## IFTM UNIVERSITY, MORADABAD
**STUDY & EVALUATION SCHEME**

**BACHELOR OF PHARMACY**

**YEAR III - SEMESTER V**

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**Notes:**
- **L**: Lecture; **T**: Tutorial; **P**: Practical; **CT**: Class Test; **AS**: Assignment; **AT**: Attendance.
SYLLABUS – B.PHARM. (Semester V)

BPH-351 PHARMACEUTICS – V (Pharmaceutical Technology -I)

Unit-I:
Preformulation studies:
Study of physical properties of drugs like physical form, particle size, shape, density, wetting, dielectric constant, Solubility, dissolution and Organoleptic properties and their effect on formulation, stability and bioavailability. [8]

Unit-II:
(A) Tablets: Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipments employed, evaluation of tablets.

(B) Coating of Tablets: Types of coating, film forming materials, formulation of coating Solution, equipments for coating process, evaluation of coated tablet. Stability kinetics and Quality assurance. [8]

Unit-III:
Capsules: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsule, size of capsules, methods of capsule filling, soft gelatin capsule shell and capsule content, importance of base adsorption and minim/gm factors in soft capsule, quality control, stability testing and storage of capsule dosage forms. [8]

Unit-IV:
Liquid Dosage Forms : Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors and others, manufacturing, packaging & evaluation of clear liquids, suspensions and emulsions. [8]

Unit-V:
(A) Semisolid Dosage Forms : Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, general formulation of semisolids, clear gels & manufacturing procedure, evaluation and packaging.

(B) Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation. [8]
BPH-351P PHARMACEUTICS-V (Pharmaceutical Technology-I) Practicals

(A) **Experiments based on Preformulation studies:** Tapped density, bulk density, Carr’s index, Hausner ratio, angle of repose, compressibility, solubility profile, partition-coefficient, particle size determination.

(B) Experiments to illustrate preparation, coating, stabilization & physical evaluation of pharmaceutical products like:
1. Capsules: Capsules as per IP specifications.
2. Tablets: Uncoated, Film coated and enteric coated tablets as per IP specifications.

(C) Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments & suppositories.

I- Liquid Orals
a) Solutions: Strong Sodium salicylate oral solution BP, Chloral hydrate oral solution BP
b) Suspensions: Magnesium sulphate oral suspension BP, Milk of magnesia IP, Aluminium hydroxide gel IP
c) Emulsions: Liquid paraffin oral emulsion BP

II – Semi-Solids
d) Ointments: Salicylic acid ointment BP, Whitfield ointment BP, Compound benzoic acid ointment

III - Suppositories
e) Suppositories: Glycerin suppositories BP, Lactic acid suppositories BP

Books Recommended:
1. “Remington’s Pharmaceutical Sciences”, John Wiley & Sons; U.S.A.
2. “Cooper, & Gunn’s Tutorial Pharmacy”, CBS publishers; India.
Unit-I:
**Enzymes:** Introduction, nomenclature and classification of enzymes, mechanism of action, enzymes-kinetics, enzyme inhibition, factors affecting enzyme activity, applications of enzymes.
**Co-enzymes:** Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance. [8]

Unit-II
**Carbohydrate metabolism:** Glycolysis, Gluconeogenesis, Glycogenolysis, HMP pathway, Citric acid cycle and Carbohydrate metabolism disorders. [8]

Unit-III
**Lipid metabolism:** Oxidation of fatty acids, biosynthesis of ketone bodies and their utilization, biosynthesis of saturated and unsaturated fatty acids, regulation of lipid metabolism, lipid metabolism disorders.

**Biological Oxidation:** The respiratory chain, its role in energy capture & control. Oxidative phosphorylation. [8]

Unit-IV

Unit-V
BPH- 352 P  PHARMACEUTICAL CHEMISTRY-V (Biochemistry) Practicals

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
4. Separation of lipids by TLC.
6. Determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by α & β amylase.
13. Qualitative analysis of inorganic as well as organic constituents of Urine.

Books Recommended:

BPH-353                              PHARMACOLOGY I

Unit I

General Pharmacology

Introduction to pharmacology, routes of drug administration, combined effect of drugs, factors modifying drug response. Bioassays, New drug development process. [08]

Unit II

Basic Concepts of Pharmacokinetics

Absorption, Distribution, Metabolism, Excretion.

Basic concept of Pharmacodynamics

Principles of drug action, Mechanism of drug action, Receptors, Dose Response curve, therapeutics index -LD50 & ED50, Adverse drug effects. [08]

Unit III

PHARMACOLOGY OF ANS

Drug acting on autonomic nervous system

Parasympathomimetic (cholinergic) drugs, Parasympatholytic (anti-cholinergic) drugs, Sympathomimetic (adrenergic) drugs, Sympatholytic (anti-adrenergic) drugs. [08]

Unit IV

PHARMACOLOGY OF CNS

General anaesthetics, alcohols & Disulfiram, Sedative- Hypnotics, Antiepileptic drugs, Anti-Parkinsonism Drugs, Psychopharmacological agents (anti-anxiety agents, antipsychotics, anti-depressants). [08]

Unit V

DRUGS ACTING ON PNS

Local anesthetics, skeletal muscle relaxants (peripherally and centrally acting muscle relaxants). [08]
BPH-353P PHARMACOLOGY- I Practicals

1) Study of different OECD guidelines.
2) Use of computer simulated software for Pharmacology practicals.
   a) To find out the effects of drugs on the size of the pupil, light reflex, corneal reflex and intraocular tension of the rabbit eye.
   b) To find out the actions of drugs on the isolated heart preparation of frog.
   c) To find out the action of certain drugs on the ciliary motility of frog esophagus.
   d) To demonstrate the actions of a few drugs on the blood pressure (BP) and heart rate (HR) of dog.
3) Preparation of different solutions for experiments.
4) Drug dilutions, use of molar and w/v solutions in experimental pharmacology.
5) Study of common laboratory animals, their handling; anesthetics used in animal studies.
6) Study of commonly used instruments in experimental pharmacology.
7) Study of common and standard techniques for evaluation of drugs.
8) Study of animals used in experimental Pharmacology.
9) Study of different routes of administration of drugs in mice/rats.
10) Study of different methods for calculation of drugs on animals.

Books Recommended:

3) “Drugs Pharmacology” by Maheshwari, K. K. Vallabh Prakashan, Delhi.
9) “Lippincott's Illustrated Reviews Pharmacology” by Richard A. Harvey PhD (Editor), Pamela C. Champe, Lippincott Williams & Wilkins Publishers, New York, U.S.A.
BPH-354 PHARMACEUTICAL CHEMISTRY –VI (Medicinal Chemistry –I)

Mode of action, uses, structure activity relationship of the following classes of drugs along with synthetic procedures of mentioned drugs only.

Unit-I:

Unit-II:

Unit-III:

Unit-IV:

Unit-V:
Local Anaesthetics: Benzocaine and Lignocaine. Centrally acting skeletal muscle relaxants: Mephenesin. CNS Stimulants-Dexamphetamine. [8]
BPH-354 P PHARMACEUTICAL CHEMISTRY-VI (Medicinal Chemistry-I) Practical

1. Synthesis of selected drugs from the course content.
2. Establishing the pharmacopoeial standards of the drugs synthesized.

Books Recommended:
Unit-I:


(B) Kinetics and Drug Stability: General considerations & concepts, Degradative pathways, half life determination, Influence of temperature, light, solvent, catalytic species and other factors, accelerated stability study, expiration dating. ICH guidelines for stability.

(C) Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting is tonicity. [8]

Unit-II:

Micromeritics and Powder rheology: Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties. [8]

Unit-III:

Surface and Interfacial Phenomenon: Liquid interface, surface and interfacial tension, surface free energy, measurement of surface and interfacial tension, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and solid-liquid interfaces, complex films, electrical properties of interface. [8]

Unit-IV:

Viscosity and rheology: Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers.

Complexation: Classification of complexes, methods of preparation and analysis, applications. [8]
Unit-V:

**Dispersion Systems**: Colloidal Dispersions: Definition, types, properties of colloids, protective colloids, application of colloids in pharmacy; Suspensions and Emulsions; Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability.

[8]
1. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. Determination of surface/ interfacial tension, HLB value and critical micellar concentration of surfactants.
4. Study of rheological properties of various types of systems using different Viscometers.
5. Studies of different types of colloids and their properties.
6. Preparation of various types of suspensions and determination of their sedimentation parameters.
7. Preparation and stability studies of emulsions.
8. Studies of different types of complexes and determination of their stability constants.
9. Determination of half-life, rate constant and order of reaction.
10. To study the influence of various factors on the rate of reaction.
11. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Experiments involving tonicity adjustments.

Books Recommended:
BPH- 356 PHARMACOGNOSY-II

Unit- I:
**Resins:** Study of drugs containing Resins and Resin combinations like Podophyllum, Cannabis, Capsicum, Shellac Asafoetida, Balsam of tolu, Balsam of Peru, Benzoin, Turmeric, Ginger. [08]

Unit- II:
**General methods of obtaining volatile oils from plants, Study of volatile oils from:** Mentha, Coriander, Caraway, Fennel, Clove, Cardamom, Black pepper, Lemon peel, Orange peel, Lemon grass, Citronella, Dill, Eucalyptus, Spearmint, Nutmeg, Cinnamon, Musk, Jatamansi, Chenopodium, Sandalwood. Utilization of aromatic plants and desired products with special reference to Sandalwood oil, Mentha oil, Lemon grass oil, Vetiver oil, Geranium oil & Eucalyptus oil in nation’s economy. [08]

Unit- III:
**Tannins:** Study of tannins & tannin containing drugs like Pale Catechu, Black Catechu, Harde, Baheda, Arjuna & Ashoka. [08]

Unit-IV: **Phytochemical Screening:** An introduction to active constituents of drugs: Their isolation, classification and properties with Qualitative chemical tests of the followings: Alkaloids, Saponins, Cardenolides and Bufadienolides, Flavonoids and Cyanogenetic glycosides. [08]

Unit-V:
1. **Fibres:** Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass wool, polyester and asbestos.
2. **Pharmaceutical aids:** Study of Pharmaceutical aids like Talc, Diatomite, Kaolin, Bentonite, Fullers earth, Gelatin and Natural colors. [08]
1. Identification of crude drugs as mentioned in theory.
2. Study of fibres and pharmaceutical aids.
3. Microscopic study of seven selected drugs and their powders mentioned under the category of volatile oils in theory with their chemical tests. General chemical test for Alkaloids, Glycosides, Steroids, Flavonoids & Tannins.

1. Morphology of Mentha, Lemongrass and Nutmeg
5. Morphology and microscopy of Cardamom and Fennel.
6. Morphology and microscopy of Clove and to study its transverse section.
7. Study of Cotton, Silk and Wool along with their chemical Tests.
8. To study the morphology and chemical tests of Talc, Diatomite, and Kaolin
9. To perform the chemical tests of Balsam (Tolu and Peru) and Asafoetida.
10. Preparation of reagents for the chemical tests of Alkaloids and to perform the chemical tests on any Alkaloid containing drug.
11. Test for identification of Glycosides (Saponin and Anthraquinone).
12. Test for identification of Tannins.

Books Recommended:
## YEAR III - SEMESTER VI

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BPH—361 PHARMACEUTICS-VII (Pharmaceutical Technology - II)

Unit-I:
(A) Parenteral Products:
Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles. Formulation details, containers and closures and their selection. Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and sealing of ampoules, vial, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.
(B) Otic Products: Formulation and evaluation of Ophthalmic, Nasal and Ear products. [8]

Unit-II:
(A) Sustained and controlled release dosage forms: Concept, approaches, techniques and characterization (In-vitro).
(B) Micro-encapsulation: Types of microcapsule, importance of microencapsulation in pharmacy, microencapsulation by phase coacervation separation, multi orifice, spray drying, spray congealing, polymerization, complex, formulation, emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules. [8]

Unit-III:
(A) Pharmaceutical Aerosols: Definition, Propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. [08]
(B) Surgical Products: Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc, bandages, adhesive type, protective cellulosic hemostasis, official dressings, absorbable and non absorbable sutures, ligatures and catguts [8]

Unit-IV:
Cosmetology and cosmetic Preparations:
1. Skin care products: Structure of skin, formulation of cold cream, vanishing cream, barrier cream, face powder.
2. Hair care products: Hair structure, Shampoos, Conditioner, hair creams & removers.
4. Oral hygiene products: Dentifrice & Mouthwash, tooth powder and tooth paste.
5. **Nail preparations**: Nail polish, nail lacquer.


7. **Personal hygiene products**: Bathing soaps, deodorants, antiperspirants & talcum powder.

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**Unit-V:**

**Packaging of Pharmaceutical Products**: Packaging component types, specifications and methods of evaluation, stability aspects of packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.
BPH-361P

PHARMACEUTICS-VII (PHARMACEUTICAL TECHNOLOGY - II) Practicals

(A) Preparation, packaging & labeling of cosmetic preparations:

1. Cold cream
2. Vanishing cream
3. Barrier cream
4. Shaving cream
5. Brushless shaving cream
6. Foundation lotion
7. Sunscreen lotion
8. Face powder
9. Body powder
10. After shave lotion
11. Tooth powder
12. Tooth paste

(B) Preparation, Evaluation, Packing of the following parenterals & microcapsules dosage forms.

a) Microcapsules: Coacervation Phase separation (Temperature change)
b) Parenteral: Disodium EDTA injection IP (vials)
c) Parenteral: Dextrose – NaCl IV infusion IP (Infusion boilers)
d) Parenteral: Water for infection IP (Ampoule)
e) Eye drops: Zinc sulphate IP
f) Eye ointment: Sulphacetamide Sodium IP

(C) Formulation and evaluation of sustained release dosage forms –Extended release (Matrix embedding method, Granules USP/NF, coating of granules)

(D) Evaluation of Materials used in pharmaceutical packaging: containers & closures.
Books Recommended:
1. “Remington’s Pharmaceutical Sciences”, John Wiley & Sons; U.S.A.
8. “Cosmetics: Science and Technology” by Balsam and Sagarin, Krieger Pub Co; U.S.A.
BPH-362 PHARMACEUTICAL CHEMISTRY –VII (Medicinal Chemistry –II)

Unit-I

**Mode of action, uses, structure activity relationship of the following classes of drugs along with synthetic procedure of mentioned drugs only.**

Unit- II

Unit-III
Prostaglandins, Antihisaminics-Promethazine and Chlorpheniramine

**Analgesics:** Opioid analgesics- Lavallorphan, Meperidine, Methadone and Pentazocine. Analgesics, antipyretics and nonsteroidal anti-inflammatory drugs: Aspirin, Paracetamol, Ibuprofen, Phenylbutazone and Mefenemic acid. Antigout drugs.

Unit-IV

Unit-V
BPH-362 P  PHARMACEUTICAL CHEMISTRY-VII (Medicinal Chemistry-II)

1. Synthesis of selected drugs from the course content.
2. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended:
BPH-363 PHARMACOLOGY-II

Unit I

Pharmacology of CVS

Cardiac-glycosides, Anti-hypertensive drugs, Anti-anginal drugs, Anti-arrhythmic, Anti-hyperlipidemics. [08]

Unit II

Drugs Acting on Haemopoetic System


Drugs Acting on Respiratory System

Anti-asthmatic drugs, Antitussives & expectorants. [08]

Unit III

Autocoids

Histamine, 5HT and their antagonists; Prostaglandins, Thromboxane, Leukotrienes, Angiotensin and Bradykinin. [08]

Unit IV

Drugs acting on GIT

Antacids and antiulcer drugs, laxatives and antidiarrhoeal agents, emetics and antiemetics. [08]

Unit V

Opioid analgesics and their antagonist, NSAIDS & anti-gout drugs, diuretics. [08]
BPH-363P PHARMACOLOGY- II Practicals

1. To record the dose response curve (DRC) of Acetylcholine (Ach) using ileum of rat/guinea pig/cock.
2. To study the parallel shift of DRC in presence of competitive antagonist on DRC of Ach using rat/guinea pig/cock.
3. To study the effects of Physostigmine on DRC of each on rat/guinea pig/cock.
4. To obtain a graded response curve of Histamine and determine the concentration of the same in solution (of unknown concentration) using matching assay with the help of software.

BOOKS RECOMMENDED:

3) “Drugs Pharmacology” by Maheshwari, K. K. Vallabh Prakashan, Delhi.
9) “Lippincott's Illustrated Reviews Pharmacology” by Richard A. Harvey PhD (Editor), Pamela C. Champe.
Unit-I. Glycosides: Study of the biological sources, cultivation, collection, diagnostic macroscopic & microscopic features, chemical constituents, specific chemical tests, uses, substitutes, adulterants and commercial varieties of following groups of drugs-
1. Saponins: Liquorice, Ginseng, Dioscorea.
2. Cardio-active: Digitals, Squill, Stropanthus & Thevetia.
4. Others: Safed Musali, Gentian, Saffron, Chirata, Quassia, Citrus fruits and Kalmegh. [8]

Unit-II: Studies of traditional drugs: Common vernacular name, biological sources, morphology, chemical nature of chief constituents, pharmacological categories, common uses and toxicological activity of marketed formulations of following indigenous drugs: Amla, Kantkari, Satavari, Tylophora, Vach, Punarnava, Chitak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun, Guggul, Gymnema, Shilajit, Nagarmotha and Neem. [8]

Unit-III: General method of isolation of glycosides. Utilization and production of phytocomstituents such as calcium Sennsoides, Diosgenin, Solasodine, Podophyllotoxin, Aloin and Hesperidin. [8]

Unit-IV: Brief Introduction and principles of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. Introduction to Herbal Pharmacopoeia with special reference to: Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas. [8]

Unit-V: Herbal formulation: A comparative study of Ayurvedic and modern dosage forms: Classification, General considerations, Different stages of herbal formulation, Dosage forms, Manufactures of herbal formulations in India. [8]
1. Macroscopic studies of crude drugs listed in theory.
2. Microscopic studies of crude drugs in entire and powdered form.
3. Standardization of some traditional drugs.
4. Preparation of herbal formulations.

Books Recommended:
5. Medicinal plants of India I&II, Indian council of Medical Research, New Delhi.
Unit- I.
Environment Studies- Definition, scope & importance of Environment studies. Natural Resources (renewable & Non renewable) along with special emphasis on utilization, exploitation and associated problems of forests, water resources, mineral resources, energy resources, land resources and role of an individual in conservation. Material cycles- Carbon, Nitrogen Cycle, Biomass & Biogas.

Unit-II:
Ecosystems
1) Introduction, types, features & functions of difference ecosystems- Forest, Grassland, Desert and Aquatic.
2) Biodiversity & its conservation with special reference to India.

Unit- III:
Environmental Pollution- Air, water, Soil, Marine, Noise, Thermal, Nuclear- introduction, causes and control measures, pollution & Public Health aspects.

Unit-IV:
Law related to Environmental Protection
Air (Prevention and Control of pollution) Act 1987
Water (prevention & Control of pollution) Act 1974

Unit-V:
Environmental Protection Act- 1986, Initiatives by government and Non- governmental organizations for environmental protection.
Hazardous Wastes, Hazardous Chemicals, Hazardous Microorganisms, Biomedical Waste.
References


3) Relevant Acts & Rules Published by Govt. of India with latest amendments.