFFAIRS
PAPER CODE –MPCC402

Lecture: 3hrs/week

Max. Marks: 100

UNIT-I

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals

UNIT-II

Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

UNIT-III

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by design, Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000.

UNIT-IV

Introduction to regulatory affairs and Indian regulatory requirements:

Introduction, International Drug Regulatory affairs, Drugs and Cosmetics Act and rules with special reference to schedule M.

Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Common Technical Document (CTD), Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

UNIT-V

- A. Good Laboratory Practices:** General provisions, organization and personnel, facilities, equipment, testing facilities operation, test and control articles, protocol for conduct of a nonclinical laboratory study, records and reports, disqualification of testing facilities
- B. Calibration and Validation:** Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan.

Recommended Books and Web link:

1. International Regulatory Affairs Updates, 2005. Available at <http://www.iraup.com/about.php>
2. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
3. Regulatory Affairs brought by learning plus, inc. available at <http://www.cgmp.com/ra.htm>.
4. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and IsaderKaufer, Marcel Dekker series, Vol.143
5. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P.Martin, Drugs and the Pharmaceutical Sciences, Vol.185, Informa Health care Publishers.

6. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino,MD,5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
7. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons.Inc.
8. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.
9. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A.Rozovsky and Rodney K. Adams

M. Sc. Pharm. Chem. IVth Sem.
HERBAL DRUG TECHNOLOGY
PAPER CODE – MPCE403 (A)

Lecture: 3hrs/week

Max. Marks: 100

UNIT-I

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation

Source of Herbs

Selection, identification and authentication of herbal materials

Processing of herbal raw material

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.

Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

UNIT-II

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

Herbal excipients:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrates, flavors & perfumes.

Herbal formulations:

Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT- IV

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs

Stability testing of herbal drugs.

UNIT-V

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine

Components of GMP (Schedule – T) and its objectives

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002

M. Sc. Pharm. Chem. IVth Sem.
ESSENTIAL OF TRADITIONAL MEDICINE
PAPER CODE – MPCE403 (B)

Lecture: 3hrs/week

Max. Marks: 100

UNIT-1

Definition, History and scope of Phytomedicines.

UNIT-II

Alternative system of medicine: Historical overview of Indian system of medicine-Ayurveda, Siddha, Homeopathic system of medicine, Development of Traditional system of medicine in India. Prospects of Traditional medicine.

UNIT-III

Herbal Remedies- Toxicity and Regulation: Importance of Herbal Therapies. Herbs versus conventional drugs. Efficacy of Herbal medicine. General concept of evaluation and quality control Assessment by drug Regulations. Herbal drug regulation in India.

UNIT-IV

Phytoconstituents and their Analysis: Introduction, Importance of Phytoconstituents in therapy, qualitative analysis of crude drug extract and isolates. Analysis of alkaloids, volatile oils, fixed oils, fats and waxes, Flavonoids, Terpenoides, Resins, Tannins, Glycosides and Steroids.

UNIT-V

Extraction of Herbal drugs: Introduction, Basic principles, Pre-extraction operations for crude drug, Effect of solvent, solvent mixtures and solution on extraction, Characteristics of Phytoconstituents, Procedure for extraction of Herbal drugs Extraction methods for specific phytochemical group, treatment of drug residue after extraction.

Recommended Books: (Latest Editions)

1. Essential of Pharmacognosy by Dr.S.H.Ansari
2. Pharmacognosy & Phytochemistry by V.D.Rangari
3. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
4. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

M. Sc. Pharm. Chem. IVth Sem.
ADVANCE DRUG DELIVERY
PAPER CODE – MPCE403(C)

Lecture: 3hrs/week

Max. Marks: 100

Unit-I

Fundamental Concept of Modified Drug Release: Definitions of controlled release, sustained release drug delivery systems. Pre requisites of drug candidates, various approaches and classification: rate preprogrammed activation modulated, feedback regulated and site targeted

Formulation and evaluation of controlled release systems.– oral, dental and parenteral

Unit–II

Polymers- Definition, Classification and Characterisation, Biodegradable and non biodegradable polymers – properties and applications in formulation of various dosage forms.

Unit – III

Transdermal Drug Delivery systems- factors influencing transdermal delivery, mechanism of percutaneous penetration, formulation and evaluation Ionophoresis and Iontophoresis.

Unit – IV

Target oriented drug delivery systems- prodrugs, Liposomes, Niosomes, Microparticles, Nano particles, anti bodies, cellular carriers, lipoproteins, Glycoprotein, Low molecular weight proteins.

Ocular, Nasal Drug Delivery system, stemcell, introduction to brain targeting.

Books Recommended:

1. Chien Y.W., Novel Drug Delivery Systems, Marcel Dekker
2. Robinson J.R. and Lee V.H., Controlled Drug Delivery: Fundamentals & Applications, Marcel Dekker.
3. Tse F.L.S. and Jaffe J.J., Biodegradable Polymers as Drug Delivery Systems, Marcel Dekker
4. Banker G.S., Rhodes C.T., Modern Pharmaceutics, Marcel Dekker.
5. Wise D.L., Handbook of Pharmaceutical Controlled Release Technology, Marcel Dekker.
6. Guy R.H., Hadgraft J., Transdermal Drug Delivery, Marcel Dekker.
7. Rathbone M.J., Hadgraft J., Modified Release Drug Delivery Technology, Marcel Dekker.
8. Swarbrick J. & Boylan J.C., Encyclopedia of Pharmaceutical Technology, Marcel Dekker.

M. Sc. Pharm. Chem. IVth Sem.
LABORATORY-1 (PHARMACEUTICAL DRUG ANALYSIS)
PAPER CODE -M PCL404

Lecture: 8hrs/week

Max. Marks: 100

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2. Estimation of dextrose by colorimetry
3. Estimation of sulfanilamide by colorimetry
4. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
5. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
6. Experiments based on HPLC
7. Experiments based on Chromatography
8. To perform In-vitro dissolution profile of CR/ SR marketed formulation
9. Formulation and evaluation of tablets
10. To carry out preformulation studies of tablets.
11. To study the effect of compressional force on tablets disintegration time.
12. To study the effect of binders on dissolution of a tablet.

1. Quality control evaluation parameters of various pharmaceutical dosage forms as per IP/BP/USP:

- | | |
|------------------------|----------------|
| a) Tablets | b) Capsules |
| b) Liquid dosage forms | d) Parenterals |

2. Assay of active ingredients as per pharmacopoeial standards by using techniques like:

- | | | |
|---------|----------------|----------------|
| a) HPLC | b) COLORIMETRY | c) UV -VISIBLE |
|---------|----------------|----------------|

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Quantitative Analysis of Drugs by D. C. Garrett.
7. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
8. Spectrophotometric identification of Organic Compounds by Silverstein

M. Sc. Pharm. Chem. IVth Sem.

PHARMACEUTICAL INDUSTRIAL MANAGEMENT INCLUDING MARKETING

(Self study Course)

UNIT-1

PAPER CODE- MPC406 (A)

MM:100

Plant location and layout of an industry: Various factors affecting locational aspects, lay out of building and equipment, product layout vs. process layout, compliance of pollution control measures, Elementary knowledge of Factories Act.

UNIT-II

Production Planning and control: Scientific purchasing, quality control, problems of productivity, stores organization, location of store, receiving, inspection and issue of materials; control of stores and stocks, stores accounting and records.

UNIT-III

Pharmaceutical Marketing: Functions, buying, selling, transportation, storage, finance, feedback information, channels of distribution, wholesale, retail, departmental store, multiple shop and order business.

UNIT-IV

Finance: Principle of economics with special reference to the laws of demand and supply, demand and supply, demand schedule, demand curves, labour welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

UNIT-V

Accountancy: Principle of account, ledger posting and journal entries, preparation of trial balance, column of a cash book. Bank reconciliation statement, rectification of error, profit and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes and hundies, documentary

Recommended Books (Latest Editions)

1. Principle and Practice of Management- Peter Drucker.
2. Principles of Management- Koontz o'Donnel.
3. Business Organization and Management- Sukla.
4. Business Organization-Ghose.
5. Principles of Industrial Organization- Kimbell and Kimbell.
6. DoubleEntry Book Keeping-Batliboi.
7. Professional Pharmacy- Jain and Sharma.
8. Factories Act.

M. Sc. Pharm. Chem. IVth Sem.

ENVIRONMENT CHEMISTRY

(Self study Course)

UNIT-I

PAPER CODE-M PCS406 (B)

MM:100

Hydrosphere: Aquatic pollution- inorganic, pesticides, agricultural, industrial and sewage, detergents, oil spills and oil pollutants. water quality parameters- dissolved oxygen, biochemical oxygen demand, solids, and metals, contents of chlorides, sulphate, phosphate, nitrates and microorganism. Water quality standards. Analytical methods for measuring BOD, DO, COD, F, oils metals (As,Cd, Cr,Hg,Pb, Se, etc.) residual chlorides and chloride demand, Purification and treatment of water.

UNIT-II

Atmosphere: Chemical and Photochemical reaction in atmosphere, smog formation, oxides of N,C,S,O,and their effect, pollution by chemicals, petroleum, minerals, chlorofluorohydrocarbons, Analytical methods for measuring air pollutants. Continuous monitoring instruments.

UNIT-III

Industrial pollution: Pollution from cement, sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy, polymers and drugs ect.

UNIT-IV

Environmental Toxicology: Chemical solutions to environmental problems, biodegradability, principles of decomposition, better industrial processes.

Recommended Books (Latest Editions)

1. Environmental Chemistry, S. E. Manahan, Lewis Publishers.
2. Environmental Chemistry, Sharma and Kaur, Krishana Publishers.
3. Environmental Chemistry, A.K. De, Wiley Eastern.
4. Environmental Pollution Analysis, S.M. Khopker, Wiley Eastern.
5. Standard Methods of Chemical Analysis, F.J. Welcher Vol. III, Van Nostrand Reinhold Co.
6. Environmental Toxicology, Ed. J. Rose, Gordon and Breach Science Publication.
7. Elemental Analysis of Airborne Particles, Ed. S. Landsberger and M. Creatchman, Gordon and Breach Science Publication.
8. Environmental Chemistry, C. Baird, W.H. Fre