SEMESTER-V

S. No.	Course Code	Subject	Periods		Evaluation Scheme					Subject Total	Credit
					Sessional				ESE		
			L	P	CA	TA	EXAM	TOTAL			
THEORY											
1	BOP-351	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	3	0	5	5	20	30	70	100	4
2	BOP-352	Pharmaceutics-VI (Pharmaceutical Technology-I)	3	0	5	5	20	30	70	100	4
3	BOP-353	Pharmaceutics-VII (Pharmaceutical & Food Microbiology)	3	0	5	5	20	30	70	100	4
4	BOP-354	Pharmacology-I (Pharmacology & Toxicology)	3	0	5	5	20	30	70	100	4
5	BOP-355	Environment & Ecology	3	0	5	5	20	30	70	100	4
PRACTICAL/PROJECT											
6	BOP-351P	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I) Practical	0	4	5	5	20	30	70	100	4
7	BOP-352P	Pharmaceutics-VI (Pharmaceutical Technology-I) Practical	0	4	5	5	20	30	70	100	4
8	BOP-353P	Pharmaceutics-VII (Pharmaceutical & Food Microbiology) Practical	0	4	5	5	20	30	70	100	4
9	BOP-354P	Pharmacology-I (Pharmacology & Toxicology) Practical	0	4	5	5	20	30	70	100	4
10	BOP-356P	Hospital Training-I	45 Days		5	5	20	30	70	100	2
		TOTAL	15	16						1000	38

CA = Class Attendance, TA = Teacher Assessment.

SEMESTER-VI

S. No.	Course Code	Subject	Periods		Evaluation Scheme					Subject Total	Credit
					Sessional				ESE		
			L	P	CA	TA	EXAM	TOTAL			
THEORY											
1	BOP-361	Pharmaceutical Chemistry-VII (Medicinal Chemistry-II)	3	0	5	5	20	30	70	100	4
2	BOP-362	Pharmaceutics-VIII (Pharmaceutical Technology-II)	3	0	5	5	20	30	70	100	4
3	BOP-363	Pharmacology-II	3	0	5	5	20	30	70	100	4
4	BOP-364	Pharmacognosy-III	3	0	5	5	20	30	70	100	
5	BOP-365	Professional Communication	3	0	5	5	20	30	70	100	4
PRACTICAL/PROJECT											
6	BOP-361P	Pharmaceutical Chemistry-VII (Medicinal Chemistry-II) Practical	0	4	5	5	20	30	70	100	4
7	BOP-362P	Pharmaceutics-VIII (Pharmaceutical Technology-II) Practical	0	4	5	5	20	30	70	100	4
8	BOP-363P	Pharmacology-II Practical	0	4	5	5	20	30	70	100	4
9	BOP-364P	Pharmacognosy-III Practical	0	4	5	5	20	30	70	100	4
10	BOP-366P	Industrial Training	30 Days		5	5	20	30	70	100	2
		TOTAL	15	16						1000	38

CA = Class Attendance, TA = Teacher Assessment.

FIFTH SEMESTER

BOP-351

PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY-I)

Unit I

Basic principles of medicinal chemistry: Physicochemical parameters in relation to biological activity, Stereochemical (Geometrical, Optical and Conformational) aspects of drug design, Bioisosterism. Drug-receptor interaction (forces), Concept of pro-drugs (Bio-precursor and Carrier linked).

Classification, mode of action, uses, recent advances and structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only).

Unit II

Drugs acting at autonomic nervous system

Cholinergic drugs: Methacholine, Pilocarpine.

Anticholinergic drugs: Atropine.

Anticholinesterases: Neostigmine, Physostigmine.

Adrenergic drugs: Ephedrine, Adrenaline, Salbutamol.

Unit III

Drugs acting at central nervous system

General anaesthetics: Methohexital, Ketamine.

Local anaesthetics: Benzocaine, Lignocaine.

Skeletal muscle relaxants: Succinylcholine, Pancuronium.

Opioid analgesics: Pethidine, Pentazocine.

Antitussives: Cramiphen, Dextromethorphen.

Unit IV

Anxiolytics: Diazepam.

Sedatives and hypnotics: Phenobarbitone, Alprazolam.

Anticonvulsants: Phenytoin, Ethosuximide, Valproic Acid, Vigabatrin.

Drugs for neurodegenerative disorders: Alzheimer's disease (Tacrine), Parkinson's disease (Levodopa).

Unit V

Antidepressants: Imipramine, Amitriptyline, Fluoxetine.

Antipsychotic: Chlorpromazine, Haloperidol.

CNS Stimulants and psychedelics: Amphetamine, Caffeine.

Antispasmodics: Dicyclomine.

BOP-351P

PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY-I) PRACTICAL

Synthesis of selected drugs from the course content involving two or more steps and characterize/evaluate their Pharmacopoeial standards (if available).

1. Synthesis of Phenytoin.
2. To evaluate the Pharmacopoeial standards of Phenytoin.
3. Synthesis of Benzocaine.
4. To evaluate Pharmacopoeial standards of Benzocaine.
5. Synthesis of Benzamide.
6. To evaluate the synthesized Benzamide.
7. Synthesis of Caffeine.
8. To evaluate the synthesized Caffeine.
9. Synthesis of Phenobarbitone.
10. To evaluate the Pharmacopoeial standards of Phenobarbitone.
11. Synthesis of Thiobarbituric acid derivatives.
12. To evaluate the synthesized Thiobarbituric acid derivatives.
13. Synthesis of Piperazin-2, 5-dione derivatives.
14. To evaluate the synthesized Piperazin-2,5-dione derivatives.

BOOKS RECOMMENDED

1. Abraham D.J., Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.
2. Block J.H. and Beale J.M., Wilson and Gisvold's Textbook of Organic Medicinal and

Pharmaceutical Chemistry, Lippincott Williams and Wilkins.

3. Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., Foye's Principles of Medicinal Chemistry, Lippincott Williams and Wilkins.
4. Vardanyan R.S. and Hruby V.J., Synthesis of Essential Drugs, Elsevier.
5. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, NewYork.
7. Silverman R.B., The Organic Chemistry of Drug Design and Drug Action, Elsevier.
8. Korolkovas A., Essentials of Medicinal Chemistry, John Wiley and Sons Inc., New York.
9. Larsen P.K., Liljefors T. and Madsen U. Textbook of Drug Design and Discovery, Taylor and Francis Inc.
10. Mann F.G. and Saunders B.C., Practical Organic Chemistry, Orient Longman Limited.
11. Furniss B.S., Hannaford A.J., Smith P.W.G. and Tatchell A. R., Vogel’s Textbook of Practical Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.).

BOP-352

PHARMACEUTICS-VI
(PHARMACEUTICAL TECHNOLOGY-I)

Unit I

Preformulation studies: Significance of physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and stability on formulation development. Brief introduction to ICH guidelines for stability.

Unit II

Biphasic liquid dosage forms (suspensions and emulsions): Vehicles, additives, stabilizers, preservatives, suspending agents, emulsifying agents, colors and flavors; manufacturing, packaging and evaluation. Brief introduction to multiple emulsion, microemulsion, nanoemulsion and nanosuspension.

Unit III

Semisolid dosage forms: Classification, skin permeation enhancement methods, semisolid bases and their selection, general formulation of semisolids and clear gel manufacturing procedures, packaging and evaluation. Introduction to *in situ* gels and hydrogels.

Suppositories: Bases, manufacturing procedures, packaging and evaluation. Introduction to liquid suppositories.

Unit IV

Ophthalmic, nasal, otic and parenteral products: Significance and formulation details, equipment for large scale manufacturing, *in-vitro* methods of evaluation, containers and closures, prefilling treatments. Ophthalmic, nasal, otic and parenteral preparations (Sterile water for injection, water for injection, suspension and sterile powder).

Unit V

Pharmaceutical aerosols: Definition, propellants, general formulation, manufacturing, packaging, evaluation and pharmaceutical applications.

Veterinary dosage forms: Animal dosage forms like solid, liquid oral, parenteral, pastes, pellets and implants; regulatory requirements for approval of animal drugs.

BOP-352P

PHARMACEUTICS-VI

(PHARMACEUTICAL TECHNOLOGY-I) PRACTICAL

1. Formulation and evaluation of the following dosage forms containing drugs mentioned in IP.
    a. Suspensions.
    b. Emulsions.
    c. Ear drops.
    d. Eye drops.
    e. Nasal drops.
    f. Topical gels.
    g. Ointments.
    h. Pastes.
    i. Suppositories.
2. Formulation and evaluation of disodium EDTA injection IP (vials).
3. Formulation and evaluation of water for infection IP (ampoules).
4. To perform tip or bead and pull sealing of ampoules.

BOOKS RECOMMENDED

1. Remington's Pharmaceutical Sciences, Vol. I & Vol. II, Mack Publishing Co., U.S.A.
2. Cooper J.W. and Gunn G., Tutorial Pharmacy, Petman Books Ltd., London.
3. Lachman L., Lieberman H.A, Kanig J.L., Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
4. Khar R. K., Vyas S.P., Ahmad F., Jain G. K., The Theory and Practice of Industrial Pharmacy, 4th Edition, CBS Publishers and Distributors.
5. Ansel, H.C., Introduction to Pharmaceutical Dosage Forms, Lea and Febiger, Philadelphia, U.S.A.
6. Juliano, R.L., Drug Delivery Systems, Oxford University Press, Oxford.
7. Brittain, H. G., Polymorphism in Pharmaceuticals Solids.
8. Turco S. J., Sterile Dosage Form-Their Preparation and Clinical Application, LWW.
9. Hardee G.E., Baggot J.D., Development and Formulation of Veterinary Dosage Forms, 2nd Edition, CRC Press.

BOP-353

PHARMACEUTICS-VII
(PHARMACEUTICAL & FOOD MICROBIOLOGY)

Unit I

A. Introduction to scope of food and pharmaceutical microbiology.
B. Optical microscopy and electron microscopy.
C. Identification of microbes: Structure of bacterial cell, stains and types of staining techniques.
D. Classification of bacteria based on temperature, pH and oxygen requirements.

Unit II

A. Nutrition, cultivation and isolation of bacteria and viruses.
B. Factory and hospital hygiene- control of microbial contamination during manufacture, concept and design of clean and aseptic areas, nosocomial infections and their control.

Unit III

Control of microbes

A. Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
B. Methods of sterilization, validation of sterilization methods and equipments.

Unit IV

Food Microbiology

A. Microbial flora of fresh food: egg, meat, fruits and vegetables.
B. Microbial spoilage of foods.
C. Elementary techniques of industrial food preservation-radiation, low and high temperatures.
D. Probiotics in food: Benefits of probiotic foods, brief introduction to probiotic milk, yogurt and ice-cream.

Unit V

A. Sterility testing as per I.P.
B. Preservative efficacy.
C. Microbial assays of antibiotics: Oxytetracycline and Erythromycin.
D. Microbial assays of Vitamin $B_{12.}$

BOP-353P

PHARMACEUTICS-VII
(PHARMACEUTICAL & FOOD MICROBIOLOGY) PRACTICAL

1. Study of sterilization methods and equipments
   - Dry heat
   - Moist heat.
2. Preparation of various types of culture media.
3. Isolation of bacteria.
4. Sub-culturing of common bacteria, fungi and yeast.
5. Identification and staining of bacteria
   - Simple staining
   - Gram staining
   - Acid fast staining
   - Hanging drop preparation.
6. Microbial examination of foods.
7. Evaluation of disinfectants and antiseptics.
8. Phenol coefficient test, minimum inhibitory concentration.
9. Test for sterility of pharmaceutical products as per IP.
10. Microbial assay of antibiotics as per IP.

BOOKS RECOMMENDED

1. Aneja K.R., Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation, Vishwa Prakashan.
2. Gunasekaran P., Lab Mannual of Microbiology, New Age Publishers.
3. Davis, Dulbetco, Eisen Microbiology.
4. Stanier R.Y., Ingraham, J.L., Wheelis M.L., Painter P.R. General Microbiology, Macmillan Press Limited.
5. Hugo and Russell, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford.
6. Prescott L.M., Harley J.P. and Klien D.A., Microbiology, McGraw Hill.
7. Sykes G., Disinfection and Sterilization: Theory and Practice, General and Industrial Chemistry Seris, Spon.

8. Pelczar and Reid, Microbiology, Tata Mc Graw Hill, Delhi.
9. Bean H. S., Beckett A. H. and Carless J. E., Advances in Pharmaceutical Sciences. Vol. 1. Academic Press Inc. Elsevier.
10. Virella G. Microbiology and Infectious Diseases, William & Wilkins.
11. Ananthanarayan R., Paniker C.K.J., Textbook of Microbiology, Orient Longman.
12. Fundamental Food Microbiology, Bibek Ray, Arun Bhunia, CRC Press.

BOP-354

PHARMACOLOGY-I
(PHARMACOLOGY & TOXICOLOGY)

Unit I

A. **General Pharmacology:** Introduction to pharmacology, routes of drug administration, combined effect of drugs, factors modifying drug action. Discovery and development of new drugs. Bioassay of drugs.

B. **Basic Concepts of Pharmacokinetics and Pharmacodynamics**: Absorption, distribution, metabolism and excretion. Principles of drug action, mechanisms of drug action, receptors.

Unit II

Pharmacology of ANS: Drug acting on autonomic nervous system:

A. **Cholinergic system:** Parasympathomimetic (cholinergic) drugs, parasympatholytic (anti-cholinergic) drugs, drug acting on autonomic ganglia (stimulants and blocking agents).

B. **Adrenergic system:** Sympathomimetic (adrenergic) drugs, sympatholytic (anti-adrenergic) drugs.

Unit III

Drugs acting on PNS: Local anesthetics, skeletal muscle relaxants (peripherally and centrally acting muscle relaxants).

Unit IV

Pharmacology of CNS: General anaesthetics, alcohols and disulfiram, sedative and hypnotics. antiepileptic drugs, drugs for neurodegenerative diseases, opioid analgesics and their antagonists. Psychopharmacological Agents: Anti anxiety agents, antipsychotics, antidepressants.

Unit V

Principles of Toxicology: Definition of poison, general principles for treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning. Heavy metal antagonists.

BOP-354P

PHARMACOLOGY-I
(PHARMACOLOGY & TOXICOLOGY) PRACTICAL

1. Use of computer simulated (CDs or video cassettes) for pharmacology practical where possible.
2. Preparation of different solutions for experiments. Drug dilutions, use of molar and w/v solutions in experimental pharmacology. Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology. Some common and standard techniques.
3. Study of different routes of administration of drugs in mice/rats.
4. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone sleeping time in mice, using software alternative to use of animals.

BOOKS RECOMMENDED

1. Katzung B.G., Basic and Clinical Pharmacology, Prentice Hall, International
2. Barar F.S.K., Text Book of Pharmacology, Interprint, New Delhi.
3. Rang M.P., Dale, M.M., Riter J.M., Pharmacology, Churchill Livingstone.
4. Tripathi K.D., Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
5. Satoskar and Bhandarkar, Pharmacology and Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
6. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
7. Bothra S.B.; Essentials of Experimental Pharmacology, Vol. 1, General Concepts, PharmaMed Press.
8. Ghosh, M.N.; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
9. Grover J.K., Experiments in Pharmacy and Pharmacology, CBS Publishers, New Delhi.
10. Goodman & Gilman's, The Pharmacological Basis of Therapeutics, Ed; Brunton L., Lazo J., Parker K., McGraw Hill Professional.
11. Laurence, D.R. and Bannet P.N., Clinical Pharmacology, Churchill Livingstone.
12. Craig C.R. and Stitzel, R.R., Modern Pharmacology, 4th Edition, Little Brown and Co.
13. Sheffield Bioscience Programs, U.K., ISBN, 1-874758-02-6.

14. Udaykumar Padmaja, Medical Pharmacology, CBS Publishers, New Delhi.
15. Saif S. R., Pharmacology Review, CBS Publishers, New Delhi.
16. Gupta P.K., Essential Concepts in Toxicology, Pharma Med.
17. Mukhopadhyay K., Undergraduate Pharmacology, CBS Publishers, New Delhi.
18. Pillai K.K., Experimental Pharmacology, CBS Publishers, New Delhi.

BOP-355

ENVIRONMENT & ECOLOGY

Unit I

Environment studies: Definition, scope and importance. Natural resources-renewable and non renewable, utilization, exploitation and associated problems of forests. Water resources, mineral resources, food resources, energy resources, land resources, equitable use of resources for sustainable life style, role of an individual in conservation.

Unit II

Components of ecosystem. Green house gases and green house effect. Biodiversity and its conservation with special reference to India.

Unit III

Environmental pollution: Introduction, causes and control measures of air, water, soil, marine, noise, thermal, nuclear pollutions.

Unit IV

Law related to environmental protection: Air (Prevention and Control of pollution) Act-1987, Water prevention and Control of Pollution Act-1974.

Unit V

Environmental Protection Act -1986, Noise Pollution Act, Hazardous Wastes Act, Hazardous Chemicals Act, Hazardous Microorganisms Act, Biomedical Waste Act, Provisions applicable to Drugs and Cosmetic Act.

BOOKS RECOMMENDED

1. Manoharachary C., Reddy P.J., Principles of Environmental Studies, BS Publications, Hyderabad.
2. Trivedy R.K., Handbook of Environmental Laws, Acts, Guidelines, Compliances and Standards, Vol. I and II, Pharma Book Syndicate, Hyderabad.
3. Relevant Acts and Rules Published by Government of India with latest amendments.
4. Reddy M.A., Text book of Environmental Science and Technology, BS Publications, Hyderabad.
5. Sinha S., Shukla M., Siddiqui A., Agrawal N. A., Text book of Environment and Ecology for Pharmacy Students, AITBS Publishers, Delhi, India.

BOP-356P

HOSPITAL TRAINING-I

Training of students at a hospital establishment for a minimum duration of 45 days. The hospital training shall include: First aid (wound dressing, artificial respiration etc.), different routes of injection, study of patient observation charts, prescriptions and dispensing, simple diagnostic reports etc.

May be performed at the end of the 4th semester.

SIXTH SEMESTER

BOP-361

PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY-II)

Classification, mode of action, uses, recent advances and structure activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

Unit I

Drug design: Basic concepts of drug design, introduction to analogue based drug design, structure based drug design, introduction to basic concepts of QSAR, molecular descriptors (2D and 3D parameters), quantitative models, introduction to 2D and 3D QSAR methodologies.

Unit II

Cardiovascular agents

Antiarrhythmic drugs: Atenolol, Procainamide.

Antianginal drugs: Isosorbide dinitrate.

Antihypertensive drugs: Captopril, Amlodipine.

Antihyperlipedmics: Lovastatin, Clofibrate.

Unit III

Hypoglycaemics: Insulin, Metformin, Tolbutamide, Glibenclamide, Alogliptin.

Diuretics: Acetazolamide, Chlorthiazide, Furosemide, Spironolactone.

Thyroid and antithyroids: Carbimazole, Propylthiouracil, Methimazole.

Unit IV

Non steroidal anti-inflammatory drugs (NSAIDS) and analgesics: Aspirin, Paracetamol, Ibuprofen, Diclofenac, Mefenamic Acid.

Coxibs: Celecoxib.

Anticoagulants: Heparin, Warfarin.

Unit V

Antihistaminics: Diphenhydramine, Chlorpheniramine, Ranitidine.

Proton pump inhibitors: Rabeprazole.

Cosmeceuticals: Isotretinoin, Minoxidil, Tazarotene.

BOP-361P

PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY-II) PRACTICAL

Synthesis of selected drugs from the course content involving two or more steps and characterize /establish their Pharmacopoeial standards (if available). Spectral analysis of the synthesized drugs.

1. Synthesis of Paracetamol.
2. To evaluate the Pharmacopoeial standards of Paracetamol.
3. Synthesis of Anthranilic Acid.
4. To characterize the synthesized Anthranilic Acid.
5. Synthesis of antipyrine (2,3-Dimethyl-1-phenyl-pyrazol-5-one).
6. To characterize antipyrine (2,3-Dimethyl-1-phenyl-pyrazol-5-one).
7. Few experiments based on Green Chemistry Approach.
8. To study the Cartesian and internal coordinates for small molecules [MOLDEN (freeware program)].
9. To study the architecture of Protein Data Bank (PDB) file.
10. To study the Hansch and Free Wilson analysis (any free statistical program).
11. To study the protein-ligand interaction [AUTODOCK (freeware)].
12. To develop and validate a 3D-QSAR model [Open3D-QSAR (freeware program) or any other licensed program].

BOOKS RECOMMENDED

1. Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., Foyes Principles of Medicinal Chemistry, Lippincott Williams and Wilkins.
2. Block J.H. and Beale J.M., Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams and Wilkins.
3. Patrick G.L., An Introduction to Medicinal Chemistry, Oxford University Press.
4. Vardanyan R.S. and Hruby V.J., Synthesis of Essential Drugs, Elsevier.
5. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
6. Abraham D.J., Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons Inc., New York.

7. Jie-Jack Li, Douglas, S. Johnson, Dhago R. Sliskovic, Bruce, D. Roth. Contemporary Drug Synthesis, John Wiley & Sons Inc.
8. Korolkovas A., Essentials of Medicinal Chemistry, John Wiley and Sons Inc., New York.
9. Pharmacopoeia of India, Ministry of Health, Govt. of India.
10. Lednicer D., The Strategies for Organic Chemistry of Drug Synthesis, John Wiley and Sons Inc., New York.
11. Burger A., A Guide to the Chemical Basis of Drug Design, A Wiley Interscience Publication (John Wiley & Sons), New York.
12. Nogrady T., Medicinal Chemistry: A Biochemical Approach, Oxford University Press, NewYork.
13. Silverman R.B., The Organic Chemistry of Drug Design and Drug Action, Elsevier.
14. Larsen P.K., Liljefors T. and Madsen U. Textbook of Drug Design and Discovery, Taylor and Francis Inc.
15. Perun T.J. and Propst C.L., Computer-aided Drug Design Methods and Applications, Saurabh Prakashan Pvt.Ltd., New Delhi.
16. Martin Y.C., Quantitative Drug Design: A Critical Introduction, 2nd Edition, CRC Press, London.
17. Purcell W.P., Bass G.E., Clayton J.M., Strategy of Drug Design: A Guide to Biological Activity, PharmaMed Press.
18. Mann F.G. and Saunders B.C., Practical Organic Chemistry, Orient Longman Limited.
19. Furniss B.S., Hannaford A.J., Smith P.W.G. and Tatchell A. R., Vogel's Textbook of Practical Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education Ltd.).

BOP-362

PHARMACEUTICS-VIII
(PHARMACEUTICAL TECHNOLOGY-II)

Unit I

Pharmaceutical polymers: Classification of polymers, synonyms, storage and pharmaceutical applications of Carbomers, Microcrystalline cellulose, Chitosan, Cyclodextrin, Hydroxypropyl methyl cellulose, Polyethylene glycol, Polymethyl methacrylate, Polyvinyl pyrrolidone (PVP), Poly(lactic co-glycolic) acid, Poloxamers.

Unit II

Tablets: Classification, granulation technology on large-scale, physics of tablets making, different types of tablet compression machinery and the equipment, evaluation of tablets.

Coating of tablets: Types of coating, film forming materials, formulation of coating solution, equipment for coating process, evaluation of coated tablet.

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 capsules- preparation and capsule content, importance of base adsorption and minim/gm factors. Quality control, stability testing and storage of capsule dosage form.

Unit IV

Controlled and sustained release dosage forms: Basic mechanism of sustained and controlled release**,** definition, advantages and limitations of liposomes, niosomes, resealed erythrocytes, dendrimers, solid lipid nanoparticle (SLN), nano lipid carriers (NLC), implants and transdermal patches.

Micro-particles: Introduction**,** polymers, methods of preparation (solvent evaporation, spray drying, emulsion cross linking method), evaluations (particle size, surface characterizations, Poly dispersity index, entrapment and loading, in-vitro release and release kinetics).

Unit V

Nanoparticles: Introduction**,** methods of preparation (emulsion solvent evaporation, double emulsion solvent evaporation, coacervation-phase separation technique), evaluation (particle size,

surface characterizations, poly dispersity index, entrapment and loading, *in-vitro* release and release kinetics).

Packaging of Pharmaceutical Products: Packaging component types, specifications and methods of evaluation, stability aspects of packaging equipments, factors affecting choice of containers, legal and other official requirements for containers, package testing.

BOP-362P

PHARMACEUTICS-VIII

(PHARMACEUTICAL TECHNOLOGY-II) PRACTICAL

1. Preparation, evaluation and packaging of the following dosage forms containing drugs mentioned in IP.
   a) Capsules.
   b) Microcapsules and microspheres.
   c) Tablets.
   d) Film coated tablets.
   e) Enteric coated tablets
2. To perform film coating of tablets.
3. To study the gel strength and gelling time of different grades of carbomers and HPMC.
4. To formulate and evaluate sustained release dosage forms.
5. To perform the evaluations of packages (containers and closures) and packaging materials.

BOOKS RECOMMENDED

1. Remington: The Science and Practice of Pharmacy Pharmaceutical Sciences Vol. I and III, Mack Publishing Company, U.S.A.
2. Avis R.E., Pharmaceutical Dosage Forms: Parenteral Medication, Vol-I, Marcel Dekker-Inc, New York & Basel.
3. Ansel H.C., Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.

4. Khar R. K., Vyas S.P., Ahmad F., Jain G. K., The Theory and Practice of Industrial Pharmacy, 4th Edition, CBS Publishers and Distributors.
5. Juliano R.C., Drug Delivery Systems, Oxford University Press, Oxford.
6. Herbert A., Liebermann, Lachman L., Theory and Practice of Industrial Pharmacy, Lea and Febiger, Philadelphia, U.S.A.
7. Potdar M. A., C-GMP for Pharmaceuticals.
8. Dinda S. C., Advances in Pharmaceutical Technology, PharmaMed Press.
9. Ansel H.C., Pharmaceutical Dosage Form and Drug Delivery System.
10. Sankar, V. Ramesh S., Shanmugam V., A Text book of Novel Drug Delivery System, PharmaMed Press.
11. Chaurasia M. K., Chaurasia M., Jain N. K., Novel Carriers for Drug Delivery, 1st Edition, PharmaMed Press.
12. Rao M.Y., Jithan A.V., Advances in Drug Delivery, Vol. I-III, PharmaMed Press.

BOP-363

PHARMACOLOGY-II

Unit I

Pharmacology of CVS: Cardiac glycosides, antihypertensive drugs, antianginal drugs, antiarrhythmics, antihyperlipidemics.

Unit II

Drugs acting on haemopoeitic system: Haematinics, Vit. K and anticoagulants, fibrinolytics and antiplatelet drugs, plasma volume expanders.

Drugs acting on respiratory system: Anti-asthmatic drugs, antitussives and expectorants, respiratory stimulants.

Unit III

Autocoids: Histamine, 5HT and its antagonists, prostaglandins, thromboxane, leukotrienes, angiotensin, bradykinin.

Unit IV

NSAIDS, Anti-gout drugs, diuretics, immunomodulators, anticancer agents.

Unit V

Drugs acting on GIT: Antacids and antiulcer drugs, laxatives and anti-diarrhoeal agents, emetics and anti-emetics.

BOP-363P

PHARMACOLOGY-II PRACTICAL

1. To record the dose response curve (DRC) of Acetylcholine using chicken ileum.
2. To study the parallel shift of DRC in presence of competitive antagonist on DRC of Acetylcholine using chicken ileum.
3. To study effect of Physostigmine on DRC of acetylcholine using chicken ileum.
4. To study the CRC of Histamine on guinea pig ileum.
5. Study of the effect of antihistaminics using software.

BOOKS RECOMMENDED

1. Katzung, B.G. Basic and Clinical Pharmacology, Prentice Hall International.
2. Barar F.S.K., Text Book of Pharmacology, Interprint, New Delhi.
3. Rang M.P. Dale M.M., Riter J.M., Pharmacology Churchill Livingstone.
4. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi.
5. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.
6. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
7. Bothra S.B., Essentials of Experimental Pharmacology, Vol. 1, General Concepts, PharmaMed Press.
8. Ghosh, M.N., Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
9. Grover J.K., Experiments in Pharmacy and Pharmacology, CBS Publishers, New Delhi.
10. Goodman and Gilman, The Pharmacological basis of Therapeutics, Edited by Hardman J.G.
11. Laurence, D.R. and Bannet P.N., Clinical Pharmacology, Churchill Livingstone.
12. Craig, C.R. and Stitzel, R.R., Modern Pharmacology, Little Brown and Co.
13. Sheffield Bioscience Programs, U.K., ISBN, 1-874758-02-6.
14. Udaykumar Padmaja, Medical Pharmacology, CBS Publishers, New Delhi.
15. Saif S. R., Pharmacology Review, CBS Publishers, New Delhi.
16. Gupta P.K., Essential Concepts in Toxicology, PharmaMed Press.
17. Mukhopadhyay K., Undergratuate Pharmacology, CBS Publishers, New Delhi.
18. Pillai K.K., Experimental Pharmacology, CBS Publishers, New Delhi

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PHARMACOGNOSY-III

Unit I

Phytochemical screening

A. Introduction, principles and types of extraction methods/techniques.
B. An introduction to active constituents of drugs: Classification, isolation, properties and qualitative chemical tests of alkaloids, saponins, cardenolides and bufadienolides, cynogenetic glycosides, flavanoids and leucoanthocyanidine.

Unit II

Study of the biological sources, commercial varieties, chemical constituents, uses, diagnostic macroscopic and microscopic features, substitutes/adulterants and specific chemical tests of drugs containing the following **glycosides**-

Saponins: Liquorice, Ginseng, Dioscorea, Coleus species.

Cardioactive sterols: Digitals, Squill, Stropanthus, Thevetia.

Anthraquinone cathartics: Aloe, Senna, Rhubarb, Cascara.

Unit III

Tannins: Study of tannins and tannin containing drugs like gumbir (pale catechu), black catechu, gall and myrobalans (Harde, Baheda, Arjuna and Ashoka).

Unit IV

Plant bitters and sweeteners: Introduction to plant bitters and sweeteners, biological source, chemical nature and therapeutic uses of bitter and sweetener principles of the following drugs-

Plant bitters*:* Chiratin (*Momordica charantia*), rotenone (*Derris elliptica*), limonin and naringin (*Citrus* fruits).

Plant sweeteners*:* Thaumatin (*Thaumatococcus danielli*), stevioside and rebaudioside (*Stevia rebaudiana*), neohesperidin (*Citrus aurantium*).

Unit V

Study of traditional drugs: Common vernacular name, biological sources, morphology, chemical nature of chief constituents, common uses and pharmacology of the following indigenous drugs: Psoralea, Gentian, Saffron, Chirata, Quassia, Amla, Kantkari, Shatavari,

Tylophora, Bhilwa, Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun, Palash, Gymnema, Shilajit, Nagarmotha.

BOP-364P

PHARMACOGNOSY-III PRACTICAL

1. Morphology and microscopy (powder) of Liquorice along with its chemical tests.
2. Morphology of Aloe and chemical tests on Aloe-extract.
3. Morphology and microscopy (powder) of Rhubarb.
4. Morphology of Psoralia, Saffron and Chirata.
5. Morphology of Amla, Kantkari, Shatavari and Vach.
6. Morphology of Punarnava, Apamarg, Gokhru, and Shankhpushpi.
7. Morphology of Brahmi, Methi, Lehsun and Palash.
    a) Morphology of Nagarmotha and Neem.
    b) Identification Tests for Guggul lipids.
8. Test for identification of glycosides (saponin and anthraquinone).
9. Test for identification of tannins.
10. Tests for identification of steroids.
11. Tests for identification of flavonoids.
12. A report on marketed preparations based on traditional drugs mentioned in theory.

BOOKS RECOMMENDED

1. Trease, G.E., and Evans, W.C., Pharmacognosy, Bailliere Tindall East Baorne, U.K.
2. Wallis. T.E. “Text Book of Pharmacognosy” J&A Churchill Ltd. London.
3. Kokate C.K., Gokhale A.S., Gokhale S.B., Cultivation of Medicinal Plants, Nirali Prakashan.
4. Tyler V.E., Lynnr B. and Robbers J.E., Pharmacognosy, 8th Edition, Lea & Febiger, Philadelphia.
5. Harborne J.B., Phytochemical method, Chapman & Hall International Edition, London.
6. Medicinal Plants of India, Vol. I & II, Indian Council of Medical Reasearch, New Delhi.
7. Nadkarni A.K., Indian Materia Medica, Vol- 1&2, Popular Prakashan (P) Ltd. Bombay.
8. Sukh Dev, A Selection of Prime Ayurvedic Plant Drug, Anamaya Publisher New Delhi.

9. Indian Herbal Pharmacopoeia, Vol. I & II, ICMR & RRL, Jammu.
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. The Wealth of India, Raw Materials (All volumes) Council of Scientific & Industrial Research, New Delhi.
12. Rastogi R. P. and Mehrotra B.N., Compendium of Indian Medicinal Plants I-IV, Publications & Information Directorate/Central Drug Research Institute, New Delhi.
13. American Herbal Pharmacopoeia, Botanical Pharmacognosy: Microscopic Characterization of Botanical Medicines, Taylor & Francis Group.
14. Wallis T.E., Analytical Microscopy, J&A Churchill Ltd., London.
15. Kokate C.K., Practical Pharmacognosy, Vallabh Prakashan, New Delhi.
16. Iyengar M.A., Pharmacognosy of Powdered Crude Drugs, PharmaMed Press.
17. Iyengar, M.A. and Nayak S.C.K., Anatomy of Powdered Crude Drugs, PharmaMed Press.

BOP-365

PROFESSIONAL COMMUNICATION

Unit I

Written skills:

a. Proposal writing formats.
b. Report writing.
c. Business letters.
d. Applications.
e. Covering letters.
f. Curriculum Vitae designing.

Unit II

a. Barriers to communication, time management simulation exercise.
b. Leadership skills.
c. Team work BSC (Boss, subordinates and colleagues).

Unit III

1. **Group discussions (GDs).**
   a. Tips.
   b. GD.
2. **Non verbal aspects of communication.**

Unit IV

a. Corporate communication, corporate expectation, office etiquettes.
b. Extempore.

Unit V

1. **Interview Tips:**
   a. What should be done before the interview, during the interview, after the interview and on the day of interview?
   b. Various questions that may be asked in an interview.
   c. Model interview (video-shooting and displaying optional).
2. **Exit interview.**

BOOKS RECOMMEDNDED

1. Raman M. and Sharma, S., Technical Communications- Principles & Practice, 2nd Edition, Oxford University Press.
2. Sharma, R. C. and Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill Co.
3. Lesikar, R.V., Pettit J.V., Flateley M.E., Lesikar's Basic Business Communication, 8th Edition, McGraw Hill Companies.

BOP-366P

INDUSTRIAL TRAINING

The training shall include training at an approved pharmaceutical unit for a minimum of 30 days. The industrial training shall compose of observation of various manufacturing sections, packaging section and testing section. It shall also include the study of GMP requirements, SOPs, batch production records (BPRs), analysis records etc.

May be performed at the end of the 5th semester.