FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010601**

Course Title: **Medicinal Chemistry-III**

Course Objectives: Upon completion of the course the student shall be able to

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Antibiotics** Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. **β-Lactam antibiotics:** Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams **Aminoglycosides:** Streptomycin, Neomycin, Kanamycin **Tetracyclines:** Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline	10

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2	**Antibiotics** Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. **Macrolide:** Erythromycin Clarithromycin, Azithromycin. **Miscellaneous:** Chloramphenicol*, Clindamycin. **Prodrugs:** Basic concepts and application of prodrugs design. **Antimalarials:** Etiology of malaria. **Quinolines:** SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. **Biguanides and dihydrotriazines:** Cycloguanilpamoate, Proguanil. **Miscellaneous:** Pyrimethamine, Artesunate, Artemether, Atovaquone.	**10**
3	**Anti-tubercular Agents** **Synthetic anti tubercular agents:** Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid. * **Anti-tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate. **Urinary tract anti-infective agents** **Quinolones:** SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin **Miscellaneous:** Furazolidine, Nitrofurantoin*, Methenamine. **Antiviral agents:** Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Ganciclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir.	**10**
4	**Antifungal agents:** **Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin. **Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*. **Anti-protozoal Agents:** Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. **Anthelmintics:** Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantel, Ivermectin. **Sulphonamides and Sulfones** Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mafenide acetate, Sulfasalazine. **Folate reductase inhibitors:** Trimethoprim*, Cotrimoxazole. **Sulfones:** Dapsone*.	**8**

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5	**Introduction to Drug Design** Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Taft's steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. **Combinatorial Chemistry:** Concept and applications of combinatorial chemistry: solid phase and solution phase synthesis.	**7**

Reference Books:

1	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2	Foye's Principles of Medicinal Chemistry.
3	Burger's Medicinal Chemistry, Vol I to IV.
4	Introduction to principles of drug design- Smith and Williams.
5	Remington's Pharmaceutical Sciences.
6	Martindale's extra pharmacopoeia.
7	Organic Chemistry by I.L. Finar, Vol. II.
8	The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9	Indian Pharmacopoeia.
10	Text book of practical organic chemistry- A.I.Vogel

Pedagogy:

1. Power point presentation
2. Traditional methodology

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
40	40	20	0	0	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Describe properties, reactions, SAR and uses of Antibiotics	**30**
CO-2	Explain the concept of pro drug with respect to chemistry	**10**
CO-3	Explain properties, reactions and mechanism of action of anti malarial, anti tubercular, anti viral drugs and urinary tract anti-infective agents	**30**
CO-4	Learn properties and reactions of antifungal, antiprotozoal, anthelmintic and sulphonamide drugs	**15**
CO-5	Explain basic concept of drug design, QSAR and combinatorial chemistry	**15**

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Curriculum Revision:	
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010602**

Course Title: **Pharmacology -III**

Course Objectives: Upon completion of the course the student shall be able to

1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisonings and
3. Appreciate correlation of pharmacology with related medical sciences.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Pharmacology of drugs acting on Respiratory system** • Anti -asthmatic drugs • Drugs used in the management of COPD • Expectorants and antitussives • Nasal decongestants • Respiratory stimulants **Pharmacology of drugs acting on the Gastrointestinal Tract** • Antiulcer agents. • Drugs for constipation and diarrhoea. • Appetite stimulants and suppressants. • Digestants and carminatives. • Emetics and anti-emetics.	10
2	**Chemotherapy** • General principles of chemotherapy. • Sulfonamides and cotrimoxazole. • Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides	10

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3	**Chemotherapy** • Antitubercular agents • Antileprotic agents • Antifungal agents • Antiviral drugs • Anthelmintics • Antimalarial drugs • Antiamoebic agents	**10**
4	**Chemotherapy** • Urinary tract infections and sexually transmitted diseases. • Chemotherapy of malignancy **Immunopharmacology** • Immunostimulants • Immunosuppressant , Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars	**8**
5	**Principles of toxicology** • Definition and basic knowledge of acute, subacute and chronic toxicity. • Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity • General principles of treatment of poisoning • Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning **Chronopharmacology** • Definition of rhythm and cycles. • b. Biological clock and their significance leading to chronotherapy.	**7**

Reference Books:

1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw- Hill
3	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4	Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams &Wilkins
5	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6	K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8	Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert, Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9	N.S.Parmar, Shiv Prakash. Screening Methods in Pharmacology
10	Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
11	N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

Pedagogy:

1. LCD Projector
2. Traditional Method(Black Board)

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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
35	50	15	0	0	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Learn classes of drugs mechanism and treatment of infectious diseases.	62
CO-2	Describe classes of drugs mechanism and treatment of Respiratory and Gastrointestinal diseases.	22
CO-3	Learn toxicity principles, symptoms and treatment of poisons.	11
CO-4	Discuss the rhythm and cycles of biological clock and their significance to chronotherapy	5

Curriculum Revision:	
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010603**

Course Title: **Herbal Drug Technology**

Course Objectives: Upon completion of this course the student should be able to:

1. Understand raw material as source of herbal drugs from cultivation to herbal drug product
2. Know the WHO and ICH guidelines for evaluation of herbal drugs
3. Know the herbal cosmetics, natural sweeteners, nutraceuticals
4. Appreciate patenting of herbal drugs, GMP.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**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. **Indian Systems of Medicine** a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.	11

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2	**Nutraceuticals** General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina **Herbal-Drug and Herb-Food Interactions:** General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypericum, kava-kava, Ginko biloba, Ginseng, Garlic, Pepper& Ephedra.	**7**
3	**Herbal Cosmetics** Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums, colors, 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, disintegrants, flavors & perfumes. **Herbal formulations:** Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes.	**10**
4	**Evaluation of Drugs** WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. **Patenting and Regulatory requirements of natural products:** a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. **Regulatory Issues** – Regulations in India (ASUDTAB, ASUDCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs	**10**
5	**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 Infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation and records.	**7**

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Reference Books:

1	Evans WC. Trease and evans' pharmacognosy E-book. Elsevier Health Sciences; 2009 May 27.
2	Tyler VE, Brady LR, Robbers JE. Pharmacognosy. 9th edition, Lea and Febigei, USA, 1988.
3	Kokate CK, Purohit AP, Gokhale SB. Text book of Pharmacognosy. 56th edition, Pune: Nirali Prakashan. 2019
4	Ansari SH. Essentials of pharmacognosy. IInd edition, Birla publications, New Delhi, 2007.
5	Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009.
6	Pharmacopeial standards for Ayurvedic Formulation. Council of Research in Indian Medicine & Homeopathy, 1996.
7	Mukherjee PK. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

Pedagogy:

1. ICT based teaching learning,
2. Chalk- board method

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	40	20	15	3	2	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Describe biodynamic agricultural techniques for medicinal plants.	**10**
CO-2	Explain role of pharmacognosy in traditional system of medicine, preparation and standardization of Ayurvedic formulations.	**20**
CO-3	Discuss account on herbal industries and Schedule T	**10**
CO-4	Discuss role of herbs used as an excipient, health food and explain herbal dosage form.	**25**
CO-5	Elaborate health benefits and role of nutraceuticals in disease management	**10**
CO-6	Elaborate assessment, patenting and regulatory requirements of natural products.	**25**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010604**

Course Title: **Biopharmaceutics and Pharmacokinetics**

Course Objectives: Upon completion of the course student shall be able to:

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
4. Understand various pharmacokinetic parameters, their significance & applications.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction to Biopharmaceutics Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs	10

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2	Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, non-renal routes of drug excretion of drugs Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.	**10**
3	Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non-compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus)(b). Intravenous infusion and (c) Extravascular administrations. Pharmacokinetics parameters - KE, $t_{1/2}$, V_d, AUC, Ka, Clt and CLR-definitions methods of eliminations, understanding of their significance and application.	**10**
4	Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings	**8**
5	Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity. c. Michaelis-Menton method of estimating parameters, Explanation with example of drugs.	**5**

Reference Books:

1	Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2	Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3	Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition, Prentice-Hall International edition. USA
4	Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B. Jaiswal, Vallabh Prakashan Pitampura, Delhi
5	Pharmacokinetics: By Milo Gibaldi Donald, R. Marcel Dekker Inc.
6	Handbook of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7	Biopharmaceutics; By Swarbrick
8	Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
9	Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
10	Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York, and Basel, 1987.
11	Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvania.

Pedagogy:

1. ICT based (Presentations, Audio Video Tools)
2. Traditional methods (Blackboard learning)

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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
33	35	13	17	2	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Learn biopharmaceutics of absorption, distribution, metabolism and elimination of drugs	**35**
CO-2	Understand the concepts and studies of bioavailability, bioequivalence of drug product	**13**
CO-3	Apply knowledge of biopharmaceutics in modification of dissolution rate and enhancement of bioavailability	**12**
CO-4	Apply pharmacokinetics, compartment, and non-compartment model theories for drug kinetics	**30**
CO-5	Learn causes of non-linearity and non-linear pharmacokinetics	**10**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010605**

Course Title: **Industrial Pharmacy - I**

Course Objectives: Upon completion of the course the student shall be able to

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Preformulation Studies:** Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. a. ***Physical properties:*** Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism b. ***Chemical Properties:*** Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.	07

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2	**Tablets:** a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression, and processing problems. Equipments and tablet tooling. b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. c. Quality control tests: In process and finished product tests **Liquid orals:** Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia	**10**
3	**Capsules:** a. ***Hard gelatin capsules***: Introduction, Production of hard gelatin capsule shells. Size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. b. ***Soft gelatin capsules:*** Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage, and stability testing of soft gelatin capsules and their applications. **Pellets:** Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets	**8**
4	**Parenteral Products**: a. Definition, types, advantages, and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injections, sterile powders, large volume parenteral and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials, and infusion fluids. Quality control tests of parenteral products. **Ophthalmic Preparations:** Introduction, formulation considerations; formulation of eyedrops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations	**10**
5	**Cosmetics:** Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, toothpastes, hair dyes and sunscreens. **Pharmaceutical Aerosols:** Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. **Packaging Materials Science:** Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.	**10**

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Reference Books:

1	Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J. B Schwartz
2	Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3	Pharmaceutical dosage form disperse system VOL-1 by Liberman &Lachman
4	Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5	Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6	Theory and Practice of Industrial Pharmacy by Liberman& Lachman
7	Pharmaceutics- The science of dosage form design by M.E. Aulton, Churchill living stone, Latest edition
8	Introduction to Pharmaceutical Dosage Forms by H. C. Ansel, Lea & Febiger, Philadelphia, 5thedition, 2005
9	Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol. 107.

Pedagogy:

1. ICT Tools: Presentation,
2. Conventional Teaching Method: Blackboard

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	30	20	20	10	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Elaborate the preformulation considerations for dosage form development	**10**
CO-2	Explain basics of tablets, capsules and pellets, their manufacturing, in-process quality control & evaluation	**45**
CO-3	Describe various liquid orals and pharmaceutical aerosols, their manufacturing, in-process quality control and evaluation	**20**
CO-4	Explain formulation and evaluation of sterile and cosmetics products	**15**
CO-5	Acquire knowledge about packaging materials science	**10**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010611**

Course Title: **Medicinal Chemistry III Practical**

Course Objectives: Upon completion of the course the student shall be able to

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	To synthesize p-Acetamido benzene sulphonyl chloride from acetanilide.
2	To synthesize p-Acetamido benzene sulphonamide from p-acetamido benzene sulphonyl chloride.
3	To synthesize p-Amino benzene sulphonamide (Sulphanilamide) from p-Acetamido benzene sulphonamide.
4	To Synthesize 7-Hydroxy, 4-methyl coumarin.
5	To Synthesize Chlorobutanol.
6	To Synthesize Triphenyl imidazole.
7	To Synthesize Tolbutamide.
8	To Synthesize Hexamine.
9	To perform assay of Isonicotinic acid hydrazide tablet.
10	To perform assay of Chloroquine phosphate tablet.
11	To perform assay of Metronidazole tablet.
12	To perform assay of Dapsone tablet.
13	To perform assay of Chlorpheniramine maleate injection
14	To perform assay of Benzyl penicillin tablet.
15	To Synthesize Aspirin by Microwave irradiation technique.
16	To Synthesize Phenytoin by Microwave irradiation technique

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17	To Synthesize Phthaloyl glycine by Microwave irradiation technique
18	To draw structures of compounds by using Chem Draw.

Reference Books:

1	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2	Foye's Principles of Medicinal Chemistry.
3	Burger's Medicinal Chemistry, Vol I to IV.
4	Introduction to principles of drug design- Smith and Williams.
5	Remington's Pharmaceutical Sciences.
6	Martindale's extra pharmacopoeia.
7	Organic Chemistry by I.L. Finar, Vol. II.
8	The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9	Indian Pharmacopoeia.
10	Text book of practical organic chemistry- A.I.Vogel

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Learn to synthesize various drug intermediates and drugs	**40**
CO-2	Perform assay of important pharmaceutical intermediates and compounds	**40**
CO-3	Learn microwave assisted synthesis of drugs	**10**
CO-4	Explain physicochemical properties of drug intermediates and drugs	**10**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010611**

Course Title: **Medicinal Chemistry III Practical**

Course Objectives: Upon completion of the course the student shall be able to

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	To synthesize p-Acetamido benzene sulphonyl chloride from acetanilide.
2	To synthesize p-Acetamido benzene sulphonamide from p-acetamido benzene sulphonyl chloride.
3	To synthesize p-Amino benzene sulphonamide (Sulphanilamide) from p-Acetamido benzene sulphonamide.
4	To Synthesize 7-Hydroxy, 4-methyl coumarin.
5	To Synthesize Chlorobutanol.
6	To Synthesize Triphenyl imidazole.
7	To Synthesize Tolbutamide.
8	To Synthesize Hexamine.
9	To perform assay of Isonicotinic acid hydrazide tablet.
10	To perform assay of Chloroquine phosphate tablet.
11	To perform assay of Metronidazole tablet.
12	To perform assay of Dapsone tablet.
13	To perform assay of Chlorpheniramine maleate injection
14	To perform assay of Benzyl penicillin tablet.
15	To Synthesize Aspirin by Microwave irradiation technique.
16	To Synthesize Phenytoin by Microwave irradiation technique

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17	To Synthesize Phthaloyl glycine by Microwave irradiation technique
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1	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2	Foye's Principles of Medicinal Chemistry.
3	Burger's Medicinal Chemistry, Vol I to IV.
4	Introduction to principles of drug design- Smith and Williams.
5	Remington's Pharmaceutical Sciences.
6	Martindale's extra pharmacopoeia.
7	Organic Chemistry by I.L. Finar, Vol. II.
8	The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9	Indian Pharmacopoeia.
10	Text book of practical organic chemistry- A.I.Vogel

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Learn to synthesize various drug intermediates and drugs	**40**
CO-2	Perform assay of important pharmaceutical intermediates and compounds	**40**
CO-3	Learn microwave assisted synthesis of drugs	**10**
CO-4	Explain physicochemical properties of drug intermediates and drugs	**10**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010612**

Course Title: **Pharmacology -III Practical**

Course Objectives: Upon completion of the course the student shall be able to

1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisonings and
3. Appreciate correlation of pharmacology with related medical sciences.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	Dose calculation in pharmacological experiments
2	Antiallergic activity by mast cell stabilization assay
3	Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model
4	Study of effect of drugs on gastrointestinal motility
5	Effect of agonist and antagonists on guinea pig ileum
6	Estimation of serum biochemical parameters by using semi- autoanalyser
7	Effect of saline purgative on frog intestine
8	Insulin hypoglycemic effect in rabbit
9	Test for pyrogens (rabbit method)
10	Determination of acute oral toxicity (LD50) of a drug from a given data
11	Determination of acute skin irritation / corrosion of a test substance
12	Determination of acute eye irritation / corrosion of a test substance
13	Calculation of pharmacokinetic parameters from a given data
14	Biostatistics methods in experimental pharmacology(student's t test, ANOVA)
15	Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

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Reference Books:

1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw- Hill
3	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4	Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams &Wilkins
5	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6	K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8	Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert, Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9	N.S.Parmar , Shiv Prakash. Screening Methods in Pharmacology
10	Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
11	N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Perform agonist and antagonists activity of drugs on isolated chicken ileum.	20
CO-2	Learn dose calculation and OECD guidelines for toxicity studies.	40
CO-3	Learn anti-ulcer, Antiallergic and gastrointestinal motility activity, serum biochemical parameters, hypoglycemic effect and pyrogen test.	15
CO-4	Discuss pharmacokinetic parameters and biostatistics in experiments.	25

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FACULTY OF PHARMACEUTICAL SCIENCES

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Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010613**

Course Title: **Herbal Drug Technology Practical**

Course Objectives: Upon completion of this course the student should be able to:

1. Understand raw material as source of herbal drugs from cultivation to herbal drug product
2. Know the WHO and ICH guidelines for evaluation of herbal drugs
3. Know the herbal cosmetics, natural sweeteners, nutraceuticals
4. Appreciate patenting of herbal drugs, GMP.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	To perform preliminary phytochemical screening of crude drugs.
2	Determination of the alcohol content of Asava and Arista
3	Evaluation of excipients of natural origin
4	Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5	Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopeial requirements.
6	Monograph analysis of herbal drugs from recent Pharmacopoeias
7	Determination of Aldehyde content
8	Determination of Phenol content
9	Determination of total alkaloids

Reference Books:

1	Evans WC. Trease and evans' pharmacognosy E-book. Elsevier Health Sciences; 2009 May 27.
2	Tyler VE, Brady LR, Robbers JE. Pharmacognosy. 9th edition, Lea and Febigei, USA, 1988.
3	Kokate CK, Purohit AP, Gokhale SB. Text book of Pharmacognosy. 56th edition, Pune: Nirali Prakashan. 2019

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4	Ansari SH. Essentials of pharmacognosy. IInd edition, Birla publications, New Delhi, 2007.
5	Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009.
6	Pharmacopoeal standards for Ayurvedic Formulation. Council of Research in Indian Medicine & Homeopathy, 1996.
7	Mukherjee PK. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Perform preliminary phytochemical screening	**10**
CO-2	Evaluate excipients of natural origin	**5**
CO-3	Prepare and evaluate herbal formulations	**60**
CO-4	Evaluate qualitative and quantitative determination of prepared extract	**10**
CO-5	Evaluate labelled content of Asavas and Aristas	**10**
CO-6	Analyze herbal drugs as per monograph	**5**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **VI**

Course Code: **108010615**

Course Title: **Industrial Pharmacy-I Practical**

Course Objectives: Upon completion of the course the student shall be able to

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	Preformulation studies on paracetamol/asparin/or any other drug
2	Preparation and evaluation of Paracetamol tablets
3	Preparation and evaluation of Aspirin tablets
4	Coating of tablets- film coating of tables/granules
5	Preparation and evaluation of Tetracycline capsules
6	Preparation of Calcium Gluconate injection
7	Preparation of Ascorbic Acid injection
8	Quality control test of (as per IP) marketed tablets and capsules
9	Preparation of Eye drops/ and Eye ointments
10	Preparation of Creams (cold / vanishing cream)
11	Evaluation of Glass containers (as per IP)

Reference Books:

1	Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman&J.B.Schwartz
2	Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman&Lachman
3	Pharmaceutical dosage form disperse system VOL-1 by Liberman&Lachman
4	Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition

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6	Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7	Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
8	Introduction to Pharmaceutical Dosage Forms by H. C. Ansel, Lea & Febiger, Philadelphia, 5thedition, 2005
9	Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol. 107.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Formulate and evaluate solid pharmaceutical dosage forms and cosmetics	**45**
CO-2	Formulate and evaluate sterile pharmaceutical dosage forms	**35**
CO-3	Evaluate packaging materials	**20**

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