

Nirma University
Institute of Pharmacy
Teaching & Examination Scheme (B.Pharm)

Semester - IV

Sr. No.	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			L	LPW/PW	T	C	Duration		Component Weightage		
							SEE	LPW/PW	CE	LPW/PW	SEE
1	BP401T	Pharmaceutical Organic Chemistry III – Theory	3	-	1	4	3.0	-	0.25	-	0.75
2	BP402T	Medicinal Chemistry I – Theory	3	-	1	4	3.0	-	0.25	-	0.75
3	BP406P	Medicinal Chemistry I – Practical	-	4	-	2	-	4.0	0.30	0.70	-
4	BP403T	Physical Pharmaceutics II – Theory	3	-	1	4	3.0	-	0.25	-	0.75
5	BP407P	Physical Pharmaceutics II – Practical	-	4	-	2	-	4.0	0.30	0.70	-
6	BP404T	Pharmacology I – Theory	3	-	1	4	3.0	-	0.25	-	0.75
7	BP408P	Pharmacology I - Practical	-	4	-	2	-	4.0	0.30	0.70	-
8	BP405T	Pharmacognosy and Phytochemistry I - Theory	3	-	1	4	3.0	-	0.25	-	0.75
9	BP409P	Pharmacognosy and Phytochemistry I - Practical	-	4	-	2	-	4.0	0.30	0.70	-
Total			15	16	5	28					
			36								

L: Lectures, P/T: Practicals/Tutorial, C: Credits
 LPW: Laboratory / Project Work

SEE: Semester End Examination
 CE: Continuous Evaluation

w.e.f. academic year 2018-2019 and onwards

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NIRMA UNIVERSITY
Institute of Pharmacy
(B. Pharm)
(Semester - IV)

L	T	P	C
3	1	-	4

Course Code	BP401T
Course Title	Pharmaceutical Organic Chemistry III - Theory

Scope:

This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objective: At the end 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.

Course Learning Outcomes (CLO):

After successful completion of the course, student will be able to -

1. Remember IUPAC rules for nomenclature and medicinal uses of heterocyclic compounds.
2. Understand basic aspects of stereochemistry including configuration and conformation.
3. Explain various reactions of synthetic importance.
4. Describe important chemical reactions and synthesis of heterocyclic rings.
5. Discuss optical & geometrical isomerism.

Syllabus:

Teaching hours: 45 Hours

Note: To emphasize on definition, types, mechanisms, examples, uses/applications.

UNIT I

10 Hours

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.

UNIT II

10 Hours

Stereo isomerism

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 stereoselective reactions.

UNIT III

10 Hours

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.

UNIT IV

08 Hours

Heterocyclic compounds:

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.

UNIT V

07 Hours

Reactions of synthetic importance:

Metal hydride reduction (NaBH_4 and LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.
Oppenauer-oxidation and Dakin reaction.
Beckmann's rearrangement and Schmidt rearrangement.
Claisen-Schmidt condensation.

Tutorials

Teaching Hours: 15 Hours

Tutorials will be based on above syllabus.

Suggested Readings[^]:(Latest edition)

1. Morrison, R. T., Boyd, R. N. *Organic Chemistry*. Prentice Hall, Inc., USA.
2. Finar, I. L. *Organic Chemistry*, Vol. I & II, ELBS.
3. Gilchrist, T. L. *Heterocyclic chemistry*. New Delhi: Pearson.
4. Bahl, B. S. *Text Book Of Organic Chemistry*. S. Chand And Company Ltd Ram Nagar; New Delhi.
5. Bansal, R. K. *Heterocyclic chemistry*. New Age International.
6. March, J. *Advanced organic chemistry: reactions, mechanisms, and structure*. John Wiley & Sons,.
7. Solomons, T. W., Fryhle, C. B., & Johnson, R. G. *Organic chemistry*. New York: Wiley.
8. Vishnoi, N. K. *Advanced practical organic chemistry*. Vikas Publishing House Pvt. Limited.
9. Gurudeep, C. R., & Gurudeep, C. R. *Reaction Mechanism and Reagents in Organic Chemistry*. Bombay: Himalaya Publishing House.

L= Lecture, T= Tutorial, P= Practical, C= Credit

[^] this is not an exhaustive list

(B. Pharm)
(Semester - IV)

L	T	P	C
3	1	-	4

Course Code	BP402T
Course Title	Medicinal Chemistry I -Theory

Scope:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

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.

Course Learning Outcomes (CLO):

After successful completion of the course, student will be able to -

1. Understand the basic principles of medicinal chemistry.
2. Explain the fundamentals of drug metabolic pathways.
3. Describe classification, mechanism of action and uses of different class of drugs of ANS and CNS.
4. Discuss structure activity relationship studies of different class of drugs.
5. Report synthetic protocol of some drugs.

Syllabus:

Teaching hours: 45 Hours

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT I

10 Hours

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 stereochemical aspects.

10 Hours

UNIT II

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents:

Direct acting agents:

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*, Metipranolol, Atenolol, Betaxolol, Bisoprolol, Esmolol, Metoprolol, Labetalol, Carvedilol.

UNIT III

10 Hours

Drugs acting on Autonomic Nervous System

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, Isoflurophate, Echothiophate iodide, Parathion, 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, Biperiden hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT IV

08 Hours

Drugs acting on Central Nervous System

Sedatives and Hypnotics:

Benzodiazepines:

SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Clorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturates:

SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital.

Miscellaneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

Antipsychotics:

Phenothiazines:

SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazines:

Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluoro butyrophenones:

Haloperidol, Droperidol, Risperidone.

Beta amino ketones:

Molindone hydrochloride.

Benzamides:

Sulpiride.

Anticonvulsants:

SAR of Anticonvulsants, mechanism of anticonvulsant action

Barbiturates:

Phenobarbital, Metharbital.

Hydantoins:

Phenytoin*, Mephénytoin, Ethotoin

Oxazolidinediones:

Trimethadione, Paramethadione

Succinimides:

Phensuximide, Methsuximide, Ethosuximide*

Urea and monoacylureas:

Phenacemide, Carbamazepine*

Benzodiazepines:

Clonazepam

Miscellaneous:

Primidone, Valproic acid, Gabapentin, Felbamate

UNIT V

07 Hours

Drugs acting on Central Nervous System

General anesthetics:

Inhalation anesthetics:

Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbiturates:

Methohexital sodium*, Thiethylal 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, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartrate.

Narcotic antagonists:

Nalorphine hydrochloride, Levallorphan tartrate, Naloxone hydrochloride.

Anti-inflammatory agents:

Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus.

Suggested Readings[^]: (Latest edition)

1. Wilson, C. O., Beale, J. M., & Block, J. H. *Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry*. Lippincott Williams & Wilkins.
2. Foye, W. O. *Foye's principles of medicinal chemistry*. Lippincott Williams & Wilkins.
3. Burger, A., & Abraham, D. J. *Burger's medicinal chemistry and drug discovery* (Vol. I-IV). Wiley.
4. Smith, H. J., & Williams, H. *Introduction to the principles of Drug design*. Elsevier.
5. Remington, J. P. *Remington: the science and practice of pharmacy* (Vol. 1 & 2). Lippincott Williams & Wilkins.
6. Reynolds, J. E. F., *Martindale: the extra pharmacopoeia*. Pharmaceutical Press, London.
7. Finar, I. L. *Organic Chemistry, Volume 2: Stereochemistry And The Chemistry Natural Product*, Pearson Education India.
8. Lednicer, D. *The organic chemistry of drug synthesis* (Vol. 1-5). John Wiley & Sons.
9. Indian pharmacopoeia, Indian Pharmacopoeial Commission.
10. Furniss, B. S. *Vogel's textbook of practical organic chemistry*. Pearson Education India.

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(B. Pharm)
(Semester - IV)

L	T	P	C
-	-	4	2

Course Code	BP406P
Course Title	Medicinal Chemistry I - Practical

Syllabus:

Teaching hours: 60 Hours

I. Preparation of drugs/ 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

II. Assay of drugs:

1. Chlorpromazine
2. Phenobarbitone
3. Atropine
4. Ibuprofen
5. Aspirin
6. Furosemide

III. Determination of Partition coefficient for any two drugs

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(B. Pharm.)
(Semester - IV)

L	T	P	C
3	1	-	4

Course Code	BP403T
Course Title	Physical Pharmaceutics II – Theory

Scope:

The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives:

Upon completion of the course the student should 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.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand physicochemical properties of solids and dispersed systems.
2. Discuss colloidal dispersion systems in designing formulations.
3. Describe rheological behavior of various compounds and its measurement by viscometers.
4. Determine coarse dispersion systems, its properties and stability.
5. Explain particle properties and its impact on various parameters.
6. Identify various conditions for stability testing.

Syllabus:

Teaching hours: 45 Hours

UNIT I

05 Hours

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.

UNIT II

10 Hours

Rheology:

Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian

systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers.

Deformation of solids:

Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.

UNIT – III

10 Hours

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.

UNIT – IV

10 Hours

Micromeritics:

Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT – V

10 Hours

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.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings[^]: (Latest edition)

1. Sinko, P. J., & Martin, A. N. *Martin's physical pharmacy and pharmaceutical sciences: Physical chemical and biopharmaceutical principles in the pharmaceutical sciences*. Philadelphia: Lippincott Williams & Wilkins.
2. Parrott, E.L. *Experimental Pharmaceutics*. Burgess Pub. Co
3. Cooper, J.W., Gunn, C., & Carter S.J. *Cooper and Gunn's tutorial pharmacy*. London: Pitman Medical.
4. Stocklosa, M.J., & Ansel, H.C. *Pharmaceutical calculations*. Philadelphia: Lea & Febiger.
5. Lieberman, H.A., Lachman, L., & Schwartz, J.B. *Pharmaceutical Dosage forms - Tablets*, volume 1 to 3. New York: Marcel Dekkar Inc.
6. Lieberman, H.A, Rieger, M.M., & Banker, G.S. *Pharmaceutical dosage forms - Disperse systems*, volume 1 to 3. New York: Marcel Dekkar Inc.
7. Ramasamy, C., & Manavalan, R. *Physical Pharmaceutics*. India: Vignesh Publisher

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(B. Pharm.)
(Semester - IV)

L	T	P	C
-	-	4	2

Course Code	BP407P
Course Title	Physical Pharmaceutics II - Practical

Syllabus:

Total hours: 60 Hours

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using Microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
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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(B. Pharm)
(Semester - IV)

L	T	P	C
3	1	-	4

Course Code	BP404T
Course Title	Pharmacology I – Theory

Scope:

The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Objectives:

Upon completion of this course the student should be able to -

w.e.f. academic year 2018-19 and onwards

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.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand general concepts of pharmacology, adverse drug reactions, drug interactions, drug discovery and clinical evaluation of drugs.
2. Relate pharmacodynamics principles of drugs with mechanism of action.
3. Describe pharmacokinetics of drugs with respect to absorption, distribution, metabolism and elimination.
4. Discuss pharmacology of drugs acting on peripheral nervous system.
5. Explain pharmacology of drugs acting on central nervous system.
6. Apply their skills of handling of instruments, animals and softwares for studying pharmacological effects of the drugs.

Syllabus:

Teaching hours: 45 Hours

UNIT I

08 Hours

General Pharmacology:

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.

Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination.

UNIT II

12 Hours

General Pharmacology:

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.

Adverse drug reactions.

Drug interactions (pharmacokinetic and pharmacodynamic).

Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

UNIT III

10 Hours

Pharmacology of drugs acting on peripheral nervous system:

Organization and function of ANS.

Neurohumoral transmission, co-transmission and classification of neurotransmitters.

Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics.

Neuromuscular blocking agents and skeletal muscle relaxants (peripheral), ganglion stimulants and blockers.

Local anesthetic agents.

Drugs used in myasthenia gravis and glaucoma.

UNIT IV

08 Hours

Pharmacology of drugs acting on central nervous system:

Neurohumoral transmission in the CNS. Special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.

General anesthetics and pre-anesthetics.

Sedatives, hypnotics and centrally acting muscle relaxants.

Anti-epileptics.

Alcohol and disulfiram.

UNIT V

07 Hours

Pharmacology of drugs acting on central nervous system:

Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.

Drugs used in Parkinson's disease and Alzheimer's disease.

CNS stimulants and nootropics.

Opioid analgesics and antagonists.

Drug addiction, drug abuse, tolerance and dependence.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings[^]: (Latest Edition)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology. New York, Churchill Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and Clinical Pharmacology. New Delhi, Tata Mc Graw-Hill
3. Brunton L., Chabner B.A., Knollman B. Goodman and Gillman's The Pharmacological Basis of Therapeutics. USA, McGraw Hill Education.
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. USA, The Point Lippincott Williams & Wilkins
5. Harvey R.A., Clark M.A., Finkel R., Rey J.A., Whalen K. Pharmacology (Lippincott's Illustrated Reviews). New Jersey, Lippincott Williams and Wilkins
6. Tripathi K.D. Essentials of Medical Pharmacology. New Delhi, Jaypee Brothers Medical Publishers (P) Ltd.
7. Sharma H. L., Sharma K. K. Principles of Pharmacology. New Delhi, Paras Medical Publisher
8. Craig C.R. Stitzel R. E. Modern Pharmacology with Clinical Applications. Lippincott Williams & Wilkins

w.e.f. academic year 2018-19 and onwards

9. Ghosh MN. Fundamentals of Experimental Pharmacology. Kolkata. Hilton & Company.
10. Kulkarni SK. Handbook of Experimental Pharmacology. New Delhi. Vallabh Prakashan
11. Goyal R.K., Mehta A.A., Balaraman R., Burande M.D. Dearsari and Gandhi's Elements of Pharmacology. Ahmedabad, B.S. Shah Prakashan.

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(B. Pharm)
(Semester - IV)

L	T	P	C
-	-	4	2

Course Code	BP408P
Course Title	Pharmacology I – Practical

Syllabus:

Total Hours: 60 Hours

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
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 anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

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(B. Pharm)
(Semester - IV)

L	T	P	C
3	1	-	4

Course Code	BP405T
Course Title	Pharmacognosy and Phytochemistry I - Theory

Scope:

The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives:

Upon completion of the course the student shall be able to-

1. Know the techniques in the cultivation and production of crude drugs.
2. Know the crude drugs, their uses and chemical nature.
3. Know the evaluation techniques for the herbal drugs.
4. Carry out the microscopic and morphological evaluation of crude drugs.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the history and scope of pharmacognosy, various sources of crude drugs and their classification.
2. Describe various aspects of cultivation, collection, processing and storage of herbal drugs.
3. Discuss the technique and applications of plant tissue culture.
4. Explain the role of pharmacognosy in various systems of traditional medicine and classify secondary metabolites.
5. Express the pharmacognostic study of some crude drugs belonging to category of carbohydrates, proteins, lipids, fibres and marine drugs.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

Introduction to Pharmacognosy:

Definition, history, scope and development of Pharmacognosy.

Sources of Drugs – Plants, Animals, Marine & Tissue culture.

Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and serotaxonomical classification of drugs.

w.e.f. academic year 2018-19 and onwards

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT II**10 Hours****Cultivation, Collection, Processing and storage of drugs of natural origin:**

Cultivation and Collection of drugs of natural origin.

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants.

Conservation of medicinal plants.

UNIT III**07 Hours****Plant tissue culture:**

Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy.

Edible vaccines.

UNIT IV**10 Hours****Pharmacognosy in various systems of medicine:**

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins.

UNIT V**08 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs.

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or medicines for the following primary metabolites:

Carbohydrates:

Acacia, Agar, Tragacanth, Honey.

Proteins and Enzymes:

Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils) :

Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax.

Marine Drugs:

Novel medicinal agents from marine sources.

Tutorials**Teaching hours: 15 Hours**

Tutorials will be based on above syllabus

Suggested Readings^: (Latest Edition)

1. Evans, W.C. *Trease and Evans Pharmacognosy*. London, W.B. Saunders & Co.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E. *Pharmacognosy*. Philadelphia, Lea and Febiger.
3. Wallis, T.E. *Text Book of Pharmacognosy*. London. J&A Churchill Ltd.
4. Ali, M. *Pharmacognosy and Phytochemistry*. New Delhi, CBS Publishers & Distribution.
5. Kokate, C.K. *Text Book of Pharmacognosy*. New Delhi, Nirali Prakashan.
6. Chaudhary, R..D. *Herbal Drug Industry*. New Delhi, Eastern Publisher.
7. Ansari, S.H. *Essentials of Pharmacognosy*. New Delhi. Birla Publications.
8. Kokate, C.K., Gokhale S.B. *Practical Pharmacognosy*. Pune, Nirali Prakashan.
9. Iyengar, M.A., Nayak, S.G. *Anatomy of Crude Drugs*. Career Publications.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

**(B. Pharm)
(Semester - IV)**

L	T	P	C
-	-	4	2

Course Code	BP409P
Course Title	Pharmacognosy and Phytochemistry I - Practical

Syllabus:**Teaching hours: 60 Hours**

1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) Starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming index

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