

V SEMESTER								
Theory						Practical		
Code	Course Name	Hours/ Week L/T	Credit Theory	University marks	Internal Evaluation	Hours/ week L/T	Credit Practical	Marks
PC	Pharmaceutics-II (Pharmaceutical Technology - I)	3-0	3	100	50	3	2	50
PC	Medicinal Chemistry-I	3-0	3	100	50	3	2	50
PC	Pharm. Analysis-II	3-0	3	100	50	3	2	50
PC	Pharmacology-I	3-0	3	100	50	3	2	50
PC	Pharmacognosy-III	3-0	3	100	50			
PC	Pharmaceutical Microbiology	3-0	3	100	50	3	2	50
	Total	18	18	600	300	15	10	250
	Total Hours/Week 33							
	Total Credits 28 (PC 28)							
	Total Marks 1150							

PHARMACEUTICS-II
(Pharmaceutical Technology-I)

PH. THEORY 3 hours / week

UNIT -I

Preformulation Studies : Principal areas like

- a. Bulk Characterization : Crystallinity and Polymorphism, Compressibility, hygroscopicity, bulk density, powder flow properties.
- b. **Solubility analysis : pKa, pH solubility profile, Common ionic effect, thermal effects, solubilization partition coefficient and dissolution.**

UNIT -II

Liquid Dosage Forms: Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizer, colors, flavours and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.

UNIT -III

Semisolid Dosage Forms: Definitions, types, mechanisms of drug permeation, factors influencing permeation, semisolid bases and their selection. General formulation of semisolids: like ointments, creams, pastes & gels, their manufacturing procedure, evaluation and packaging.

Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

UNIT -IV

Tablets: Types of tablets, excipients used, and different granulation techniques used for preparation of tablets, types of tablet press, manufacturing defects and evaluation of tablets. Coating of tablets : Type of coating – Sugar coating, film coating, enteric coating, film defects, materials used and evaluation of coated tablets. Discussion on new materials such as superdisintegrants, equipments like rapid mixers, granulators, fluid bed dryer.

UNIT -V

Capsules: Advantages and disadvantages of capsule dosage forms, materials used for production of hard gelatin capsules, different sizes of capsules, methods of capsule filling, Soft gelatin capsules, capsule shell and content of capsules, importance of base absorption and minim/gm. Quality control and storage of capsule dosage forms.

RECOMMENDED BOOKS :

1. Bently's Textbook of pharmaceuticals edited by E.A. Rawlins (All India Traveller Book Seller, New Delhi)
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig (Varghese Pub. House, Bombay)
3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich (B. I. Waverly Pvt. Ltd., New Delhi)
4. REMINGTON: The Science and Practice of Pharmacy, 20th Edition (Lippincott Williams & Wilkins, Baltimore)
5. Pharmaceuticals: The Science of Dosage Form Design by Aulton (Churchill Livingstone, Edinburgh)

PHARMACEUTICS-II
(Pharmaceutical Technology – I)
PRACTICAL **3 hours / week**
(A minimum of 15 experiments shall be conducted)

1. Preparation and evaluation of different types of syrup.
2. Preparation and evaluation of elixirs.
3. Preparation and evaluation of oral rehydration solutions.
4. Preparation and evaluation of different types of suspension such as flocculated, deflocculated suspension, dry suspension, suspensions based on high and low solid content etc.
5. Preparation and evaluation of emulsions by HLB method.
6. Preparation and evaluation of ointment by using different types of base.
7. Preparation and evaluation of creams, gels and pastes.
8. Preparation and evaluation of suppositories by using different base.
9. Granulation by different methods (wet granulation, dry granulation)
10. Preparation of different types of tablets.
11. Evaluation of tablets.
12. Preparation of coated tablets (sugar coating, film coating)
13. Evaluation of film coated and enteric coated tablets.
14. Filling and evaluation of hard gelatin capsules.

MEDICINAL CHEMISTRY – I

THEORY

3 hours/ week

UNIT -I

Basic Principles of Medical Chemistry: Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action

Brief concept on QSAR: Hansch analysis – its derivation and discussion on different parameters like electronic parameters, steric factor, and partition coefficient. Free Wilson model.

Virtual drug screening techniques and its applications.

3-D QSAR Analysis: Receptor independent 3-D QSAR Analysis, Receptor dependent 3-D QSAR Analysis

UNIT -II

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

A. Drugs acting on autonomic nervous system:

Cholinergics and Anticholinesterase: Acetylcholine, Carbachol, Bethanechol, methacholine and Neostigmine.

Adrenergic drugs and adrenergic blocking agents: Adrenaline, Salbutamol, Naphazoline, Propranolol, Atenolol

Antispasmodic and anti ulcer drugs: Homatropine, Cyclopentolate, Diclomine, Tropicamide.

Neuromuscular blocking agents: Gallamine, succinylcholine

UNIT -III

B. Autacoids :

Antihistamines: Diphenhydramine, Mepyramine, Chlorpheniramine, Promethazine, Chlorcyclizine, Ranitidine.

Eicosanoids : Occurrences, Chemical nature, Medicinal applications

Analgesic – antipyretics, anti-inflammatory (non-steroidal) agents: Aspirin, Paracetamol, Ibuprofen, Naproxan, Diclofenac sodium.

UNIT -IV

Diuretics: Acetazolamide, Chlorthiazide, Furosemide,

Cardiovascular drugs: Clonidine, Methyldopa, Procainamide, Nifedipine, Prazocin, clofibrate.

UNIT -V

Anti-TB and anti-leprosy Drugs: Isoniazid, Ethambutol, Pirazinamide, Dapsone

Antiamoebic agents: Metronidazole, Diloxamide furoate

Anthelmintics : Thiabendazole, Mebendazole, Niclosamide

Diagnostic Agents: Propylidone, Sodium diatrizoate, Fluorescein sodium.

PHARMACEUTICAL CHEMISTRY-V
(Medicinal Chemistry – I)

PRACTICAL 3 hours/week

(A minimum of 15 experiments shall be conducted)

1. Synthesis of selected drugs and intermediates from the course content.
2. Monographs of selected official drugs including identification tests and tests for purity.

RECOMMENDED BOOKS

1. Wilson and Grisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry.
2. Principles of Medicinal Chemistry by William O.Foye.
3. A Text Book of Medicinal Chemistry by S.N.Pandeya.
4. Medicinal Chemistry by Ashutoshkar.
5. Bentley's and Driver's Text Book of Pharmaceutical Chemistry.
6. Introduction to Medicinal Chemistry by Graham L. Patrick

TENTATIVE
Likely to be Modified

PHARMACEUTICAL ANALYSIS-II

THEORY 3 hours/ week

UNIT -I

1. Gravimetric Analysis: Precipitation techniques, solubility products. The colloidal state, supersaturation, co-precipitation, post precipitation, Digestion, washing of the precipitate, Filtration, Filter papers, and crucibles, Ignition. Thermo gravimetric curves, specific examples like barium sulphate, aluminum as aluminum oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants.

UNIT -II

- 1. Potentiometry and pH Meter**
- 2. Conductometry**

UNIT -III

- 1. Polarography and Amperometry**
- 2. Nephelometry and Turbidimetry.**

UNIT -IV

- 1. Diazotisation titrations, Kjeldahl method of nitrogen estimation,**
- 2. Karl-Fischer titration, Oxygen flask combustion gasometry.**

UNIT-V

- 1. Radioimmuno Assays.**
- 2. Electrophoresis**

PHARMACEUTICAL ANALYSIS-II

PRACTICAL 3 hours/ week

(A minimum of 15 experiments shall be conducted)

- 1. Exercise involving diazotization, Kjeldahl, Karl-Fischer, shall be covered.**
- 2. Exercises based on acid base titration in aqueous and non-aqueous media,**
- 3. Oxidation reduction titrations using potentiometric technique.**
- 4. Determination of acid-base dissociation constants and plotting of titration curves using pH meter.**
- 5. Exercises involving conductometric titrations.**

RECOMMENDED BOOKS:

- 1. Vogel's Text Book of Quantitative Chemical Analysis.**
- 2. Practical Pharmaceutical Analysis by Beckett and Stenlake Vol. I & II.**
- 3. Indian Pharmacopocia Vol. I & II 46**
- 4. Instrumental methods chemical analysis by B.K. Sharma 5. Bentley and Driver's Text Book of Pharmaceutical Chemistry**

PHARMACOLOGY-I

THEORY 3Hrs/Week

UNIT-I

1. General Pharmacology:

- 1.1. Introduction to pharmacology, Source of Drug, Routes of administration with special reference to its advantages and disadvantages.
- 1.2. Pharmacokinetics: Absorption, factors affecting drug absorption, distribution, metabolism and excretion of drug.
- 1.3. Pharmacodynamics: General principle and molecular aspects of drug action with special emphasis on receptors, receptor classification, Drug-receptor interaction, potentiation, antagonism phenomenon.

UNIT-II

2. Pharmacology of drugs acting on peripheral (autonomic) nervous system:

- 2.1. Neurohumoral transmission of autonomic nervous system.
- 2.2. Drugs acting on cholinergic system: Cholinergic drugs (parasympathomimetic), Anticholinergic drugs (parasympatholytic).
- 2.3. Drugs acting adrenergic system: Adrenergic drugs (sympathomimetic), Adrenergic blocking drugs (sympatholytic).
- 2.4. Drugs acting on autonomic ganglia: Ganglion stimulant and Ganglion blocking agent.

UNIT-III

3. Pharmacology of drugs acting on peripheral (somatic) nervous system:

- 3.1. Neurohumoral transmission of somatic nervous system.
- 3.2. Neuromuscular blocking agent and peripherally acting skeletal muscle relaxant.
- 3.3. Local anesthetics.

UNIT-IV

4. Pharmacology of drugs acting on central nervous system:

- 4.1. Neurohumoral transmissions in CNS with special emphasis on neurotransmitters like serotonin, dopamine, GABA, Glutamate.
- 4.2. General anesthetics.
- 4.3. Sedative and hypnotics, centrally acting muscle relaxants.
- 4.4. Anti-epileptics.
- 4.5. Opioid analgesics and antagonist.
- 4.6. Nootropic agents.

UNIT-V

5. Psychopharmacological agents:

- 5.1. Antipsychotics/Neuroleptics.
- 5.2. Antidepressant and anti-manic drugs.
- 5.3. Antiparkinsonian drugs

PHARMACOLOGY-I

PRACTICAL

1. Commonly used laboratory instruments, laboratory animals in experimental pharmacology, dose calculation and study of different routes of administration of drugs in rat/mice. (01 Experiment)
2. Commonly used anesthetics used in animal study, some common and standard laboratory techniques like procedure for rendering animal unconscious, blood withdrawal and plasma serum separation. (01 Experiment)
3. Effects of various agonist and antagonist and their characterization using isolated tissue preparations like frog's rectus abdominis muscle, isolated ileum preparation of rat and isolated fundus strip preparation of rat. (03 Experiment)
4. Experiment to explain the concept of reversible antagonism using suitable isolated tissue preparation. (01 Experiment)
5. Experiment to explain the role of choline esterase enzyme and its inhibitor using suitable isolated tissue preparation. (01 Experiment)
6. Effects of autonomic drugs on rabbit's eye. (01 Experiments)
7. Effect of physostigmine and atropine on ciliary movement in frog buccal cavity. (01 Experiments)
8. Experiments on skeletal muscle relaxant activity (01 Experiment)
9. Local anesthetic activity of drugs using suitable animal model. (02 Experiment)
10. Experiments on hypnotic and sedative activity. (01 Experiment)
11. Experiments on central analgesic activity. (01 Experiment)
12. Experiments on anti-epileptic activity. (02 Experiments)
13. Experiments on antidepressant activity. (02 Experiment)
14. Experiments on antipsychotic activity. (01 Experiment)

Books Recommended

1. Essentials of Medical Pharmacology by K.D. Tripathy
2. Pharmacology & Pharmacotherapeutics by Santoshkar & P Sen
3. Pharmacology by Prasun K Das, S.K. Bhattacharya and P.Sen
4. The Pharmacological basis of the Therapeutics by Goodman & Gilman
5. Pharmacology by Rang, Dale & Ritter
6. Basic and Clinical Pharmacology by B.G.Katzung

PHARMACOGNOSY-III

THEORY 3 hours/ week

MODULE -I

1. General methods of isolation and preliminary phytochemical screening of glycosides.
2. Study of the biological source, cultivation, collection, chemical constituents, adulterants, uses, macroscopic, microscopic features and chemical tests of following group of drugs containing –
 - i) Saponins : Liquorice, ginseng, dioscorea, sarasparilla and senega.
 - ii) Cardioactive sterols : Digitalis, squill and strophanthus
 - iii) Anthraquinone cathartics : Aloes, senna, rhubarb and cascara.
 - iv) Others : Psoralea, gentian, saffron, chirata and quassia

MODULE -II

3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.
4. Basic metabolic pathways. Techniques used to study of various pathway. Biogenesis of aromatic aminoacids, steroidal glycosides, tropane alkaloids and indole alkaloids.

MODULE -III

5. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Application of plant tissue cultures with special reference to production of secondary metabolites.

MODULE -IV

6. An introduction to poisonous plants in India.
7. Marine pharmacognosy, novel medicinal agents from marine sources.

MODULE-V

8. Study of Nutraceuticals: General introduction, Classification, minerals & vitamin supplements, Digestive enzymes, Probiotics, Dietary fibres, Cereals & grain, Health drinks.

PHARMACOGNOSY-III

PRACTICAL 3 hours/ week

(A minimum of 15 experiments shall be conducted)

1. Identification of crude drugs listed in theory (Any five)
2. Microscopic study of at least four drugs including the powder study listed in theory.
3. Specific identification tests for crude drugs listed in theory

RECOMMENDED BOOKS:

1. Textbook of Pharmacognosy by C.K.Kokate and D.P.Purohit (Nirali Prakashan, Pune)
2. Trease G.E. and Evans w.e., Pharmacognosy (Baillere Tindall, Eastbourne)
3. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)
4. Pharmacognosy by T.E. Wallis(CBS Publisher, New Delhi)
5. Staba E.J., Plant Tissue Culture as a source of Bio-medicinals
6. Rangari V D., Text book of Pharmacognosy Vol-I & II.
7. Pharmacognosy & Pharmabiotechnology by Ashutosh Kar

PHARMACEUTICAL MICROBIOLOGY

THEORY 3 hours/ week

UNIT -I

Scope and future of microbiology. Classification of microbes. Morphological study of Bacteria, Brief introduction about Actinomycetes, Fungi, Rickettsiae, Spirochetes and Viruses and their importance in pharmaceuticals.

UNIT-II

Nutrition, cultivation and isolation of bacteria, actinomycetes, fungi and viruses. Identification of Microbes : Cultural characteristics, Biochemical reactions, Staining techniques (simple staining, Gram staining, negative Staining) of bacteria. Preservation of microbial cultures.

UNIT -III

Microbial genetics – Mutations, Isolation of mutants, factors influencing rate of mutation, mutagens. Transformation, conjugation, transduction.

UNIT -IV

Sterilization, different methods, validation of sterilization methods & equipment. Disinfection, factors influencing disinfectants and antiseptics and their evaluation. Test for sterility – Importance, objectives, methodology as per pharmacopoeial standards, evaluation tests. Microbial limit tests for pharmaceutical dosage forms.

UNIT -V

Microbiological assay of antibiotics – penicillin, Vitamins – vitamin B12 and amino acids – lysine. Industrial production of Ethanol and Lactic acid

PHARMACEUTICAL MICROBIOLOGY

PH. PRACTICAL

3 hours/ week

(A minimum of 15 experiments shall be conducted)

Experiments devised to prepare various types of culture media, sub-culturing of common aerobic bacteria, fungi and yeast. Various staining methods, various methods of isolation of microbes, sterilization techniques and validation of sterilizing techniques, evaluation of antiseptics and disinfectants, Testing the sterility of pharmaceutical products as per I.P. requirements and Microbiological assay of antibiotics.

1. Sterilization
2. Preparation of Culture media
3. Isolation of microbes (Bacteria and Fungus)
4. Morphological identification of microbes
5. Gram's staining Technique
6. Evaluation of disinfectants
7. Microbiological assay of antibiotics
8. Sterility testing

RECOMMENDED BOOKS:

1. Microbiology of Pelczar and Kreig.
2. Text Book of Microbiology by Anantanarayana and Panicker.
3. Prescott, Harley and Klein's Microbiology
4. Shah and Shah (Pharmaceutical Microbiology)
5. Microbiology by Tortora
6. Microbiology by R P Singh
7. A textbook of Microbiology by R C Dubey
8. Industrial Microbiology by L E Casida
9. Textbook of Medical microbiology by Satish Gupte.