

Department of Pharmaceutical Sciences
Saurashtra University, Rajkot
Master of Pharmacy Management (MPM) syllabus scheme
From Batch 2016 - 2017

Semester - 5

No.	Name of the subject	Code of the subject	Credits			Maximum Marks				Minimum Passing standards				
			Theory	Theory (Hrs./credits)	Practical (Hrs./credits)	Total	Theory		Practical		Theory		Practical	
							External	Internal	External	Internal	External	Internal	External	Internal
1	Pharmaceutical Microbiology I	1612010701050100	03	03	06	80	20	80	20	32	08	32	08	
2	Pharmaceutical Chemistry-V (Biochemistry-II)	1612020701050200	03	--	03	80	20	---	---	32	08	---	---	
3	Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)	1612030701050300	03	03	06	80	20	80	20	32	08	32	08	
4	Pharmaceutical Analysis - III	1612040701050400	03	03	06	80	20	80	20	32	08	32	08	
5	Pharmacology - II	1612050701050500	03	03	06	80	20	80	20	32	08	32	08	
6	Pharmacognosy-IV	1612060701050600	03	03	06	80	20	80	20	32	08	32	08	
7	Pharmaceutical Marketing and drug store management	1612070701050700	03	--	03	80	20	---	---	32	08	---	---	
TOTAL CREDITS					36	560	140	400	100	224	56	160	40	
TOTAL MARKS					1200					480				

Semester – V
PHARMACEUTICAL MICROBIOLOGY - I
Subject code: 1612010701050100
Theory (3 Hours / Week; 3 Credits, 45 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
3	0	3	6	80	20	80	20

Course Objectives

- This course deals with the various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance.
- To study the microbial growth including microscopy and staining techniques for identification of microorganisms.
- To study the various microbial growth controlling techniques and various other tests used for detection of microorganisms.

Students Learning Outcome

Upon completion of the subject student shall be able to –

- Understand about the growth cycle of microorganisms including effects of various chemical agents on their growth and various staining techniques used for identification of microorganisms by using microscope.
- Describe the various methods used for controlling the growth of microorganisms in various fields of pharmaceutical industries.
- Describe various tests for detection of presence of microorganisms in sterile and non-sterile dosage forms.
- do cultivation and identification of the microorganisms in the laboratory
- Appreciate the behavior of motility and behavioral characteristics of microorganisms.

Sr. No	Course Contents	Total Hrs.
1	Introduction to Microbiology: Scope and applications to pharmaceuticals, Whittaker's five kingdom concept, classification of microbes into bacteria, rickettsia, actinomycetes, fungi, protozoa, algae and viruses. Historical developments- contributions of Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch and Paul Ehrlich	03
2	General microbiology a) Microscopy Principle and applications of compound, Dark- field, phase contrast and	15

	<p>fluorescence microscope. Different parts of compound microscope, resolving power, magnification power, numerical aperture and working distance. Electron microscopy-SEM and TEM</p> <p>b) General Structure Structure of bacterial cell, Prokaryotic and Eukaryotic Cell</p> <p>c) Structure and Taxonomy of Actinomycetes, Bacteria, Spirochetes, Rickettsia and Viruses, fungus with emphasis on pathogenic and pharmacological importance.</p> <p>d) Identification of microbes Staining Techniques</p> <p>e) Nutritional requirements</p> <ul style="list-style-type: none"> ➤ Nutrition requirements, Growth curve ➤ Introduction to various nutritional media, ➤ Cultivation and Isolation of bacteria, virus and fungus <p>f) Bacterial count techniques</p>	
3	<p>Control of microbes in pharmaceutical industry</p> <p>a. Disinfection:</p> <ul style="list-style-type: none"> ➤ Classification, mode of actions and Factor affecting Disinfection ➤ Dynamics of Disinfection ➤ Evaluation of Disinfection <p>b. Sterilization:</p> <ul style="list-style-type: none"> ➤ Introduction, significance, sensitivity of microorganisms, ➤ Detailed methods for sterilization processes. ➤ Sterilization control and sterility assurance. 	12
4	<p>Aseptic Techniques: Designing of aseptic area, sources of contamination in aseptic area, and methods of prevention, laminar air flow.</p> <p>Sterility testing of pharmaceutical products Importance, objectives, methodology as per pharmacopoeial standards, evaluation tests</p>	07
5	Microbiological assays of antibiotics, vitamins, amino acids etc.	05
6	Microbial limit tests for Pharmaceutical dosage forms as per IP	03

Semester – V
PHARMACEUTICAL MICROBIOLOGY I
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Aim of the experiment
1	To study the principle and working of microbiology laboratory equipment.

2	Preparation and sterilization of nutrient broth, nutrient agar, slants, stabs and plates.
3	To study different techniques of Inoculation of cultures.
4	A. Isolation of pure culture by streak plate technique. B. Isolation of pure culture by pour plate technique.
5	Study of Aspergillus, Penicillium and Candida species with respect to morphology (wet mount technique)
6	Observation of motility of bacteria by hanging drop technique.
7	To Observe Oligodynamic effect of metal on growth of micro-organisms.
8	Cultivation of anaerobes by stab method.
9	Identification of isolated bacteria by simple, Gram, acid fast and spore Staining.
10	Evaluation of Disinfectant by (a) agar cup method (b) Filter paper disc method.
11	Study of effect of UV light on growth of micro-organisms.
12	Determination of phenol coefficient of given disinfectant by Riedal Walker test.
13	A. To Perform sterility testing of absorbent cotton gauze. B. To Perform sterility testing of ampoules and vials having water for injection. C. To Perform sterility testing of soluble powders.
14	Estimation of potency of given antibiotic (streptomycin) by microbial assay (One & Two level fractional assay).
15	A. To Perform the spirochetes staining by negative staining method and Fontana's method. B. To Determine the viable count of micro-organisms by using Petri plate method.
16	Study of microbial limits of following as per I.P. a. Aluminum hydroxide gel. b. Starch.

Note: Any other practical related to theory topic can be carried out.

References Books

- 1) Pharmaceutical Microbiology, Edited by W.B. Hugo and A.D. Rusell Blackwell Science, United Kingdom.
- 2) Microbiology an Inroduction, G. J. Tortora, B. R. Funke, Pearson Education, New Delhi.
- 3) Textbook of Microbiology, C. K. J. Paniker, Orient Longman PVT LTD., India.
- 4) Microbiology, Prescott L. M., McGraw Hill, Columbus.
- 5) Industrial Microbiology, L. E. Casida, JR., New Age International Publishers, India.
- 6) Microbiology, M. J. Pelczar, JR., E.C.S. Chan and N. R. Krieg, Tata McGraw-Hill, Inc.,New York.
- 7) Fundamental Principles of Bacteriology. A.J. Sale, Tata McGraw-Hill Publishers Company Ltd., New York.
- 8) General Microbiology, Stanier R. Y., Machillan Press Ltd., Hampshire.
- 9) Microbiology A Laboratory Manual, J. G. Cappuccino, Pearson Education, New Delhi.
- 10) Remington: The Science and Practice of Pharmacy, Vol I & II, Gennaro Alfonso R., Lippincott Williams & Wilkins, New York.

- 11) Pharmaceutical Microbiology, AshutoshKar, New Age International publishers, New Delhi.
- 12) Indian Pharmacopoeia (Latest Edition), Indian Pharmacopoeial Commission, Ghaziabad.
- 13) Bentley's Text Book of Pharmaceutics, Edited by E. A. Rawlins, Bailliere Tindall, United Kingdom.

Semester – V
PHARMACEUTICAL CHEMISTRY-V (BIOCHEMISTRY – II)
Subject code: 1612020701050200

Theory (3 Hours / Week; 3 Credits, 45 Hours)

Teaching Scheme				Evaluation Scheme	
Theory	Tutorial	Practical	Total	Theory	
				External	Internal
3	0	0	3	80	20

Course Objectives

- Introduce students to Bio-Chemistry with emphasis on basic biological chemistry with respect to bio molecules like Protein, DNA, RNA, Nucleic acid etc.
- Cover areas including Biosynthesis of bio-molecules, Metabolism, Catabolism, Protein synthesis, Formation of bile pigments and Purine and Pyrimidine synthesis etc
- Genetic code and gene expression, brief over view of genetic engineering, PCR and its application.
- Study of energy, equilibrium constant, bioenergetics, ATP production and its biological role.

Students Learning Outcomes:

- The curriculum of the Department is designed to satisfy the diverse needs of students. Advanced coursework and educational activities outside the traditional classroom. At graduation, chemistry majors should have a set of fundamental competencies that are knowledge-based, performance/skills-based, and affective.
- Graduates will be able to solve problems competently by identifying the essential parts of a problem and formulating a strategy for solving the problem. They will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.

Sr. No.	Course Contents	Hrs
1.	Detailed chemistry of Proteins and nucleic acid	08
2.	Metabolism of ammonia and nitrogen containing monomers: nitrogen balance, biosynthesis of amino acids, catabolism of amino acids, conversion of amino acids to specialized products. Assimilation of ammonia, urea cycle. Metabolic disorders of urea cycle, metabolism of sulphur containing amino acids, porphyrin biosynthesis, formation of bile pigments, hyperbilirubinemia, purine biosynthesis, purine nucleotide interconversion, pyridine biosynthesis	12

3.	Biosynthesis of nucleic acids. Brief introduction of genetic organization of the mammalian genome, alteration and rearrangement of genetic material, biosynthesis of DNA and its replication, DNA repair mechanism, biosynthesis of RNA	05
4.	Genetic code and protein synthesis: genetic code, components of protein synthesis and inhibition of protein synthesis. Brief account of genetic engineering and polymerase chain reactions	05
5.	Regulation of gene expression	02
6.	The Concept of free energy, Determination of Change in free energy from Equilibrium Constant and Reduction Potential, Bioenergetics, Production of ATP and its Biological Significance	02
7.	Biological oxidation, enzymes and co-enzymes involved in oxidation reduction and its control. The respiratory chain, its role in energy capture and its control, energetic of oxidative phosphorylation, inhibitors of respiratory chain and oxidative phosphorylation, mechanism of oxidative phosphorylation	08
8.	Techniques used in biochemistry: spectrophotometry, centrifugation, electrophoresis, chromatography, extraction and purification of proteins and nucleic acids	03

Books Recommended (Latest Editions):

1. U.Satyanarayan, Biochemistry, Books and allied (P) ltd. Calcutta, latest edn
2. A. L. Lehninger, Principles of biochemistry, CBS Publishers and Distributors.
3. R. K. Murray, D. K. Granner, P. A. Mayes. V.W. Rodwell, Harpers Biochemistry, Prentice hall International Inc. latest edn.
4. S. C. Rastogi, Biochemistry, Tata McGraw Hill New delhi, Latest edn.
5. M.Cohn, K.S. Roth, Biochemistry and Disease. William and Wilkins co. Baltimore, Latest edn.
6. G. F. Zubay, W. W. Parson, D. E. Vance, Principles of Biochemistry, WCB Publishers, England, latest edn.
7. S. Ramkrishnan, K. G. Prasannan, R. Rajan. Textbook of medical Biochemistry, Orient Longman Madras, Latest edn.
8. S.K. Sawhney, Randir Singh Eds, Introductory practical Biochemistry, Narosa Publishing house New Delhi.
9. G. T. Mills, G. Leaf Practical Biochemistry, John Smith and Son Ltd
10. E. E. Conn and P. K. Stumpf, Outlines of biochemistry, John Wiley and Sons, New York.

Semester – V
Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)
Subject code: 1612030701050300
Theory (3 Hours / Week; 3 Credits, 45 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
03	00	03	06	08	20	80	20

Course Objective

- Medicinal chemistry-I will provide the sound knowledge about basic principles of medicinal chemistry like development of various drugs on various basis, Nature and Property of various class of drugs, influence of these property on biological activity/potency, basic about receptors, their sites and interaction of same with different drugs, to study stereochemical aspect of drugs, study of importance, property, and detail study about the drugs and their effect on autonomic system, and autocooids.

Students Learning Outcome

- Know the basic concepts of medicinal chemistry, its scope and various branches.
- Know the mechanism of action and effects of drugs on various organs of the body.
- To study about chemistry of individual drug molecule.
- To study about drug interactions and adverse effects.
- To study in detail about the SAR (structure activity relationship) of different classes of drugs.
- Know about the development of new drug.
- To study separation techniques (physical and chemical) of mixture component and identification methods of the same.

Sr. No.	Course Contents	Total Hrs.
1.	An introduction to the subject of medicinal chemistry History and development of branch medicinal chemistry. Application of medicinal chemistry in pharmacy.	02
2.	Physiochemical properties of drug molecules influencing biological	06

	<p>activity</p> <p>A. Solubility, Partition coefficient, Hydrogen bonding, Complexation, Ionization, Redox potential, Surface activity and protein binding</p> <p>B. Stereochemical features of drugs: Geometric and Optical isomers, Bioisosterism</p>	
3.	<p>Receptors and Drug action:</p> <p>A. Types of receptors</p> <p>B. Theory of receptors</p> <p>C. Drug-receptor interaction and factors affecting it</p>	03
4.	<p>Introduction, history, classification, nomenclature, mechanism of action, adverse effects, therapeutic uses, structure activity relationship (SAR) and synthetic procedures of selected drugs and recent developments of following categories to be covered. (Synthesis of drugs mentioned in each category)</p> <p>Drugs acting on ANS</p> <p>A. Cholinergics: SAR- Acetylcholine mimetics- Muscarinic agonists</p> <p>B. Anticholinergics: SAR:- Acetylcholine Antagonists- Muscarinic antagonists Synthesis of Neostigmine, Dicyclomine hydrochloride</p> <p>C. Adrenergics: SAR:- Phenylethanolamines</p> <p>Synthesis of Adrenaline, Dopamine, Isoprenaline, Ephedrine</p> <p>D. Adrenergic antagonists: Synthesis of Naphazoline, Salbutamol</p> <p>E. Neuromuscular blocking agents and ganglionic blockers:</p> <p>I. Ganglion blocking agents: trimethaphan, camsylate, mecamlamine</p> <p>II. Neuromuscular blocking agents: tubocurarine, gallamine, triethiodide, succinyl choline chloride</p>	12
5.	<p>Autocoids</p> <p>A. Histamines and anti-histamines: Histamine receptors, H1 antagonists, H2 antagonists (histamines, diphenhydramine, tripelemine, chlorcyclizine, trimeprazine, chlorpheniramine, promethazine,</p>	10

	<p>cyproheptadiene, antazoline, cetirizine)</p> <p>B. Eicosanoids: History and discovery, eicosanoids biosynthesis, drug action mediated by eicosanoids, eicosanoids approved for human clinical use.</p>	
6.	<p>Drugs acting on respiratory tract</p> <ul style="list-style-type: none"> i. Anti-asthmatics ii. Expectorants iii. Anti-tussive agents iv. Respiratory stimulants v. Mucolytics vi. Decongestants 	05
7.	<p>Drugs acting on gastrointestinal tract</p> <ul style="list-style-type: none"> i. Antacids ii. Anti-secretary (Ranitidine) iii. Proton pump inhibitors (Omeprazole) iv. Anti-emetics v. Anti-diarrheals vi. Laxatives vii. Prokinetics viii. Antispasmodics and drug modifying intestinal motility ix. Drugs for irritable bowel syndrome x. Local colorectal preparations xi. Enzymes, carminatives and hepatobiliary preparations 	07

Semester – V
Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Content	No. of practical hours
A	<p>Separation and qualitative analysis of Organic binary mixtures containing having salt, acidic, phenolic, amphoteric, basic and neutral nature (Solid + Solid (Solid), Solid + Solid (Eutectic)) with derivative preparations.</p> <p>1. Salts (sodium benzoate, Sodium salicylate etc.)</p> <p>2. Acids (Benzoic acid, salicylic acid, cinnamic acid, acetyl salicylic acid etc.)</p> <p>3. Phenols (α-Naphthol, β-Naphthol, o/m/p-nitrophenol etc.)</p> <p>4. Strong acidic amphoteric (P-amino benzoic acid, o-amino benzoic acid, sulphanilic acid etc.) and weak acidic amphoteric (Sulphanilamide etc.)</p> <p>5. Bases (α-Naphthylamine, p-anisidine, diphenyl amine, o/m/p-nitroaniline etc.)</p> <p>6. Neutrals (Benzophenone, m-dinitrobenzene, acetanilide, benzamide, naphthalene etc.)</p>	30
1	Separation and qualitative analysis of organic binary mixture	
2	Separation and qualitative analysis of organic binary mixture	
3	Separation and qualitative analysis of organic binary mixture	
4	Separation and qualitative analysis of organic binary mixture	
5	Separation and qualitative analysis of organic binary mixture	
6	Separation and qualitative analysis of organic binary mixture	
7	Separation and qualitative analysis of organic binary mixture	
8	Separation and qualitative analysis of organic binary mixture	
9	Separation and qualitative analysis of organic binary mixture	
10	Separation and qualitative analysis of organic binary mixture	

B	Synthesis of some organic compounds including some heterocyclic compounds:	12
11	Benzimidazole from o-phenylenediamine	
12	2-phenylindole from phenyl hydrazine	
13	Methyl orange from sulphanilic acid	
14	9,10dihydroanthracene-9,10-endo- α,β -succinic anhydride from anthracene (Diels-Alder Reaction)	
15	Workshops on stereo models using some selected drugs	03

Text Books:

1. Foe's principles of medicinal chemistry. David A. Williams & Thomas L. Lemke. Lippincott Williams & Wilkins.
2. Wilson and Griswold's textbook of organic medicinal and Pharmaceutical Chemistry, John H. Block and John M. Beale, Jr.. Lippincott Williams & Wilkins.

Reference Books:

1. Harkishan Singh and V.K Kapoor – text book of medicinal chemistry.
2. Medicinal chemistry by ashutoshkar
3. Principles of medicinal chemistry by kadam and bothara
4. Experimental organic and medicinal chemistry by biren n., shah. S. vikas.
5. Practical organic chemistry, Hitesh G. Raval, Sunil L. Baldania, Dimal A. Shah, Nirav and Roopal Prakashan.
6. Burger's Medicinal Chemistry and Drug Discovery, Donald j Abraham, Wiley interscience.
7. Vogel's text book of practical organic chemistry.
8. Practical organic chemistry by F.G Mann and Saundars

Semester – V
PHARMACEUTICAL ANALYSIS-III
Subject Code: 1612040701050400
Theory (3 Hours / Week; 3 Credits, 45 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
3	0	3	6	80	20	80	20

Course Objectives

- Introduce students to different spectroscopic methods with emphasis on its application in quality control and quality assurance.
- Cover areas including fundamental spectroscopy, UV-Visible, IR, Fluorescence, Atomic absorption and emission, Raman spectroscopy. Principles of turbidometry and Nephelometry techniques.

Students Learning Outcomes:

- To demonstrate an understanding of the theory and applications of the most basic spectroscopic methods used in pharmaceutical analysis.
- Learn the practical aspects and importance of quantitative and qualitative analysis of different drugs, pharmaceuticals and compounds involving various spectroscopic techniques.

Sr. No.	Course Contents	Hrs
1	<p>Fundamentals of Spectroscopy</p> <p>Classification of spectra, Wave properties of electromagnetic radiation, Particle/photon properties Electromagnetic radiation, Electromagnetic spectrum.</p>	06
2	<p>UV-VIS spectroscopy</p> <p>Theory; Beer and Lambert's law - limitations and deviations from the law; Terminologies associated with absorption measurements; Types of transitions; Factors affecting spectral characteristics (structural and nonstructural); Effect of conjugation; Wood ward Fieser rule; Photometric titrations; Instrumentation, applications (in analysis of organic compounds and inorganic complexes), advantages and limitations of UV Visible spectroscopy; Quantitative analysis of binary mixtures of absorbing substances by simultaneous equation method;</p>	11

	Calibration of UV Visible Spectrophotometer as per Pharmacopoeia.	
3	IR spectroscopy Theory of absorption of Infrared radiation by molecules; Molecular vibrations; Factors influencing vibrational frequencies; Calculation of vibrational frequencies (Hooke's law); Sample handling techniques; Instrumentation (Dispersion and FTIR spectrometer) and applications of IR Spectroscopy; Calibration of IR spectrophotometer as per Pharmacopoeia	08
4	Fluorescence spectroscopy Introduction: luminescence, photoluminescence; Theory of Fluorescence and Phosphorescence; Jablonski diagram; Factors affecting fluorescence intensity (structural and nonstructural); Instrumentation, applications, advantages and limitations of fluorescence spectroscopy.	05
5	Atomic absorption and emission spectroscopy Theory, Principle, instrumentation and applications of Flame photometry. Basics of atomic spectroscopy; Principle of atomic absorption and atomic emission spectroscopy; Interferences in atomic spectroscopy; Factors affecting atomic spectroscopy like solvents, buffers, other ions, etc; Flame Photometry; Atomic emission spectroscopy with plasma and electrical discharge sources; Instrumentation (including radiation sources like hollow cathode lamp), applications, advantages and limitations of atomic absorption and atomic emission spectroscopy.	09
6	Overview of scattering Spectroscopy like Raman spectroscopy, Nephelometry and Turbidimetry	06

Semester – V
Pharmaceutical Analysis- III
Practical (03 Hours/ Week; 03 Credits, 45 Hours)

Sr. No.	Practical Contents
1	Calibration of UV spectrophotometer.
2	Determination of λ_{max} , $A(1cm 1\%)$, Detection-Quantitation Limit and preparation of calibration curve (Verification of Beer's law) for any drug by UV-visible spectrophotometer.
3	Determination of the dissociation constant of indicator/ stability constant of complex.
4	Determination of isosbestic point/ pK_a of indicator.

5	Experiments on Spectrophotometric estimation of drugs in marketed formulations.
6	Experiments on Fluorimetric estimation of drugs.
7	Experiments on Colorimetric assay of colored drug & non-colored drug.
8	Experiments based on flame photometry.
9	Identification of API by IR spectrum.
10	Experiments based on principle of turbidometry and nephelometry.
11	Exercise on structure elucidation of simple organic compounds using UV and IR.

Books Recommended (Latest Editions):

1. Instrumental Methods of Analysis - Scoog and West.
2. Spectrometric Identification of Organic Compounds - Silverstein et., al.
3. Instrumental Method of Analysis - Willard Dean & Merrit.
4. Pharmaceutical Chemistry Vol. I & Vol. II — Becket and Stanlake
5. Pharmaceutical Analysis — Hiquchi, Bechmman, Hassan.
6. Pharmaceutical Analysis — Modern methods — Part A and B — Munson James. W.
7. Quantitative Analysis of Drugs — Garrot.
8. Quantitative Analysis of Drugs in Pharmaceutical Formulations — P. D. Sethi.
9. Application of Absorption Spectroscopy of Organic Compounds — Dyer.
10. Analytical Profiles of Drug Substances — Florey [Volume 13].
11. Spectroscopy of Organic Compound - P. 5. Kalsi, Wiely Eastern Ltd., New Delhi.
12. Absorption Spectroscopy of Organic Molecules — V. M. Parikh, Addision — Wesley Publishing Company, London.

Semester – V
PHARMACOLOGY - II
Subject code:1612050701050500
Theory (3 Hours / Week; 3 Credits, 45 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
3	0	3	6	80	20	80	20

Course Objectives

- This course is designed to provide basic instruction in the principles of pharmacology and the course will emphasize on mechanisms of drug action, adverse reactions, dose and uses of drugs in the **Therapy of Cardiovascular Disorders, Neurological Disorders, Psychiatric Disorders**, Drugs affecting Blood and blood formation and kidney. This content will provide students a knowledge with a comprehensive introduction to the fundamental Pharmacology and uses of the major classes of clinically important drugs currently used in medical practice of above diseases.

Students Learning Outcome

- At the end of the course, students will be able to understand the fundamental scientific principles of drug action, mechanisms of action, pharmacokinetics date (absorption, distribution, metabolism and elimination of drugs in the body), different dosing regimens of drugs useful in **Cardiovascular Disorders, Neurological Disorders, Psychiatric Disorders, Blood related disorders and kidney diseases**.

Etiology & Pathophysiology of following disease/disorders and pharmacology of drugs (mechanism of action, ADME, therapeutics use, and adverse effects, toxicity and possible drug interaction) of the following catagories:

Sr. No.	Course Contents	Total Hrs
1	Unit I: Cardiovascular Disorders: Drugs acting on Renin Angiotensin System and plasma kinins, Congestive Cardiac Failure, Coronary Heart Diseases, Hypertension, Arrhythmias, Angina, hyperlipidemia and atherosclerosis	15
2	Unit IIA: Drugs Acting on Central Nervous System: General Anaesthetics, Ethyl & Methyl Alcohols, Sedatives and Hypnotics, Opioid analgesics and antagonists, CNS stimulants and cognition enhancers	09
3	Unit IIB: Neurological Disorders: Epilepsy, Parkinson's disease, Migraine.	06

4	Unit III: Psychiatric Disorders: Anxiety, Depression, Mania, Schizophrenia, Alzheimer's disease	07
5	Unit IV: Miscellaneous A. Drugs affecting Blood and blood formation: Haematinics and erthropoietin, drugs affecting coagulation, bleeding and thrombosis, hypolipidemic drugs and plasma expanders, B. Drugs acting on Kidney: Diuretics, Antidiuretics, Benign Prostate Hypertrophy, Renal failure C. Gastrointestinal Tract disorders: Drugs for Peptic Ulcer, Emesis, Constipation, Diarrhea, Gastro Esophageal Reflex Disorder (GERD)	08

References Books: (Latest Edition):

1. Tripathi KD, Essentials of Medical Pharmacology, Jaypee Brothers.
2. Satoskar R.S., Bhandarkar S.D. and Rege N.N., Pharmacology and Pharmacotherapeutics, Popular Prakashan Pvt Ltd.
3. HP Rang, MM Dale, Pharmacology, Elsevier Sciences
4. Katzung, B.G., Basic and clinical pharmacology, Prentice Hall, Int.,
5. Goodman and Gilman, Pharmacological Basis of Therapeutics, Mcgraw Hill Publishing
6. Joseph T. Dipiro, Pharmacotherapy-A Pathophysiological Approach.
7. F.S. Barar, Essentials of Pharmacotherapeutics
8. Sharma H.L. and Sharma K.K., Principles of Pharmacology, Paras Medical.
9. Paul L. Munson, Principles of Pharmacology
10. Golan David E, Principles of Pharmacology, The Pathophysiologic Basic.
11. Lewis's Pharmacology – James Crossland – Churchil Livingston
12. Craig, Charles R., Modern Pharmacology with Clinical Applications
13. Chaudhary S.K., Quintessence of Medical Pharmacology, Central Book Agency Pvt. Ltd.

Semester – V

Pharmacology - II

Practicals (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Practicals
1	To find out Nature of Unknown Drugs (Acetylcholine , Histamine, Bacl ₂ , Physostigmine, Atropine , Mepyramine and Papaverine) using Rat/Guinea Pig/Chicken Ileum Preparation
2	To find out Nature of Unknown Drugs (Acetylcholine, Histamine , Bacl ₂ , Physostigmine, Atropine, Mepyramine and Papaverine) using Rat/Guinea Pig/Chicken Ileum Preparation
3	To find out Nature of Unknown Drugs (Acetylcholine, Histamine, Bacl ₂ , Physostigmine , Atropine, Mepyramine and Papaverine) using Rat/Guinea Pig/Chicken Ileum Preparation.
4	To find out Nature of Unknown Drugs (Acetylcholine, Histamine, Bacl₂ , Physostigmine, Atropine, Mepyramine and Papaverine) using Rat/Guinea Pig/Chicken Ileum Preparation
5	Study on the Effects of CNS Stimulant (Coffee/Tea) on Human Volunteers
Demonstration Experiments on Central Nervous System:	
6	To study the effect of pentobarbitone on righting reflex (hypnosis) in mice
7	To study the effect of chlorpromazine on the locomotor activity of mice using actophotometer
8	To study the effect of apomorphine-induced compulsive behaviour (stereotypy) in mice
9	To study the muscle relaxant property of diazepam in mice using rotarod apparatus
10	<p>A. To study the analgesic effect of morphine/tramadol in mice using tail-flick method</p> <p>B. To study the analgesic effect of morphine/tramadol in mice using hot plate method</p> <p>C. To study the analgesic effect of morphine/tramadol in mice against acetic acid –induced writhing in mice</p>
11	<p>1. To study the anti-inflammatory property of indomethacin against carrageenan-induced paw oedema</p> <p>2. To study the anticonvulsant activity of phenytoin against maximal electro-shok-induced convulsions in rats</p> <p>3. To study the anticonvulsant property of diazepam against pentylenetetrazole-induced convulsions in mice</p>
12	To study the antianxiety effect of diazepam in mice using elevated plus-maze apparatus

13	To study phenothiazine-induced catatonia in rats
14	Simulation Experiments on Cardiovascular System: A. Effects of Various Drugs on Isolated Frog Heart.
15	B. Demonstration on the Effects of Various Drugs on the Rat blood Pressure

*** Any experiment demonstrating theoretical concept can be added to the above list**

References Books- Practicals: (Latest Edition):

1. Kulkarni S.K.-Handbook of Experimental Pharmacology, Vallabh Prakashan
2. Ghosh M.N.-Fundamentals of experimental Pharmacology-
3. Medhi B., Prakash A.-Practical manual of experimental and clinical pharmacology, Jaypee Brothers
4. Goyal R.K., Mehta A.A.-Handbook of Experimental Pharmacology, BS Shah Prakashan
5. MC Prabhakar, Experimental Pharmacology
6. Kale S.R.-Pharmacology and Toxicology-
7. DK Basu-Essential of Pharmacology-
8. R.A. Turner-Screening methods in pharmacology (vol I & II)
9. Gerard Vogel-Drug Discovery and Evaluation in Pharmacology assay:
10. D.R. Laurence, Evaluation of Drug Activity: Pharmacometrics

References Books- Theoretical concepts: (Latest Edition):

1. Tripathi KD, Essentials of Medical Pharmacology, Jaypee Brothers.
2. Satoskar R.S., Bhandarkar S.D. and Rege N.N., Pharmacology and Pharmacotherapeutics, Popular Prakashan Pvt Ltd.
3. HP Rang, MM Dale, Pharmacology, Elsevier Sciences
4. Katzung, B.G., Basic and clinical pharmacology, Prentice Hall, Int.,
5. Goodman and Gilman, Pharmacological Basis of Therapeutics, Mcgraw Hill Publishing
6. Joseph T. Dipiro, Pharmacotherapy-A Pathophysiological Approach.
7. F.S. Barar, Essentials of Pharmacotherapeutics
8. Sharma H.L. and Sharma K.K., Principles of Pharmacology, Paras Medical.
9. Paul L. Munson, Principles of Pharmacology
10. Golan David E, Principles of Pharmacology, The Pathophysiologic Basic.
11. Lewis's Pharmacology – James Crossland – Churchil Livingston
12. Craig, Charles R., Modern Pharmacology with Clinical Applications
13. Chaudhary S.K., Quintessence of Medical Pharmacology, Central Book Agency Pvt. Ltd.

SEMESTER: V

PHARMACOGNOSY-IV

Subject Code: 1612060701050600

Theory (3Hours/Week; 3Credits, 45 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
3	0	3	6	80	20	80	20

Objective of the Course:

- To make students familiar with Pharmacognostic study of Alkaloids, tannin and fibres containing crude drugs, utilized as medicine.

Student Learning Out comes:

- The students are expected to learn the pharmacognostic aspects of Alkaloids, tannin and fibres specifically, the sources, the preparation methods and utilization of containing drugs.
- Understand basic idea of extraction, isolation and separation of active phytoconstituents from medicinal plants
- Understand concept of phytochemical screening of the phytoconstituents obtained from the natural sources.

Sr. No	Course content	Total Hours
1	Alkaloids: Definition, classification, physico-chemical properties, general methods for isolation, biological sources, agronomy (cultivation, collection), processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic, microscopic features and specific chemical tests of following alkaloid containing drugs Pyridine – Piperidine: Tobacco, Lobelia, Pomegranate Piper, Areca nut Tropane: Datura, Belladonna, Hyocyamus, Scopolia Withania, Dubosia, Cocca Quinoline & Isoquinoline: Cinchona, Ipecac, Opium, Camptotheca Indole: Ergot, Rauwolfia, Catharanthus, Nuxvomica, Physostigma Imidazole: Pilocarpus Steroidal: Veratrum, Kurchi, Kantakari	33

	Alkaloidal Amine: Ephedra, Colchicum Purines: Coffee, Tea, Cola Quinazoline: Vasaka Diterpene Alkaloids: Aconite, Taxus Others: Tylophora	
2	Tannins: Definition, classification, Physico-chemical properties, general methods for isolation, source, cultivation, collection, commercial varieties and their systematic pharmacognostic study Hydrolysable: Amla, Harde, Behda, Galls Condensed: Pale catechu, Black catechu, Ashoka, Bael, Pterocarpus	7
3	Fibres: Study of fibres used in pharmacy such as Cotton, silk, wool, nylon, glass wool, polyester, asbestos	5

SEMESTER: V
PHARMACOGNOSY-IV
Practical (3 Hours/Week; 3 Credits, 45 Hours)

Sr. No	Course contents
1	Study of Morphology, Microscopy and TLC of crude drugs: (T.S., Powder and TLC of underlined drugs): <ul style="list-style-type: none"> ➤ <u>Datura</u>, Tobacco, Pomegranate, <i>Piper longum</i>, <i>Piper nigrum</i> ➤ <u>Withania</u> (Root), Belladonna, Hyocyanus, Dubosia, Lobelia, Areca ➤ <u>Cinchona</u>, Ipecac, Campothecca ➤ <u>Rauwolfia</u>, Ergot ➤ <u>Nuxvomica</u>, Catharanthus, Physostigma ➤ <u>Kurchi</u>, <u>Kantakari</u> (Leaf & Stem) ➤ <u>Ephedra</u>, Colchicum, (Seed & Corm) ➤ <u>Vasaka</u>, Coffee, Tea, Cola ➤ <u>Tylophora</u>, Aconite, Taxus
2	Isolation of Quinine from Cinchona.
3	Isolation of Caffeine from Tea
4	Isolation of Piperine from Black Piper.
5	Estimation of Total Alkaloids from Datura by Titrimetric method
6	Estimation of Quinine by UV Spectroscopy.
7	Microscopy of raw and absorbent Cotton, Wool, Jute, Silk and Rayon.
8	Study of Morphology and Microscopy (TS and powder drugs) of Amla, <u>Ashoka</u> , Pale catechu, Black catechu, Galls, Harde, Behda, Bael, Pterocarpus

9	Isolation of tannins from crude drugs and extract. Removal of tannin from drugs and extract. Tests for tannins
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Recommended Books:

1. A Textbook of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmadabad. 15th Edition, 2009.
2. Textbook of Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors, New Delhi, 5th Edition, reprinted, 2009.
3. Pharmacognosy: C.K. Kokate, A.P. Purohit, S.B. Gokhale, Nirali Prakashan Pune, 42nd edition, 2008.
4. Trease and Evans Pharmacognosy. 16th Edition, William Charles Evans, W. Saunders, Edinburg London New York Philadelphia St. Louis Sydney Toronto 2009.
5. Essentials of Pharmacognosy by Ansari S. H., Birla Publications Pvt. Ltd., 4th Edition, 2011.
6. Pharmacognosy of Powdered crude drugs- M.A. Iyenger. (Manipal Power Press)
7. Practical Pharmacognosy, Technique and Experiment by C. K. Kokate and S. B. Gokhale, Nirali Prakashan, Pune, 8th edition, 2005
8. The Practical Evaluation of Phytopharmaceutics by Brain K.R. and Turner R.D., Wrigth-Scientechincs Bristol.
9. Malati G Chanhani & A. P.G Pillai, Microscopic profile of powdered drugs used in Indian system of medicine, Volume I, Bark drugs 2005, Institute of Ayurvedic medicinal plant science, Gujarat Ayurved unit Jamnagar; CPTA.
10. Malati G Chauhan & A.P.G Pillai, "Microscopic profile of powdered drugs used in Indian systems of Medicine, Leaf Drugs, Vol2, 2007, Institute of P.G Teaching & Reaearch in Ayurveda, Gujarat Ayurved University, Jamnagar.
11. Malati G Chauhan & A.P.G Pillai, "Microscopic profile of Drugs used in Indian system of Medicine, seed drugs, Volume- 3, part- 1, 2011; Publisher: Prof Malati G Chauhan, P.G T-S.F C cell, I.P. G T.& R.A, Gujarat Ayurved University, Jamnagar
12. Practical pharmacognosy: K. R. Khandelwal, Nirali Prakashan Pune, latest edition

Semester – V
PHARMACEUTICAL MARKETING AND DRUG STORE MANAGEMENT
Subject code: 1612070701050700
Theory (3 Hours / Week; 3 Credits, 45 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
3	0	0	3	80	20	0	0

Objective of the Course

- Basic Understanding of Pharmaceutical marketing strategies, planning in marketing, communication and needs of pharma sector

Student Learning Outcomes/ Objectives

- At the end of the course, students will be able to understand the fundamental scientific principles of Drugs store Management and inventory control, Strategic marketing process, Consumer market and Retail and whole sale drugs store.

Sr. No.	Course Contents	Total Hrs.
1	Marketing tasks and philosophies: Marketing systems and pharma marketing environment	03
2	Consumer market: Pharmaceutical and buyer behaviour	02
3	Strategic marketing process: Industrial market, market segmentation, market measurement and forecasting.	05
4	Strategic planning in pharma marketing: Situation analysis, developing marketing. Objectives; Determining positioning and differential advantage, selecting target markets designing marketing mix for target market.	05
5	Product decisions: Product classification, product life-cycle strategies, Branding, packaging and labelling decisions	03
6	Pricing decisions: Pricing methods and strategies	02
7	Distribution decisions: Importance and functions of distribution channels, distribution channel members	05
8	Promotion decisions: Promotion mix elements	03
9	Communication in pharmaceutical industry	02
10	Drugs store Management and inventory control: Organization of drugs store, Types of materials stocked, storage conditions, purchase and inventory control principles, purchase procedures, purchase order, procurement and stocking. Quality control of drugs in hospitals.	08

11	Retail and whole sale drugs store: Organization and structure of retail and whole sale drug store, types of drug stores and design, maintenance of drug store, dispensing of proprietary products, maintenance of records of retail and wholesale.	07
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Reference Books

- 1) Pharmaceutical Marketing by Subba Rao
- 2) Pharmaceutical Marketing by Dimitris and Dogramatiz
- 3) Pharmaceutical Marketing by Smith
- 4) Marketing Management, a South Asian Perspective by Kotlar
- 5) Marketing Management, Planning, Implementation and Control by Ramaswami and Namakumari.
- 6) Marketing Management and Administrative Action, Tata McGraw Hill Management Information Systems by Kenneth C. Laudon
- 7) Information Systems for Modern Management by Robert G. Murdick
- 8) Fundamentals of Information Systems, Second Edition by Ralph M. Stair and George Walter Reynolds