FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010401**

Course Title: **Pharmaceutical Organic Chemistry –III**

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

1. Understand the methods of preparation and properties of organic compounds
2. Explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. Know the medicinal uses and other applications of organic compounds

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	**Stereo isomerism** Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds, Elements of symmetry, chiral and achiral molecules, DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers, Reactions of chiral molecules, Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute	10
2	Geometrical isomerism: Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereo selective reactions	10
3	**Heterocyclic compounds:** Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds / derivatives: Pyrrole, Furan, and Thiophene. - Relative aromaticity and reactivity of pyrrole, Furan and Thiophene	10

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4	Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives	**8**
5	**Reactions of synthetic importance** Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation	**7**

Reference Books:

1	Organic chemistry by I.L. Finar, Volume-I & II.
2	A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3	Heterocyclic Chemistry by Raj K. Bansal
4	Organic Chemistry by Morrison and Boyd
5	Heterocyclic Chemistry by T.L. Gilchrist
6	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5
7	http://ndl.iitkgp.ac.in/document/YkxlRXFvZXJrTDBkVzVVZi9ESjl6NnZUS0oyRk9NcW00ZkxwdGxDcXVJVlA4SU9iY3NaV0Roa3NqNWRoN2ZCTQ
8	http://ndl.iitkgp.ac.in/document/d1p3QXlpNzFRZFhCaDNNcHJwbWRXeGZ2SXAzRmFzaWtuZ05zMWd3VkYxZz0
9	http://ndl.iitkgp.ac.in/document/MDl5cHdNUUlnd0lnZHNoQXlvOG5lQkN3bUNiS3lWN0Zkcy9BOXYzcXEzWT0
10	https://www.khanacademy.org/science/organic-chemistry/stereochemistry-topic/diastereomers-meso-compounds/v/stereoisomers-enantiomers-diastereomers-constitutional-isomers-and-meso-compounds

Pedagogy:

1. Usage of Ball and stick Stereo models
2. Prepare Power point presentation and explain on projector
3. Traditional Methodology (Chalk and duster)

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	15	0	5	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	Explain stereoisomerism and geometric isomerism of organic compounds and stereo chemical reactions	**30**
CO-2	Learn reactions with respect to reactivity, stability, properties and orientation of heterocyclic compounds	**30**

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CO-3	Describe name reactions of synthetic importance	**20**
CO-4	Demonstrate stereo-models and 3D view of stereoisomers	**10**

Curriculum Revision:	
Version:	1
Drafted on (Month-Year):	June 2021
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Next Review on (Month-Year):	June 2026

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010402**

Course Title: **Medicinal Chemistry-I**

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

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship (SAR) of different class of drugs
4. Write the chemical synthesis of some 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	**Introduction to Medicinal Chemistry** **History and development of medicinal chemistry** **Physicochemical properties in relation to biological action** Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. **Drug metabolism** Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.	10
2	**Drugs acting on Autonomic Nervous System** **Adrenergic Neurotransmitters:** Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.	10

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	Sympathomimetic agents: SAR of Sympathomimetic agents **Direct acting:** Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. **Indirect acting agents:** Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. **Agents with mixed mechanism:** Ephedrine, Metaraminol. **Adrenergic Antagonists:** **Alpha adrenergic blockers:** Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. **Beta adrenergic blockers:** SAR of beta blockers, Propranolol*,Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	
3	**Cholinergic neurotransmitters:** Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. **Parasympathomimetic agents: SAR of Parasympathomimetic agents** **Direct acting agents:** Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine. **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):** Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion. **Cholinesterase reactivator:** Pralidoxime chloride. **Cholinergic Blocking agents: SAR of cholinolytic agents** **Solanaceous alkaloids and analogues:** Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*. **Synthetic cholinergic blocking agents:** Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.	**10**
4	**Drugs acting on Central Nervous System** **A. Sedatives and Hypnotics:** **Benzodiazepines:** SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem **Barbiturtes:** SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital **Miscelleneous:** Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.	**8**

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	B. Antipsychotics **Phenothiazeines:** SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride. **Ring Analogues of Phenothiazeines:** Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine. **Fluro buterophenones:** Haloperidol, Droperidol, Risperidone. **Beta amino ketones:** Molindone hydrochloride. **Benzamides:** Sulpieride. **C. Anticonvulsants:** SAR of Anticonvulsants**,** mechanism of anticonvulsant action **Barbiturates**: Phenobarbitone, Methabarbital. **Hydantoins:** Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:** Trimethadione, Paramethadione **Succinimides:** Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**: Phenacemide, Carbamazepine* **Benzodiazepines**: Clonazepam **D. Miscellaneous:** Primidone, Valproic acid , Gabapentin, Felbamate	
5	**Drugs acting on Central Nervous System** **General anesthetics:** **Inhalation anesthetics:** Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. **Ultrashort acting barbitutrates:** Methohexital sodium*, Thiamylal sodium, Thiopental sodium. **Dissociative anesthetics:** Ketamine hydrochloride* **Narcotic and non-narcotic analgesics** **Morphine and related drugs:** SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate. **Narcotic antagonists:** Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. **Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.	**7**

Reference Books:

1	Wilson and Griswold'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.

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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.
11	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=833
12	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=833
13	https://youtu.be/bxFaLGRzITQ
14	https://youtu.be/VRTCoijjLCA

Pedagogy:

1. ICT tools (LCD projector, Laptop)
2. Traditional method (Black board)

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	45	5	5	5	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	Correlate physicochemical properties of drug with respect to biological action	**20**
CO-2	Describe chemistry and structure activity relationship of drugs correlating with pharmacological activity	**30**
CO-3	Narrate the drug metabolic pathways through illustrations and impact on drug action	**20**
CO-4	Learn and categories chemical synthetic pathways of selected drugs	**20**
CO-5	Understand uses of drugs in treatment of diseases	**10**

Curriculum Revision:	
Version:	1
Drafted on (Month-Year):	June 2021
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Next Review on (Month-Year):	June 2026

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010403**

Course Title: **Physical Pharmaceutics –II**

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms

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	**Colloidal dispersions:** Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.	7
2	**Rheology:** Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatants, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers. **Deformation of solids:** Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.	10

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3	**Coarse dispersion:** Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.	**8**
4	**States of Matter and properties of matter:** State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism. **Physicochemical properties of drug molecules:** Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	**10**
5	**Drug stability:** Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.	**10**

Reference Books:

1	Physical Pharmacy by Alfred Martin, Sixth edition
2	Experimental pharmaceutics by Eugene, Parott.
3	Tutorial pharmacy by Cooper and Gunn.
4	Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5	Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6	Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7	Physical Pharmaceutics by Ramasamy C, and Manavalan R
8	https://ich.org/

Pedagogy:

1. ICT Tools: Power point 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**	
25	35	25	5	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.

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Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Learn different states of matter and physicochemical properties of drugs and excipients in preformulation studies	**20**
CO-2	Acquire fundamental knowledge of coarse dispersion	**25**
CO-3	Know basic concepts, physicochemical properties, and stability of colloidal dispersion	**15**
CO-4	Explain fundamentals of rheological behavior in formulation of semisolids and liquids	**20**
CO-5	Know the principles of chemical kinetics and degradation pathways of drugs	**20**

Curriculum Revision:	
Version:	1
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Next Review on (Month-Year):	June 2026

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010404**

Course Title: **Pharmacology-I**

Course Objectives: Upon completion of the course the student shall be able to
1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other biomedical 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	**General Pharmacology** **a. Introduction to Pharmacology-** Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. **b. Pharmacokinetics-** Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination	8

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2	**General Pharmacology** **a. Pharmacodynamics-** Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. **b.** Adverse drug reactions. **c.** Drug interactions (pharmacokinetic and pharmacodynamics) **d.** Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.	**12**
3	**Pharmacology of drugs acting on peripheral nervous system** **a.** Organization and function of ANS. **b.** Neurohumoral transmission, co-transmission and classification of neurotransmitters. **c.** Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. **d.** Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). **e.** Local anesthetic agents. **f.** Drugs used in myasthenia gravis and glaucoma	**10**
4	**Pharmacology of drugs acting on central nervous system** **a.**Neurohumoral transmission in the C.N.S. Special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. **b.** General anesthetics and pre-anesthetics**.** **c.** Sedatives, hypnotics and centrally acting muscle relaxants. **d.** Anti-epileptics **e.** Alcohols and disulfiram	**8**
5	**Pharmacology of drugs acting on central nervous system** **a. Psychopharmacological agents:** Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. **b.** Drugs used in Parkinsons disease and Alzheimer's disease. **c.** CNS stimulants and nootropics. **d.** Opioid analgesics and antagonists **e.** Drug addiction, drug abuse, tolerance and dependence.	**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	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

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5	Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
6	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
7	K. D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
8	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher.
9	Screening methods in Pharmacology. N.S. Parmar Shiv Prakash, Narosa Publishing House
10	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
11	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan
12	Screening methods in Pharmacology. N.S. Parmar Shiv Prakash, Narosa Publishing House
13	Practical Pharmacology-I by Dr. R. K. Goyal & Dr. N. M. Patel, B. S. Shah Prakashan, Gujrat

Pedagogy:

1. LCD projector, laptop
2. Traditional method(Black Board)

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	60	0	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	Discuss scope of pharmacology, routes of administration and pharmacokinetic parameters.	**18**
CO-2	Explain drug discovery and mechanisms of drug action, adverse drug reactions and drug interaction.	**27**
CO-3	Describe classes of drug mechanism and treatment of diseases of peripheral and central nervous system.	**55**

Curriculum Revision:	
Version:	1
Drafted on (Month-Year):	June 2021
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010405**

Course Title: **Pharmaceutical Jurisprudence**

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

1 The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals
2. Various Indian pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

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	**Drugs and Cosmetics Act, 1940 and its rules 1945:** Objectives, Definitions, Legal definitions of schedules to the act and rules. Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties. Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.	10
2	**Drugs and Cosmetics Act, 1940 and its rules 1945:** Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA). Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties. Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the act and rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors.	10

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3	**Pharmacy Act –1948:** Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; its constitution and functions, Registration of Pharmacists, Offences and Penalties. **Medicinal and Toilet Preparation Act –1955:** Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties. **Narcotic Drugs and Psychotropic substances Act-1985 and Rules:** Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties.	**10**
4	**Study of Salient Features of Drugs and magic remedies Act 1954 and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties. **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)	**8**
5	**Pharmaceutical Legislations:** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee. **Code of Pharmaceutical ethics:** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath. **Medical Termination of pregnancy act:** Introduction, Termination of Pregnancies, Offences and Penalties. **Right to information Act** **Introduction to Intellectual Property Rights (IPR)**	**7**

Reference Books:

1	Forensic Pharmacy by B. Suresh
2	Text book of Forensic Pharmacy by B.M. Mithal
3	Handbook of drug law-by M.L. Mehra
4	A textbook of Forensic Pharmacy by N.K. Jain
5	Drugs and Cosmetics Act/Rules by Govt. of India publications.
6	Medicinal and Toilet preparations act 1 955 by Govt. of India publications.
7	Narcotic drugs and psychotropic substances act by Govt. of India publications
8	Drugs and Magic Remedies act by Govt. of India publication
9	Bare Acts of the said laws published by Government. Reference books (Theory)
10	https://legislative.gov.in

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11	https://rti.gov.in
12	https://legislative.gov.in
13	https://www.indiacode.nic.in
14	https://dor.gov.in
15	https://cdsco.gov.in
16	https://www.wipo.int

Pedagogy:

1. ICT tools: Presentation,
2. Conventional Teaching Method: Black board

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	35	30	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	Acquire knowledge about basic principles of pharmaceutical Acts, laws and schedules in India.	**55**
CO-2	Explain provisions and prohibitions in relation to drugs and cosmetics Act, 1940	**20**
CO-3	Discuss the constitution and functions of board of various governing bodies and licensing authorities of India for pharmacy regulation	**5**
CO-4	Learn various laws governing narcotic & psychotropic substances	**10**
CO-5	Learn code of pharmaceutical ethics and knowledge about IPR and RTI	**10**

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CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010412**

Course Title: **Medicinal Chemistry-I Practical**

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

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship (SAR) of different class of drugs
4. Write the chemical synthesis of some 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	**Preparation of drugs and intermediates** 1. 1,3-pyrazole 2. 1,3-oxazole 3. Benzimidazole 4. Benztriazole 5. 2,3- diphenyl quinoxaline 6. Benzocaine 7. Phenytoin 8. Phenothiazine 9. Barbiturate
2	**Assay of drugs** 1. Chlorpromazine 2. Phenobarbitone 3. Atropine 4. Ibuprofen 5. Aspirin 6. Furosemide
3	**Determination of Partition coefficient for any two drugs.**

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Reference Books:

1	Wilson and Griswold'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.
11	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=833
12	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=833
13	https://youtu.be/bxFaLGRzITQ
14	https://youtu.be/VRTCoijjLCA

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Learn to synthesize drug intermediates and active pharmaceutical ingredients	**40**
CO-2	Perform assay of drugs using analytical methods	**40**
CO-3	Determine partition coefficient of medicinal compounds	**10**
CO-4	Carry out calculations and representation of data in synthetic chemistry	**10**

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CVM UNIVERSITY
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010413**

Course Title: **Physical Pharmaceutics-II Practical**

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms

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	Determination of surface tension of given liquids by drop count and drop weight method
2	Determination of HLB number of a surfactant by saponification method
3	Determination of Freundlich and Langmuir constants using activated char coal
4	Determination of critical micellar concentration of surfactants
5	Determination of viscosity of liquid using Ostwald's viscometer
6	Determination sedimentation volume with effect of different suspending agent
7	Determination sedimentation volume with effect of different concentration of single suspending agent
8	Determination of viscosity of semisolid by using Brookfield viscometer
9	Determination of reaction rate constant first order.
10	Determination of reaction rate constant second order
11	Accelerated stability studies

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Reference Books:

1	Physical Pharmacy by Alfred Martin, Sixth edition
2	Experimental pharmaceutics by Eugene, Parott.
3	Tutorial pharmacy by Cooper and Gunn.
4	Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5	Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6	Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7	Physical Pharmaceutics by Ramasamy C, and Manavalan R
8	https://ich.org/

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Determine physicochemical properties of drugs and excipients	**35**
CO-2	Carry out stability studies of drug substance	**30**
CO-3	Determine flow property and derived properties of drugs and excipients	**35**

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CVM UNIVERSITY
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **IV**

Course Code: **108010414**

Course Title: **Pharmacology-I Practical**

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

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio 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	Introduction to experimental pharmacology.
2	Commonly used instruments in experimental pharmacology.
3	Study of common laboratory animals.
4	Maintenance of laboratory animals as per CPCSEA guidelines.
5	Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies
6	Study of different routes of drugs administration in mice/rats.
7	Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8	Effect of drugs on ciliary motility of frog oesophagus
9	Effect of drugs on rabbit eye.
10	Effects of skeletal muscle relaxants using rota-rod apparatus.
11	Effect of drugs on locomotor activity using actophotometer.
12	Anticonvulsant effect of drugs by MES and PTZ method.

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13	Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14	Study of anxiolytic activity of drugs using rats/mice.
15	Study of local anaesthetics by different methods

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	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	Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
6	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
7	K. D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
8	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher.
9	Screening methods in Pharmacology. N.S. Parmar Shiv Prakash, Narosa Publishing House
10	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
11	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan
12	Screening methods in Pharmacology. N.S. Parmar Shiv Prakash, Narosa Publishing House
13	Practical Pharmacology-I by Dr. R. K. Goyal & Dr. N. M. Patel, B. S. Shah Prakashan, Gujrat

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Summarize the common laboratory animal experimental techniques and CPCSEA guidelines.	**20**
CO-2	Learn skeletal muscle relaxants, locomotor and anticonvulsant activity by simulation.	**25**
CO-3	Demonstrate stereotype and anti-catatonic activity, anxiolytic activity, local anesthetics activity of drugs on rats or mice by simulation.	**55**

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