

SAURASHTRA UNIVERSITY



Syllabus
Master of Pharmacy Management
(MPM)
(Bachelor of Pharmacy and
Master of Pharmacy Management)

Effective from
June 2014
(Five and Half year full time course)

Department of Pharmaceutical Sciences
Saurashtra University
Rajkot - 360 005

SAURASHTRA UNIVERSITY

Master of Pharmacy Management Integrated Course (B. Pharm. and Master of Pharmacy Management)

Semester - I

Unit Operation - I

Subject code: BP101T

Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives

1. Subject gives knowledge about various unit operations used in the pharmaceutical industry with its basic mechanisms.
2. The students can understand an importance of the particular process and its applicability in industry.

Students Learning Outcome

- 1) Knowledge of Different pharmaceutical equipment's-its design, material of construction and operation; and calculation of various physical parameters
- 2) Awareness regarding Humidity, Ventilation and Air Conditioning Systems (HVAC) system and its importance for pharmaceutical industry point of view
- 3) Determine the basic concepts of process parameters of pharmaceutical equipment involving different unit operation
- 4) Give ideas about Introduction to latest process control systems used in pharmaceutical industry

Sr No	Course Contents	Total Hrs.
1	Filtration: Theory and mechanism of filtration process, Types of filtration, factors influencing filtration, filter aids, filter media, industrial filter including filter press, filter leaf, rotary filter, edge filter, cartridge filters, membrane filters, mathematical problems on filtration, optimum cleaning cycle in batch filters, applications in pharmacy.	12
2	Centrifugation: Principle and theory of centrifugation, industrial centrifuges including	8

	perforated basket centrifuge, sedimentation type centrifuge, continuous centrifuges, etc., applications in pharmacy.	
3	Drying: Theory and mechanism of drying, moisture content, loss on drying, rate of drying & time of drying calculations, classification of dryers, factors affecting selection of dryers, dryers used in pharmaceutical including drum dryer, spray dryer, fluidized bed dryer, tray dryer, tunnel dryer, rotary dryer vacuum dryer, Microwave, Radiant heat dryer (Infra-Red), Mathematical problems on drying, applications in pharmacy.	10
4	Distillation: Raoult's law and its limitation, Henry's Law, Phase diagram, volatility & relative volatility, General parts of distillator, simple steam and flash distillation, batch and continuous distillation, rectification distillation columns and their efficiency, McCabe Thiele method for calculation of number of theoretical plates, azeotropic, molecular & steam distillation, mathematical problems, applications in pharmacy.	10
5	Evaporation: Basic concept of phase equilibria, factors affecting evaporation, heat transfer in evaporators, Duhring's Rule and Raoult's law, evaporators including natural circulation, forced circulation & film	10
6	Humidity, Ventilation and Air Conditioning Systems (HVAC): Basic concepts & definitions, measurement of humidity, psychometric charts, theory and calculations of humidification processes, humidity control, applications of humidity, equipment for humidification and dehumidification operations. Types of refrigeration cycles, air conditioning, applications in pharmacy. Design of HVAC systems.	10

Semester - I
Unit Operation - I
Subject code: BP101P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Aim of the Experiment
1	Study of filtration process and various factors affecting it.
2	Demonstration of centrifuge.
3	Study of rate of drying curve and various parameters related to it.
4	Demonstration of various dryers.
5	Study of various distillation processes.
6	Comparison of efficiency of different columns used in distillation process.
7	Study of evaporation process and various factors affecting it.
8	Determination of humidity and related parameters using DBT/WBT and dew point method.
9	Demonstration of sling psychrometer, dial type and digital humidity measuring instruments
10	Visit to Pharmaceutical industries/Pharmaceutical Instrument manufacturing units/Govt. laboratories/Indian Pharmaceutical Congress and other conferences/workshops/seminars for gaining practical knowledge

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

References Books

- 1) Elementary Chemical Engineering - Max S. Peters, Published by McGraw Hill Book Company, New York, 1954
- 2) Perry's Chemical Engineer's Handbook - Robert H Perry, Green D.W., Maloney J.O. 7th Edition, 1998, McGraw - Hill Inc., New York.
- 3) Tutorial Pharmacy by Cooper & Gunn, ed. S.J. Carter, CBS Publishers & Distributors, Delhi, 6th Edition, 2000.
- 4) Unit Operations of Chemical Engineering, 5th edition - McCabe, Smith & Harriott, McGraw - Hill Inc., New York.
- 5) Pharmaceutical Engineering - K.Sambamurthy, 2002 NAI (P) Ltd., Delhi.
- 6) Pharmaceutics: The Science of Dosage Form Design - M.E. Aulton.
- 7) The Theory & Practice of Industrial Pharmacy - Lachman L., Lieberman H.A. & Kanjig J.L., 3rd edition, 1990 Varghese Publishing House, Bombay.
- 8) Alfonso G. Remington: The Science & Practice of Pharmacy. Vol.I & II. Lippincott, Williams & Wilkins Philadelphia.
- 9) Introduction to Chemical Engineering by Walter L. Badger & Julius T. Banchemo, McGraw Hill International edition, New Delhi, 1955.
- 10) Pharmaceutical Engineering (Principles and Practices) by C.V.S. Subrahmanyam, Vallabh prakashan, Delhi 110034.

Semester - I
Pharmaceutical Chemistry - I
(Pharmaceutical Inorganic Chemistry)
Subject code: BP102T
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives

Course objectives are to:

- Introduce students to Inorganic Pharmaceutical Chemistry with emphasis on basic chemistry with respect to inorganic drugs and pharmaceuticals.
- Cover areas including impurities, acids, bases & buffers, gastrointestinal agents, intra and extra-cellular electrolytes, essential and trace elements, topical agents, gases and vapors, dental products, complexing and chelating agents
- Highlight pharmaceutical aids used in pharmaceutical industry.
- Study of qualitative and quantitative aspects of inorganic drugs and pharmaceuticals

Students Learning Outcomes:

- The curriculum of the Department is designed to satisfy the diverse needs of these 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.

Detailed Syllabus-Theory

Sr. No.	Course Contents	Hrs
1	Introduction to Pharmaceutical Chemistry	1
2	Impurities in Pharmaceuticals: Sources of impurities, tests for purity and identity, limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate	4
3	An outline of method of preparation, uses, special tests if any, of the following class of inorganic pharmaceuticals included in the current pharmacopoeia:	4
a	Acids and Bases: Buffers, Waters	4

b	Gastrointestinal agents: Acidifying agents, Antacids, Protective and Adsorbents, Cathartics	4
c	Major intra and extra-cellular electrolytes: physiological ions, Electrolytes used for replacement therapy, acids-base balance and combination therapy	5
d	Essential and trace elements: Transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements	3
e	Topical agents: Protective, Astringents and Anti-infectives	3
f	Gases and Vapors: Oxygen, Anesthetics and Respiratory Stimulants	2
g	Dental products: Dentifrices, Anti-carries agents	3
h	Complexing and Chelating agents used in therapy	2
i	Miscellaneous agents: Sclerosing agents, Expectorants, Emetics, Poisons and Anti-dotes, Sedatives etc	4
j	Pharmaceutical Aids used in pharmaceutical industry : Anti-oxidants, Preservatives, Filter aids, Adsorbents, Diluents	4
k	Inorganic Radio pharmaceuticals: Nuclear radiopharmaceuticals, reactions, Nomenclature, Methods of obtaining their standards and units of activity, measurements of activity, clinical applications and dosage, hazards and precautions	3
l	Introduction to Inorganic material useful as drug carrier system for novel drug delivery	2

Semester - I
Pharmaceutical Chemistry - I
(Pharmaceutical Inorganic Chemistry)
Subject code: BP102P
Practical (3 hours/week, 3 credits, 45 hours)

Sr. No.	Practical Contents	Hrs.
1	The backgrounds and systematic qualitative analysis of Inorganic mixture of up to 4 radicals. Six mixtures to be analyzed, Preferably by semi-micro methods.	18
2	All identification tests for pharmacopoeial inorganic pharmaceuticals and qualitative tests for cations and anions should be covered.	6
3	Limit tests for Cl, SO ₄ , As, Heavy metals and Lead along with a Few modifications	9
4	Volumetric Analysis of few important compounds covered in Theory.	12

Books Recommended (Latest Editions):

1. Inorganic Medicinal and Pharmaceutical Chemistry : J. H. Block, E. B. Roche, T. O. Soine, C. O. Wilson, Varghese Publishing House, First Indian Reprint, 1986.
2. Bentley and Driver's Textbook of Pharmaceutical Chemistry: Revised by L. M. Atherden, Oxford University Press, 8th Ed. 1969.
3. The Indian Pharmacopoeia, Latest Edition, Controller of Publications, Delhi.
4. Practical Pharmaceutical Chemistry edited by A. H. Beckett, J. B. Stenlake, CBS Publishers, and First Indian edition 1987.
5. Vogel's Qualitative Inorganic Analysis Revised by G. Svehla, Longman Gr. Ltd., 7th Ed. 1996.

Semester - I
PHARMACEUTICAL ANALYSIS-I
Subject code:BP103T
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives

- Introduce students to basics of drugs and formulation analysis with emphasis on its application in quality control and quality assurance.
- Cover areas including Acid-base titrations, Redox titrations, Argentometric or precipitation titrations, Nonaqueous titrations, Complexometric titrations, Karl-Fischer titrations, Kjeldahl method, Gravimetric analysis

Students Learning Outcomes:

- To demonstrate an understanding of the theory and applications of the most common basic methods of pharmaceutical analysis.
- Learn the practical aspects of various titration techniques with calibration of glasswares and checking precision and lower limit of quantitation of titrimetric methods.

Detailed Syllabus

Sr. No.	Course Contents	Hrs
1	Basics of drugs and formulation analysis : Weights, balances, importance of analysis, quality control and quality assurance, analytical methods (classification, validation parameters), requirements – chemicals (types, purification, checking purity), glass wares (types, calibration, cleaning), sampling techniques, sampling error minimization. Units of concentrations. Errors science, errors minimization.	6
2	Volumetric analysis (Titrimetric analysis)	
2.1	Acid-base titrations: Relative strength and its effect on titration, common ion effect, pH, Henderson- Hesselbach equation, buffers, neutralization curve, acid bas indicators, theory of indicators, back titrations, biphasic titrations, pharmacopoeial applications, hydrolysis of salts, ionic products of water and law of mass action.	15
2.2	Redox titrations : Theory of redox titrations, redox indicators, types of redox titrations,	12

	iodometry, cerimetry, mercury metry, diazotization nitrite titrations, 2,6-dichlorophenol indophenol titrations, titration curve and calculations of potentials during course of titrations.	
2.3	Argentometric or precipitation titrations : Mohrs, Fajans and Volhard methods	6
2.4	Nonaqueous titrations : Nonaqueous solvents, titrants and indicators. Differentiating and levelling solvents.	5
2.5	Complexometric titrations : Theory of the titrations, titrant, indicators and pharmacopoeial applications.	6
2.6	Miscellaneous titrations : Karl-Fischer titrations, Kjeldahl method.	3
3	Gravimetric analysis : Stability, solubility products, types of precipitations, precipitation techniques, pharmacopoeial applications	7

Semester - I
PHARMACEUTICAL ANALYSIS- I
Subject code: BP103P
Practical (3 hours/week, 3 credits, 45 hours)

Sr. No.	Practical Contents
1	Acid-base titrations Simple, back titrations, titrations of mixtures like NaOH+Na ₂ CO ₃ , borax + boric acid.
2	Simple, back titrations, titrations of mixtures like NaOH+Na ₂ CO ₃ , borax + boric acid. 2 Redox titrations Simple, iodometry, cerimetry, 2,6-dichlorophenol-indophenol titrations, mixtures like Fe ⁺² + Fe ⁺³ , oxalic acid + sodium oxalate
3	Complexometric titrations Replacement, back titrations
4	Nonaqueous titrations
5	Argentometric titrations
6	Gravimetric assay of one pharmacopoeial drug
7	Calibrations/cleaning of glasswares and checking precision and lower limit of quantitation of titrimetric methods.

Books Recommended (Latest Editions):

1. Pharmacopoeia: USP, B.P., I.P.
2. Practical Pharm. Chemistry, Vol. I – Backett, The athlone Press of University of London.
3. Fundamentals of Analytical Chemistry – Skoog, Harcourt College Publishers.
4. Quantitative chemical analysis – Vogel A. I., Pearson Education.
5. Text Book of Pharmaceutical Analysys – K. A. Connor, John Willey & Sons, New York.
6. Quantitative Chemical Analysis – Ayer by Harper & Row, New York.

Semester – I
Human Anatomy and Physiology-I
Subject Code: BP104T
Theory (4 hours/week, 4 credits, 60 hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives

Course objectives are to:

- Introduce students to human anatomy and physiology with emphasis on systems of body and how they are interrelated.
- Cover areas including medical terminology, basic chemistry, cell and tissue structure, and different systems of human body (integumentary, skeletal, muscular, nervous, endocrine, circulatory, lymphatic, digestive, respiratory, urinary and reproductive).
- Highlight the practical application of anatomical and physiological concepts to students.
- Study of various systems by Models / Charts / Specimens / Histology
- Learn the determination of body temperature, pulse rate, blood pressure, listening to heart sounds and demonstration of ECG.

Students Learning Outcomes:

- Study of anatomy and physiology as a gateway to careers in health related fields, athletics training etc., as a foundation to advanced scientific studies, for understanding pathology of disease and pathological changes
- To provide base for proper understanding of effects of drug on body and factors affecting various physiological processes and its effects.

Sr. No.	Course Contents	Total Hrs
1	Introduction and Scope of Anatomy and Physiology: Structural and functional organization of various organ systems. Homeostasis, Negative and positive feedback system. Definitions of various terms used in Anatomy.	4
2	Structure and function of: cell and its components with special emphasis on molecular structure of cell membrane, transporter mechanisms, mitochondria and nucleus. Transcellular, Extra-cellular and Intra-cellular fluids and their composition. Cell cycle and its significance. Mechanism of protein synthesis by cell organelles. Serosal cavities.	6
3	Elementary tissues of the body: Various elementary tissues and their subtypes with Characteristics, location and functions: epithelial tissue,	4

	muscular tissue, connective tissue and nervous tissue	
4	Osseous system: Structure, Composition and function of skeleton. Histology of bone. Classification of joints and their function. Types of movements of joints. Brief introduction to disorders of bones and joints	5
5	Muscular system: Gross anatomy of skeletal muscles. Neuromuscular junction. Physiology of muscle contraction and its components. Properties of skeletal muscles. Brief introduction to muscle disorders.	7
6	Haemopoietic system: Introduction, composition, properties and functions of blood and its components. Haemopoiesis, Lifecycle and physiology of RBC. Blood groups and their significance. Hemostasis and fibrinolytic pathway. Brief information regarding disorders of blood.	9
7	Lymph and lymphatic system: Composition, formation, circulation and functions of lymph. Basic physiology and functions of spleen. Disorders of lymph and lymphatic system.	3
8	Cardiovascular System: Anatomy and physiology of the heart. Circulatory system including coronary circulation and pulmonary circulation. Properties of Cardiac muscle, Electrocardiogram (ECG), Blood pressure and its regulation, Basic understanding of cardiac cycle and heart sounds, cardiac output and factors affecting cardiac output. Renin Angiotensin system, Aldosterone and its significance. Brief introduction to cardiovascular disorders like hypertension, atherosclerosis, angina pectoris, myocardial ischemia and infarction, congestive cardiac failure and cardiac arrhythmias.	11
9	Body defence Mechanisms and Immunity: Basic principles of immunity, innate immunity, adaptive immunity, acquired immunity, immune interactions (cellular and humoral immunity).	5
10	Digestive system: Gross anatomy of the gastrointestinal tract. Structure and functions of various organs of alimentary canal and associated organs like liver, pancreas and gall bladder. Physiology of digestion and absorption at various parts of gastrointestinal tract including phases of gastric secretion. Brief overview of disorders of G. I. tract and associated organs.	6

Semester - I
Human Anatomy and Physiology-I
Subject Code: BP104P
Practical (3 hours/week, 3 credits, 45 hours)

Sr. No.	Course Contents
1	Study of the human skeleton with the help of charts and models, Study of joints with the help of charts
2	Digestive and Muscular System (Names, position, attachments and functions of various muscles) with the help of charts and models
3	Histology of elementary tissues and various organs of Cardiovascular, Digestive and Muscular System
4	Hematology experiments: <ul style="list-style-type: none"> • Use and Care of Microscope • Study of Haemocytometry • Hemoglobin estimation • Total WBC count • Total RBC count • Differential WBC count • Determination of clotting time and bleeding time of blood • Erythrocyte Sedimentation Rate (ESR) • Blood Groups, Effect of Osmosis on RBC
5	Study of the human cardiovascular (Heart, Arterial and Venous System), Circulatory system including arterial and venous system with special reference to the names and positions of main arteries and veins, Coronary circulation, Pulmonary circulation. Determination of pulse rate, blood pressure, listening to heart sounds. Demonstration of ECG
6	Amphibian experiments for study of properties of skeletal muscle using either demonstrations or computer simulated experiments

Books Recommended (Latest Editions):

1. William J. Larsen: Anatomy – Development, function, Clinical Correlations-Saunders (Elsevier Science)
2. Guyton A.C. and Hall J.E.: Textbook of Medical Physiology – 10th Edition– W. B. Saunders
3. Seeley R. R., Stephens T. D. and Tate P.: Anatomy and Physiology 2000 McGraw Hill Co.
4. Waugh A. and Grant A.: Ross and Wilson’s Anatomy and Physiology in Health and illness – Churchill Livingstone
5. Sobotta. Atlas of Human Anatomy (2 Volumes) –Edited by Putz and R. Pabst, Lippincott, Williams and Wilkins
6. Anne M. R. Agur & Ming J. Lee: Grant’s Atlas of Anatomy –Lippincott, Williams and Wilkins
7. Gosling T. A., Harris P. F., Whitmore I., William, Human Anatomy: Color Atlas and Text -- Mosby
8. Bullock B.L. & Henze R.L., Focus on Pathophysiology –Lippincott
9. Martini F. Fundamentals of Anatomy and Physiology (Prentice Hall)
10. Goyal R. K. & Mehta A. A. Human Anatomy Physiology and Health Education, (B. S. Shah Prakashan)
11. West J. B. Best and Taylor’s physiological Basis of Medical Practice (Williams and Wilkins, Baltimore)
12. Tortora G. J. and Anagnostokos, N. P. Principles of Anatomy and Physiology (Harper and Colling Publishers, New York)
13. Joshi Vijaya D. Preparatory Manual for Undergraduates Physiology (B.I. Churchill Livingstone) –
14. Chatterjee C. C. Human Physiology (Medical Allied Agency, Calcutta)
15. Goyal R. K. et al.: Practical Anatomy Physiology and Biochemistry (B.S. Shah Prakashan, Ahmedabad)
16. Garg K. et al. A Text Book of Histology (CBS Publishers, New Delhi)
17. Lesson C. R. et al.: Text Book of Histology (W.B.Saunders Company)

Semester - I
Remedial Mathematics
Subject Code: BP105AT
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	0	4	80	20	-	-

Objective of the Course:

To introduce the basic concepts of Mathematics to students passing HSC with B-group.

Student Learning Outcomes:

The emphasis during Lecture sessions will be on Understanding of Concepts rather than on complexities of Computational Techniques. Stress is also given on Visual perception through Mathematical Software. Relevant Illustrations will be provided from the Real World processes. Sufficient home assignments will be given to the students which will test their fundamentals and ability to relate Mathematical concepts with reality.

Sr No	Course Contents	Total Hrs
1	<p>Sets, Relations and Functions:</p> <ul style="list-style-type: none"> • Sets, Number systems (Real and Complex numbers) • Cartesian Product of sets • Relations One-One, Many-One, One-Many, Many-Many Relations • Functions Certain Standard functions Polynomial, Algebraic, Exponential, Logarithmic, Trigonometric • Visualization of graphs of standard functions • Curves using Mathematical Software. 	6

2	<p>Concepts of Limit, Continuity and Differentiation:</p> <ul style="list-style-type: none"> • Concept of Limits, • Evaluation Techniques • Continuity of functions • Concept of Differentiation • Derivatives of Standard Functions • Evaluation Techniques • Derivative as a Rate of Change • Visualization of graphs of Continuous and Differentiable functions. 	8
3	<p>Concept of Integration:</p> <ul style="list-style-type: none"> • Indefinite Integrals (Primitives / Antiderivatives) • Primitives of Standard Functions • Methods of Integration • Definite Integral • Integration as Area under the curve • Use of Mathematical Software for evaluating Derivatives • Indefinite and Definite Integrals 	8
4	<p>Equations and their solutions:</p> <ul style="list-style-type: none"> • Polynomial equations in single variables • Solution of an equation • Graphical representation of an equation • Standard curves and surfaces • Determination of solution of Quadratic equations • System of Linear equations & its Matrix representation • Consistency and solution of a System of Linear equation using Matrix Inversion 	8
5	<p>Basic Statistics:</p> <ul style="list-style-type: none"> • Ungrouped and Grouped data • Diagrammatic Representation of Data • Measures of Central tendency • Measures of Dispersion • Computations of these measures through Statistical Software 	8

6	Higher order derivatives and applications <ul style="list-style-type: none"> • Real world problems involving concepts of first and higher order derivatives • successive differentiation • nth derivative of elementary functions viz., rational, logarithmic, trigonometric, exponential and hyperbolic • Leibnitz rule for the nth order derivatives of product of two functions 	8
7	Mean value theorems and expansion of functions: <ul style="list-style-type: none"> • Lagrange's and Cauchy mean value theorems • expansion of functions • Maclaurin's & Taylor's series expansions 	6
8	Laplace Transforms: <ul style="list-style-type: none"> • Laplace transforms of elementary functions • Inverse Laplace transforms • linearity property • first and second shifting theorem • Laplace transforms of derivative and integrals • applications of Laplace transforms in solving ordinary differential equations 	8

Recommended study materials:

1. Calculus and Analytical Geometry; Thomas G. B. and R. L. Finney; Addison Wesley, 9th Ed., 1996.
2. Advanced Engineering Mathematics; Erwin Kreyszig; John Wiley & Sons, India, 8th Ed., 1999.
3. Calculus Early Transcendental; Stewart James; Thomson India; 5th Ed., 2007.
4. Advanced Engineering Mathematics; Wylie & Barrett; McGraw Hill pub.
5. Advanced Engineering Mathematics; Greenberg M D; Pearson Education, 2nd Edition.
6. Calculus and Analytical Geometry; Thomas G. B. and R. L. Finney; Addison Wesley; 9th Ed., 1996.
7. Advanced Engineering Mathematics, Erwin Kreyszig; John Wiley & Sons, India, 8th Ed., 1999
8. Calculus Early Transcendental; Stewart James; Thomson India, 5th Ed., 2007
9. Advanced Engineering Mathematics; Wylie & Barrett; McGraw Hill publication.
10. Advanced Engineering Mathematics; Greenberg M D; Pearson Education, 2nd edition.

Semester - I
REMEDIAL BIOLOGY
Subject Code: BP105BT
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	0	4	80	20	-	-

Objective of the course:

This is an introductory course in Biology, which gives basic study of natural sources such as plant and animal origin. This subject has been introduced to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy.

Sr No	Course Contents	Total Hrs
1	<p>Plant Kingdom:</p> <ul style="list-style-type: none"> • Introduction, General organization of plants and its inclusions • Plant cell: its structure and non-living inclusions, mitosis and meiosis, different types of plant tissues and their functions. • Plant tissues • Plant kingdom and its classification • Morphology of plants • Root, Stem, Leaf and Its modifications • Inflorescence and Pollination of flowers • Morphology of fruits and seeds • Plant physiology • Taxonomy of Leguminosae, umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae, Rubiaceae • Study of Fungi, Yeast, Penicillin and Bacteria 	20
2	<p>Animal Kingdom:</p> <ul style="list-style-type: none"> • Study of Animal cell • Study animal tissues • Study of frog, Raptiles, Aves • General organization of mammals • Study of poisonous animals 	20

Recommended Books :

1. Plant Anatomy, by Fahn, A., Pergamon Press, Oxford
2. Reproductive Biology of Plants, by B. M. Johri, Narosa publishing House, Mumbai..
3. Concepts in Molecular Biology, by S. C. Rastogi, Willey eastern Ltd., Mumbai.
4. Introduction to Animal Biology by Claude A. Villee, W. D. Saunders co., Philadelphia.
5. A Text Book of Pharmaceutical Biology by S. Sardana, O.P. Sharma.
6. Text book of Biology by S.B.Gokhale
7. A Text book of Biology by Dr.Thulajappa and Dr. Seetaram.
8. A Text book of Biology by B.V.Sreenivasa Naidu
9. A Text book of Biology by Naidu and Murthy
10. Botany for Degree students By A.C.Dutta.
11. Outlines of Zoology by M.Ekambaranatha ayyer and T.N.Ananthakrishnan.
12. A manual for pharmaceutical biology practical by S.B.Gokhale and C.K.Kokate
13. Isolation and Identification of Drugs, Clarke, E. C. G., The Pharmaceutical Press, London.
14. Plant Physiology, Irwin P., Addison Wesley Publishing Co., London.
15. Developmental Biology, Scott F. Gilbert, Sinauer Associates, Inc. Publisher, Sunderland.
16. Life: Cells, Organisms, Populations, Edward O. Wilson, Sinauer Associates, Inc. Publisher, Sunderland

Semester - I
English & Communication Skill
Subject Code: BP106T
Theory (2 Hours / Week; 2 Credits, 30 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
2	0	0	2	80	20	-	-

Objective of the Course:

- To hone basic Communication Skills (LSRW) of the students by exposing them to the key communication techniques, and thereby
- To improve Comprehension and Expressional Skills of the students required for day to day and classroom, academic and cultural situations.

Students Learning Outcomes:

- Communication Skills of the students will be sharpened with reference to Organizational Structure,
- Students will be exposed to the modern modes of communication, and will be prepared for Campus Interviews

Sr No	Course Contents	Total Hrs
1	An Introduction to Communication and Key Concepts in Communication: <ul style="list-style-type: none"> • An Introduction to Communication • Basic terms, concepts, and contexts of communication • Importance, Types and Principles of Communication 	4
2	Major Communication Techniques and Styles: <ul style="list-style-type: none"> • Introduction to Communication styles and techniques • Assertive, Aggressive, Passive and Passive – Aggressive Communication • Working with different Styles 	5

3	Different Skill for Communication: <ul style="list-style-type: none"> • Listening Skills • Presentation Skills • Reading Skills • Writing Skills • Advanced Report Writing 	8
4	Grammar and Vocabulary: <ul style="list-style-type: none"> • Tenses and the Concept of Time • Active and Passive Constructions • Direct – Indirect Speeches • Prepositions and Conditionals • Idioms, Confusables, One-word Substitutes, Synonyms, Antonyms 	4
5	Group Communication and Group Dynamics : <ul style="list-style-type: none"> • Introduction to Group Communication • Introduction to Group Dynamics • Communication Networks within and outside the Groups • Social & Behavioural Sciences and Group Communication 	5
6	Interviews: <ul style="list-style-type: none"> • Introduction to Interviews • General preparations for an interview • Types of questions generally asked at the interviews • Types of interviews • Importance of nonverbal aspects 	4

Recommended Study Material:

Reference reading:

1. Effective English for Engineers and Technologists; Dr. Rai Ajay.
2. Spoken English 2nd Edition; Sreevalsan M. C.
3. English for Technical Communication Volume 2&2 Combined; Laxminarayan R. K.

Additional Reading:

1. English for Technical Communication Volume 2&2 Combined; Laxminarayan R. K.
2. Longman Dictionary of Common Errors; Turton N. D.
3. Learning to Communicate: A Resource Book for Scientists and Technologists English 1 & 2; Chellammal V.

Semester – II
PHYSICAL PHARMACY
Subject code: BP201T
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives:

- 1) To study basic physical characterization of solid, liquid and gaseous material, which are used during various preparations of formulations.
- 2) Subject gives the guideline for complex compounds and buffer solution use in pharmaceutical formulations. .

Students Learning Outcome:

- 1) By the end of this course, the student should have a good understanding of the basic concepts of derive properties and measurements powders, rheological properties of liquids and mixing of materials in various field of pharmacy.
- 2) Students should be able to know the methods of preparation of different buffer solution and Complexation of polymer and drug material.

Sr. No.	Course Contents	Hours
1	States of Matter: Introduction, binding forces between molecules, states of matter-solids, liquids, gases, liquid crystals, glassy state, phase equilibrium and phase rule, condensed systems	6
2	Solubility and Distribution Phenomenon: General principles, solvent-solute interactions, solubility of gases in liquids, solubility of liquids in liquids, solubility of solids in liquids, distribution of solutes between immiscible solvents.	10
3	Surface and Interfacial phenomenon: Liquid interface, adsorption at liquid interfaces, adsorption at solid interface, applications of surface active agents, electrical properties of interfaces.	8
4	Complexation and protein binding: Metal complexes, organic molecular complexes, protein binding, thermodynamic treatment of stability constants, applications of complexes in dosage forms.	6
5	Disperse systems: a. Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy. b. Suspensions and Emulsions : Interfacial properties of suspended particles/globules, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation	12

	parameters, wetting of particles, controlled flocculation, flocculation in structured vehicle, rheological considerations, emulsions ; types, theories, physical stability.	
6	Micromeritics: Particle size and distribution, methods for determining particle size, particle shape and surface area, methods for determining surface area, derived properties of powders,	9
7	Rheology: a. Newtonian system, Non-Newtonian systems, thixotropy in formulation, determination of rheological properties, applications in pharmacy. b. Flow of Powders: Introduction, methods to determine, factors affecting powder flow, pharmacopeial specification of angle of repose, hausner's ratio, Carr 's index.	9

Semester – II
PHYSICAL PHARMACY
Subject code: BP201P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Aim of the Experiment
1	Solubility of solids.
2	Determination of phenol water coefficient.
3	Preparation of thymol salol eutectic system.
4	Preparation of ternary phase system with one pair of partially miscible liquid.
5	Determination of latent heat, vapour pressure, critical point.
6	To find out the distribution coefficient of given solid.
7	Determination of surface / interfacial tension, HLB value and CMC of surfactants
8	Determination of particle size and size distribution of powders by different methods.
9	Determination of derived properties of powder
10	Determination of particle shape and surface area
11	Determination of viscosity of Newtonian and Non-newtonian systems
12	Effect of temperature on viscosity of liquids.
13	Effect of particle size, porosity, moisture, lubricants, glidants on flow property of powder.
14	Studies on different types of complexes and determination of their stability constants
15	Determination of sedimentation parameters for suspensions and emulsions.
16	Visit to Pharmaceutical industries/Pharmaceutical Instrument manufacturing units/Govt. laboratories/Indian Pharmaceutical Congress and other conferences/workshops/seminars for gaining practical knowledge

Books Recommended(Latest Editions):

1. Martin's Physical pharmacy by Patrick J . Sinko, 5th edit ion, Lippincott Williams &Wilkins, New York, 2006.
2. Pharmaceutics: The Science of Dosage Form Design, 2nd edition, Aulton, Michael E.,Chrchill Livingstone, London, 2002.
3. Remington: The Science and Practice of Pharmacy, Vol-I & II, 20th edition, Gennaro,Alfonso R.,Lippincott Williams & Wilkins, New York, 2002.
4. Physicochemical Principles of Pharmacy, 3rd edition, Florence, A. T. Atwood, D. Macmillan Press Ltd., London 1998.
5. Pharmaceutical Dosage Forms and Drug Delivery Systems, Ansel, Howard. C., Allen, Loyd V., Popovich, Nicholas G. Lippincott Williams & Wilkins, New York, 2002.
6. Cooper and Gunn's Tutorial Pharmacy, ed. Carter, S .J ., 6th edit ion, CBS Publishers & Distributors, Delhi, 2000.
7. Bentley's textbook of Pharmaceutics b y E. A. Rawlins

Semester – II
Pharmaceutical Chemistry – II
(Physical Chemistry)
Subject Code: BP202T
Theory (4 Hours/Week, 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives

On the completion of the course, students will be able to:

- Introduce students to Physical Pharmaceutical Chemistry with emphasis on basic chemistry with respect to physical properties of drugs and pharmaceuticals.
- Cover areas like physical state of drugs and pharmaceuticals.
- Learn physical properties like thermodynamics, adsorption, Chemical kinetics , Photochemistry, Radioactivity
- Study of different imaging system

Students Learning Outcomes:

- Learn the practical aspects and importance of different physical properties like surface tension and viscosity, partition coefficient, adsorption, order of reaction (First and Second), refractive index and molar refraction .
- Graduates will be able to master a broad set of chemical knowledge concerning the fundamentals in the basic areas of physical chemistry.

Detailed Syllabus-Theory

Sr. No.	Course Contents	Hrs
1	The liquid state: Physical properties surface tension, parachor, viscosity, refractive index, optical rotation, dipole moment of chemical constituents	06
2	Solutions: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition co-efficient, conductance and its measurement, Debye-Huckel theory	07
3	Thermodynamics: Basic principles, First, Second and Third laws, absolute temperature scale, thermochemical equations, phase equilibria and phase rule.	04
4	Adsorption: Basic principles, Freundlich and Gibbs adsorption isotherms, Langmuir theory of adsorption.	04
5	Photochemistry: Basic principles, Consequence of light adsorption, Jablonski diagram, Lambert-Beer Law, Quantum efficiency.	06
6	Chemical kinetics: Zero, first and second orders reactions, complex reaction, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysts, acidbase enzyme catalysis	10
7	Radioactivity: Basic principles of Radioactivity, Radioactivity Rays and Measurements of Radioactivity, Applications	04
8	Introduction to different imaging system	04

Semester - II
Pharmaceutical Chemistry - II
(Physical Chemistry)
Subject Code: BP202P
Practical (3 Hours/Week, 3 Credits, 45 Hours)

Practical Contents

Experiments on surface tension and viscosity, partition coefficient, adsorption, order of reaction (First and Second), refractive index and molar refraction.

Books Recommended (Latest Editions):

1. Text book of Physical Chemistry: Samuel Glasstone, Macmillan India Limited, 2nd Ed. 1995.
2. Elements of physical chemistry; Peter Atkins, Julio de paula, Oxford University Press, 4th Ed. 2007.
3. Martin's Physical Pharmacy and Pharmaceutical Sciences; Patrick J. Sinko, Lippincott Williams and Wilkins, Latest Edition
4. Essentials of Physical Chemistry ; Arun Bahl, B.S. Bahl , G.D.Tuli , S. Chand & Company Ltd. , Latest Edition
5. Physical Chemistry, G. M. Barrow, International Student Edition, McGraw Hill.

Semester – II
PHARMACEUTICAL ANALYSIS-II
Subject code:BP203T
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives

- Introduce students to basics of instrumental analytical methods with emphasis on its application in quality control and quality assurance.
- Cover areas including Chromatography, Electroanalytical methods, Potentio and pH metric methods, Polarography, amperometry, biamperometry, Calorimetry, Polarimetry, Extraction techniques

Students Learning Outcomes:

- To demonstrate an understanding of the theory and applications of the most common basic methods of pharmaceutical analysis.
- Learn the practical aspects and importance of quantitative analysis of different compounds involving various analytical techniques.

Detailed Syllabus

Sr. No.	Course Contents	Hrs
1	Basics of instrumental analytical methods: Advantages, limitations, validation, signal to noise ratio.	4
2	Chromatography: Classification, theories, retention mechanism, separation efficiency, methodology an pharmacopoeial applications of column, paper and thin layer chromatography.	15
3	Electroanalytical methods: Basics of electroanalytical methods	4
3.1	Conductometry: Conductances, factors affecting conductance, Kohlrausch law, conductivity cells, applications	6
3.2	Potentio and pH metric methods: Standard reduction potentials, various electrodes, electrodes and cell potential, applications of potentiometry and pH metry.	8
3.3	Polarography, amperometry, biamperometry: Basics of current flow in polarography, dropping mercury electrode, diffusion current, half wave potential, modifications like pulsed and differential pulse polarography, stripping voltametry, biamperometric titrations, amperometric titrations.	11

4	Calorimetry: Types, thermogravimetric analysis, differential scanning calorimetry, differential thermal analysis, melting point, etc. and their applications	5
5	Polarimetry: Polarimeter, qualitative and quantitative applications	3
6	Extraction techniques : Simple extraction, multiple extractions, separation of drugs in multicomponent system. Effect of pH on extractability of drugs, continuous extractions.	3
7	Miscellaneous methods: Oxygen combustion flask method, gasometric method, etc.	1

Semester - II
PHARMACEUTICAL ANALYSIS- II
Subject code: BP203P
Practical (3 hours/week, 3 credits, 45 hours)

Sr. No.	Practical Contents	Hours
	Quantitative analysis of different compounds involving following techniques:	45
1	Conductometry	
2	Potentiometry	
3	pH metry	
4	Polarimetry	
5	Column chromatography	
6	Thin layer chromatography	
7	Paper chromatography	
8	Polarography, amperometry and biamperometry	

Books Recommended (Latest Editions):

1. Pharmacopoeia: IP, BP, USP.
2. Practical Pharm. Chemistry, Vol. I – Backett, The athlone Press of University of London.
3. Fundamentals of Analytical Chemistry – Skoog, Harcourt College Publishers.
4. Quantitative chemical analysis – Vogel A. I., Pearson Education.
5. Text Book of Pharmaceutical Analysis – K. A. Connor, John Willey & Sons, New York.
6. Textbook of Pharmaceutical Analysis – J. W. Munson, Marcel Dekker Inc., New York.

Semester – II
Human Anatomy and Physiology-II
Subject Code: BP204T
Theory (4 hours/week, 4 credits, 60 hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	3	7	80	20	80	20

Course Objectives

On the completion of the course, students will be able to:

- Learn anatomy and physiology of various systems like respiratory, nervous, senses, urinary, endocrine, and reproductive.
- Know various feedback mechanisms that maintain physiological processes.
- Learn various disorders associated with disturbances in normal structural and functional alterations in various systems

Students Learning Outcomes:

- Study of anatomy and physiology as a gateway to careers in health related fields, athletics training etc., as a foundation to advanced scientific studies, or understanding pathology of disease and pathological changes, provide base for proper understanding effects of drug on body and factors affecting various physiological processes and its effects.
- Overall effective maintenance of individual and community health.
- Acquisition of intellectual and motor skills.

Sr. No.	Course Contents	Contact Hrs
1	Respiratory System: Anatomy and physiology of various organs of respiratory system, pulmonary ventilation and factors affecting it, lung volumes and capacities, gas laws in relation to exchanges of oxygen and carbon dioxide, external and internal respiration including transport of gases in the blood, control and regulation of respiration, voice production, brief outline of hypoxia, asthma, COPD, emphysema, chronic bronchitis, pneumonia, tuberculosis, pulmonary oedema, sudden infant death syndrome, severe acute respiratory syndrome.	8
2	Nervous system: Organization and functions of nervous system, parts of Neuron, structural and functional classification of neurons, Neuroglia, Myelination, Gray and white matter, Graded potential, Resting membrane potential, Generation and propagation of Nerve action potential, Signal transmission at synapses, Post synaptic potentials (EPSP, IPSP) and their summation, Brief overview of various types of neurotransmitter, Overview of nervous disorders like multiple sclerosis, epilepsy etc.	22

	<p>Anatomy of spinal cord (External, Internal), Protective structures of Spinal cord and nerves, names and functions of spinal nerves, physiology of spinal cord, sensory and motor tracts, reflexes and reflex arcs, brief outline of meningitis and poliomyelitis</p> <p>Major parts and protective coverings of brain, blood brain barrier, CSF, medulla oblongata, pons, midbrain, reticular formation, cerebellum, thalamus, Epithalamus, subthalamus, hypothalamus, cerebral cortex, lobes of cerebrum, cerebral white matter, basal nuclei, limbic system, sensory, motor and association areas of cerebral cortex, brain waves, cranial nerves names and functions, brief outline of cerebrovascular accident, transient ischemic attack, Alzheimer's disease, Dementia, Encephalitis, Attention Deficit Hyperactivity Disorder</p> <p>Comparison of somatic and autonomic nervous system, Anatomy of autonomic motor pathways (preganglionic neurons, autonomic ganglia, postganglionic neurons, enteric neurons), Synthesis, release and removal of neurotransmitters (e.g. Acetylcholine, Nor adrenaline), Physiology of the ANS, comparisons of sympathetic and parasympathetic divisions of ANS.</p>	
3	<p>Special Senses: Basics</p> <p>Sensory modalities, Process of sensation, sensory receptors, somatic sensation, somatic sensory and motor pathways, Brief outline of Parkinson's disease, Amyotrophic lateral sclerosis.</p> <p>Olfactory receptors, physiology of olfaction, Anatomy of taste buds and papillae, physiology of gustation, Accessory structures of eyes, anatomy of eyeball, image</p>	6
4	<p>Urinary System:</p> <p>Anatomy of kidney, nephron, functions of renal system, glomerular filtration, tubular reabsorption and tubular secretion and their regulation, formation of urine, ureter, urinary bladder, urethra, brief outline of renal calculi, urinary tract infection, glomerular disease, renal failure, acid base balances and imbalances.</p>	8
5	<p>Hormones and its regulations:</p> <p>Hormone, its type, endocrine (pituitary gland, thyroid, parathyroid, adrenals, Pancreas, testes and ovary) and exocrine glands, their secretion, regulation of secretion, functions and disorders</p>	8
6	<p>Reproductive System:</p> <ul style="list-style-type: none"> • Gross Anatomy of male reproductive system and their functions, sperm and spermatogenesis, and related sex glands. • Gross Anatomy of Female reproductive system and their functions, Ovum and Oogenesis, Physiology of Menstruation • Family planning, various contraceptive methods, Medical termination of pregnancy (Abortion), • Brief outline of erectile dysfunction (Impotence), Premenstrual syndrome, Male and female infertility, endometriosis, Benign prostatic hyperplasia. 	8

Semester – II
Human Anatomy and Physiology-II
Subject Code: BP204P
Practical (3 hours/week, 3 credits, 45 hours)

Sr. No.	Course Contents	Contact Hrs
1	Biochemical analysis of urine: physical characteristics, normal constituents	3
2	Biochemical analysis of urine: abnormal constituents	3
3	Identify the constituents of urine in unknown sample	3
4	Study anatomy of Respiratory system using charts and models	3
5	Study anatomy of Nervous system using charts and models	3
6	Study anatomy of Ear and Eye using charts and models	3
7	Study anatomy of Urinary system using charts and models	3
8	Study anatomy of Male & Female reproductive system using charts & models	3
9	Study histology and functions of various organs of Respiratory system and nervous system using slides	3
10	Study histology and functions of various organs of slides urinary system and male and female reproductive system using slides.	3
11	Study of various contraceptive techniques using charts	3
12	Determination of body temperature and study of learning and memory (Short term and long term)	3
13	Determination of lung function a. Determination of lung volumes and vital capacity using Spirometer / Flowmeter b. Determination of breath holding time	3
14	Determination of vision acuity a. Near Point and near response b. Determination of Stereoscopic vision c. Dominance of the eye	3
15	Determination of other special senses a. Temperature sensations b. Sensation of taste c. Sensation of smell	3

Books Recommended (Latest Editions):

1. Tortora Gerard. J. and Derrickson Bryan. Principles of Anatomy and Physiology (International Student Edition 13th edition- Wiley)
2. Guyton A.C. and Hall J.E. : Textbook of Medical Physiology – 10th Edition– W. B. Saunders
3. Waugh A. and Grant A.: Ross and Wilson’s Anatomy and Physiology in Health illness -- Churchill Livingstone
4. Chatterjee C. C. Human Physiology (Medical Allied Agency, Calcutta)
5. West, J. B. Best and Taylor’s physiological Basis of Medical Practice (Williams and Wilkins, Baltimore)
6. Martini, F. Fundamentals of Anatomy and Physiology (Prentice Hall)
7. Goyal R. K. & Mehta A.A. Human Anatomy Physiology and Health Education, (B. S. Shah Prakashan)
8. Garg K. et al. A Text Book of Histology (CBS Publishers, New Delhi)
9. Sobotta : Atlas of Human Anatomy (2 Volumes) –Edited by Putz and R. Pabst, Lippincott, Williams and Wilkins
10. Anne M. R. Agur & Ming J. Lee: Grant’s Atlas of Anatomy –Lippincott, Williams and Wilkins
11. Gosling T.A., Harris P.F., Whitmore I., William, Human Anatomy: Color Atlas and Text - Mosby
12. Joshi Vijaya D. Preparatory Manual for Undergraduates Physiology (B.I. Churchill Livingstone)
13. Textbook of practical Physiology C.L.Ghai (Jaypee Brothers Medical publishers)
14. Goyal R.K. et al.: Practical Anatomy Physiology and Biochemistry (B. S. Shah Prakashan, Ahmedabad)
15. Garg K. et al. A Text Book of Histology (CBS Publishers, New Delhi)
16. Lesson C. R. et al.: Text Book of Histology (W.B.Saunders Company)

Semester – III
DISPENSING PHARMACY & DRUG STORE MANAGEMENT
Subject code: BP301T
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

- 1) To study basic process which are used in different stage during preparation of pharmaceutical formulation.
- 2) Subject gives the guideline for calculation of formulas, labeling, and packing of different types of pharmaceutical products.
- 3) To study role of pharmacist in hospital and as a community pharmacist.

Student Learning Outcome

- 1) By the end of this course, the student should have a good understanding of the basic concepts of formulation, labeling, packing of different types of pharmaceutical dosage forms.
- 2) Students should be able to know the appropriate dose calculation and drug for patient
- 3) Students can also be able to work as a community pharmacist as a part of Health Care system.

Sr. No.	Course Content	Hours
1	Definition and scope.	01
2	The prescription: Handling of prescription, source of errors in prescription, care required in dispensing procedures including labelling at dispensed products.	02
3	Dispensing techniques: Compounding and dispensing procedures, packaging, storage and stability of medicines, labelling of dispensed product.	02
4	Pharmaceutical calculations: Posology: Introduction to imperial and metric system, avoirdupois and apothecaries system of weights and measures. Calculation of doses for infants, adults and elderly patients, enlarging and reducing recipes, percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc.	04

5	Principles involved and procedures adopted in dispensing of <ul style="list-style-type: none"> • Liquid Products – Oral and external solutions, Mixtures and Emulsions. Liniments, lotions etc. • Solid Products – Powders, Lozenges, Pastilles, Tablet triturates etc. • Ophthalmic- Eye drops, Eye lotions, Eye ointments, Contact lens solutions etc. • Oral unit dosage forms, inhalations etc. 	09
6	Principles involved and procedures adopted in dispensing of <ul style="list-style-type: none"> • Semisolid Products – Ointment, Creams, Gels, Pastes • Suppositories – Bases, Dispensing, Displacement value etc. 	06
7	Incompatibilities: Physical, chemical and therapeutic	06

Drug Store Management		
8	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.	8
9	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.	7

Semester – III
DISPENSING PHARMACY & DRUG STORE MANAGEMENT
Subject code: BP301P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Aim of the Experiment
1	Introduction to Latin to English translation, imperial, metric system, avoirdupois and apothecaries system of weights and measures.
2	To prepare and dispense aromatic waters (e.g. chloroform and camphor), elixirs (e.g. Phenobarbitone elixirs BPC)
3	To prepare and dispense gargles (e.g. Potassium chloride and phenol gargle) Mouth washes (e.g. Compound sodium chloride, mouth wash B.P.) Thorat paints (e. g. Mandel's paint s) Douches (e.g. boric acid, potassium permanganate) Ear Drops (e.g. Sodium bicarbonate, Chloramphenicol)
4	To prepare and dispense Mixtures Containing; diffusible, indiffusible solid with volatile oil, precipitate forming liquid, slightly soluble liquid and paediatric Kaolin Mixture as per BP '88)
5	To prepare and dispense emulsion (liquid paraffin emulsion, emulsion with fixed oil, volatile oil, resinous liquids, soap emulsion, emulsion based enema, w/o type emulsion etc.)
6	To prepare and dispense lotions (e.g. salicylic acid Calamine and precipitate Sulphur), liniments (e. g turpentine liniment, white liniment)
7	To prepare and dispense Eutectic powder, aspirin powder, dispensing of potent drug in powders, Compound Rhubarb Powder, Compound Sodium Bicarbonate powder, Compound zinc Oxide-salicylic acid dusting powder, Zinc starch And talc Dusting Powder.
8	To prepare and dispense Insufflations (Camphor – Menthol Insufflations etc.) and Kaolin Poultices B.PC
9	To prepare and dispense effervescent granules (Sodium phosphate effervescent granules, antacid effervescent granules etc.)
10	To prepare and dispense tablet triturates and lozenges.
11	Visit to Pharmaceutical industries/Pharmaceutical Instrument manufacturing units/Govt. laboratories/Indian Pharmaceutical Congress and other conferences/workshops/seminars for gaining practical knowledge

References Books

1. Pharmaceutical Practice –by Diana M. Collett and Michale E. Aulton, ELBS Publishers.
2. Dispensing for pharmaceutical by Cooper and Gunn by S.J. Carter, CBS Publishers
3. Pharmaceutical Calculations by Mitchell J. Stocklosa and Howard C. Ansel, B. I. Waverly Pvt. Ltd., New Delhi.
4. Pharmaceutical Dosage forms and Drug delivery systems by Howard C. Ansel, Lippincott Williams and Wilkins.

5. Pharmaceutical Practice, Edited by A.J. Winfield and R.M.E. Richards.
6. Bentley's Text book of pharmaceuticals, E A Rawlins.
7. Remington: The Science and Practice of Pharmacy, Latest Edition, by Mack Publishing Company.
8. Management by James A.F. Stoner.
9. Statistics for Management by Richard I. Levin.
10. Personnel Management by Arun Monappa.
11. Business Organisation and Office Management by Santhosh Bushan.

Semester – III
PHARMACEUTICAL ENGINEERING
Subject code: BP302T
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

- 1) To study basic process which are used in different stage during preparation of raw materials in pharmaceutical industry.
- 2) Subject gives the guideline for clarification and purification of solid and liquid raw materials.

Student Learning Outcome

- 1) By the end of this course, the student should have a good understanding of the basic concepts of clarification and purification of solid and liquid raw materials in pharmacy.
- 2) Students should be able to know the appropriate instrumental requirement for different types of unit operations used in pharmaceutical industry.

Sr. No.	Content	Hours
1	Introduction: Pharmaengineering and its significance, unit operations and unit processes. Unit systems, SI unit, CgS unit, gas constant and conversion of units. Physical quantities, dimensions and units, dimensional equations, dimensional analysis and dimensionless groups. Different types of graphical representation.	3
2	Stoichiometry: General principles, material balance-tie substances, chemical reactions and molal units, rate process, steady, unsteady and equilibrium state, laws of combining weights, applications of gas laws, energy balance, fuels and combustion, etc., Mathematical problems.	8
3	Fluid flow: Types of steady flow, Reynold number & its significance, types of pressure, viscosity, concept of boundary layers, total energy balance and total mechanical energy balance, losses in mechanical energy of fluids, basic equations of fluid flow, valves, flow meters, manometers. Mathematical problems.	10
4	Material handling systems: Solid handling- storage, conveyers, vacuum & pneumatic conveying. Liquid handling- storage, pumps Gases- Fans, blowers and compressors. Colour coding of Pipelines, use of forklifts and	8

	pallets, store design in pharmaceutical industries.	
5	Heat transfer: Modes of heat transfer. Conduction- Fourier's law, resistances in series and parallel, use of mean area and mean temperature difference. Convection-Concept of film, overall coefficient, heat transfer by forced convection in laminar and turbulent flow, condensing vapours, evaluation of individual film coefficients. Radiation-Black body, absorptivity & emissivity. Heating of fluids, steam as heating medium, properties and uses of steam, steam traps, study of steam table. Heat exchange equipments-Heat exchangers, condensers, boilers, extended surface scraped and surface equipments etc. applications of heat transfer in industrial processes. Mathematical problems.	10
6	Mass Transfer: Principle, streams in mass-transfer operations, solid/fluid and fluid/fluid mass transfer, influence of mass transfer on unit operations.	3
7	Materials of Pharmaceutical Plant Construction: General study of composition, corrosion resistance, properties, factors affecting the selection of material of pharmaceutical plant construction with special reference to stainless steel and glass. Corrosion-types, causes, theories of corrosion and its prevention.	3

Semester – III
PHARMACEUTICAL ENGINEERING
Subject code: BP302P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Aim of the Experiment
1	To demonstrate unit systems and conversion of units.
2	To demonstrate stoichiometry and tie substances in chemical reactions
3	To measure pressure of gas and other fluids using different manometers (U-tube manometer, inclined manometer etc.)
4	Study of various flow meters (orifice meter, venturi meter, rotameter) and ejector pump.
5	Experiment on Reynolds number
6	Determination of overall heat transfer coefficient.
7	Demonstration of corrosion resistance of various materials.
8	Practical related to topics in pharmaceutical engineering theory should be carried out.
9	Introduction to engineering drawing – Demonstration of orthographic and isometric projections, preparation of sheets based on orthographic projections.
10	Visit to Pharmaceutical industries/Pharmaceutical Instrument manufacturing units/Govt. laboratories/Indian Pharmaceutical Congress and other conferences/workshops/seminars for gaining practical knowledge

Reference Books

1. Elementary Chemical Engineering - Max S. Peters, Published by McGraw Hill Book Company, New York, 1954.
2. Perry's Chemical Engineer's Handbook - Robert H Perry, Green D.W., Maloney ThJ.O.7th Edition, 1998, McGraw – Hill Inc., New York.
3. Tutorial Pharmacy by Cooper & Gunn, ed. S.J.Carter, CBS Publishers & Distributors, Delhi, 6th Edition, 2000.
4. Unit Operations of Chemical Engineering, 5th edition - McCabe, Smith & Harriott, McGraw – Hill Inc., New York.
5. Pharmaceutical Engineering – K.Sambamurthy, 2002 NAI (P) Ltd., Delhi.
6. Pharmaceutics : The Science of Dosage Form Design - M.E. Aulton.
7. The Theory & Practice of Industrial Pharmacy – Lachman L., Lieberman H.A. & Kanjig J.L., 3rd edition, 1990 Varghese Publishing House, Bombay.
8. Alfonso G. Remington: The Science & Practice of Pharmacy. Vol. I & II. Lippincott, Williams & Wilkins Philadelphia.

9. Pharmaceutics I (Pharmaceutical Engineering), Jani G. K., B. S. Shah Prakashan, Ahmedabad.
10. Pharmaceutical Engineering : Principles and Practice, Subramanyam C.V.S., Thimma J, Suresh S.S. et. al., 2002, Vallabh Prakashan, Delhi.
11. A Textbook of Engineering Drawing Vol. I and II, P.J.Shah,6th Edition, 2003, Ahmedabad
12. Engineering Drawing, 34th edition, N.D.Bhatt Charutar Publishing House, 1994
13. Engineering Drawing & Graphic Technology, 13th edition by Thomas E. French, Charles J. Vierch, Rebot J. Foster, McGraw Hill International Edition, New Delhi, 1972
14. Introduction to Chemical Engineering by Walter L. Badger & Julius T. Banchero, Mc graw Hill International edition, New Delhi, 1955

Semester – III
Pharmaceutical Chemistry-III (Biochemistry – I)
Subject code: BP303T
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

Course objectives are to:

- Introduce students to basics of carbohydrates, Lipid,enzymes, Water Minerals Metabolism and also about Biochemical Organization of the cell and Transport Processes Across Cell Membrane

Students Learning Outcomes:

- The curriculum of the Department is designed to satisfy the diverse needs of these 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 aware about carbohydrates, Lipid,enzymes, Water Minerals Metabolism and also about Biochemical Organization of the cell and Transport Processes Across Cell Membrane

Detailed Syllabus

Sr. No.	Course Contents	Hrs
1	Biochemical Organization of the cell and Transport Processes Across cell Membrane.	4
2	Introduction to Carbohydrates, Lipids	08
3	a. Carbohydrate Metabolism: Conversion of Polysaccharides to Glucose-1-Phosphate. Glycolysis and Fermentation and their Regulation, Gluconeogenesis, Glycogenesis and Glycogenolysis, Metabolism of Galactose and Fructose. Role of Sugar Nucleosides in Biosynthesis and Pentose-Phosphate Pathway. b. The Citric Acid Cycle: Significance, Reaction and Energetic of the Cycle, Amphibolic Role of the Cycle and Glyoxalic Acid Cycle, Uric Acid Cycle c. Role of Hormones in Maintenance of Blood Sugar Level.	15
4	Lipid metabolism: oxidation of fatty acids, beta-oxidation and energetic,	07

	alpha-oxidation, omega-oxidations, biosynthesis of ketone bodies and their utilization, biosynthesis of saturated and unsaturated fatty acids, control of lipid metabolism and metabolism of cholesterol.	
5	Enzymes: Nomenclature, Enzyme Kinetics and its Mechanism of action, Mechanism of Inhibition, Enzymes and Iso-Enzymes in Clinical Diagnosis.	05
6	Co-Enzymes: Vitamins as Co-Enzymes and their Significance. Metals as Co-Enzymes and their Significance.	03
7	Water and mineral metabolism: brief introduction	03

Semester – III
Pharmaceutical Chemistry-III (Biochemistry – I)
Subject code: BP303P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Practical Contents
1	To perform the identification for carbohydrates (Glucose, Maltose, Lactose, Sucrose, Fructose etc.....)
2	Detection and identification of lipids (Glycerol, Cholesterol, Oleic Acid, Stearic Acid etc.....).
3	To determine the Acid value and Saponification value of the given fixed oil.
4	To determine the Iodine value of the given fixed oil.
5	To estimate glucose in urine by Benedict's method.
6	To determine glucose content in blood by folin Wu method.
7	To estimate the total cholesterol in plasma.
8	To perform biochemical analysis of flour and potato.
9	To perform biochemical analysis of cheese or milk or bread.
10	To perform biochemical analysis of (i) gastric juice and (ii) estimation of total acidity in gastric juice.
11	To perform the estimation of pepsin in gastric juice
12	To perform the Gastric juice analysis.
13	To perform estimation of diastase in urine.
14	To determine the achromic point and chromic period of salivary amylase
15	To estimate acidity and ammonia in Uria.

Books Recommended (Latest Editions):

1. E. E. Conn and P. K. Stumpf, Outlines of biochemistry, John Wiley and Sons, New York.
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. U.Satyanarayan, Biochemistry, Books and allied (P) ltd. Calcutta, latest edn.
7. G. F. Zubay, W. W. Parson, D. E. Vance, Principles of Biochemistry, WCB Publishers, England, latest edn.
8. S. Ramkrishnan, K. G. Prasannan, R. Rajan. Textbook of medical Biochemistry, Orient Longman Madras, Latest edn.
9. S.K. Sawhney, Randir Singh Eds, Introductory practical Biochemistry, Narosa Publishing house New Delhi.

10. D. T. Plummer, An Introduction to Practical Biochemistry, Tata McGraw Hill New Delhi.
 11. J. Jayaraman, Laboratory manual in Biochemistry, Wiley eastern Ltd. New Delhi

Semester – III
Pharmaceutical Chemistry-IV (Organic Chemistry – I)
Subject code: BP304T
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

Objective of the course:

- The course is designed to make students familiar with the principles of organic chemistry as applied to pharmaceuticals and to study organic compounds used as pharmaceutical aids, therapeutic agents and diagnostic agents.

Students Learning Outcomes:

- The course will help the student to have a good understanding of the history and basic concepts of organic chemistry.
- Students should be able to describe in detail synthetic approaches as well as mechanisms of action of some important organic base therapeutic and diagnostic agents.
- The course may help the students in understanding rational approaches towards the design of important therapeutic agents and their biological implications.

Detailed Syllabus

Sr. No.	Course Contents	Hrs
1	Structure and Properties : Introduction to organic chemistry, quantitative analysis of elements, determination of molecular weight and molecular formula, Atomic structure, atomic orbitals, molecular orbital theory, molecular orbitals, bonding and antibonding orbitals.	08
2	Chemical bonding and Properties : Introduction, covalent bond, hybridization and hybrid orbitals, intermolecular and intramolecular forces, bond dissociation energy, electronegativity, polarity of bonds, polarity of molecules, resonance, hyperconjugation	08
3	Reactive intermediates of carbon:	04

	Carbocation, carbanion, free radical, carbenes, nitrenes, reaction involving these intermediates	
4	Structure, properties, nomenclature, preparation and reactions of the following class of functional groups <ul style="list-style-type: none"> • Alkanes, alkenes, alkynes, dienes, alkyl halides, alcohols, ethers, • Benzene, • Polynuclear aromatic compounds, [naphthalene, anthracene. 	25

Pharmaceutical Chemistry-IV (Organic Chemistry - I)

Semester - III

Pharmaceutical Chemistry-IV (Organic Chemistry - I)

Subject code: BP304T

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

Sr. No.	Practical Contents
1	Introduction to safe working in organic chemistry laboratory.
2	Systemic qualitative analysis of organic compounds and preparation of their derivatives {Various examples of organic compounds include, Acidic: Oxalic acid, succinic acid, tartaric acid, citric acid, benzoic acid, salicylic acid, cinnamic acid, p-nitrobenzoic acid, acetyl salicylic acid, Phthalic acid etc; Strong acidic Amphoteric: p-aminobenzoic acid, o-aminobenzoic acid, sulphanilic acid etc.; Weak acidic amphoteric: Sulphanilamide etc.; Phenolic: α -naphthol, β -naphthol, Phenol, Resorcinol, Catechol, o/m/p-nitrophenol, o/m/p-cresol etc.; Basic: Aniline, N-methyl aniline, N,N-dimethyl aniline, o/m/p-anisidine, o/m/p toluidine, o/m/p chloroaniline, diphenyl amine, o/m/p-nitroaniline etc.; Neutral: Isopropyl alcohol, tert. Butyl alcohol, Acetophenone, benzophenone, acetaldehyde, benzaldehyde, m-dinitrobenzene, nitrobenzene, o/m/p/-nitrotoluene, acetanilide, benzanilide, benzamide, acetamide, urea, thiourea, naphthalene, anthracene, chlorobenzene, bromobenzene, ethylacetate, benzyl alcohol, methanol, ethanol, diethyl ether, toluene etc.; * Salt: Sodium benzoate, Sodium salicylate}:
2.1	Preliminary test for given organic compounds. (3)
2.2	Nature identification of given organic compounds (Category: Salts, Acidics, Strong acidic amphoteric, Phenolics, Weak acidic amphoteric, Basics, Neutrals* (6)
2.3	Element detection for given organic compounds(3)
2.4	Oxidizability and bromination test for selected category(3)
2.5	Functional group test for following functional groups: <ul style="list-style-type: none">• Carboxylic acids and phenols. (3)• Basic compounds and amino carboxylic acids. (3)• Aldehyde, ketone, ester, ether, alcohol, amide, acetamido, halogenated and non-halogenated hydrocarbon and nitro compounds (including nitrocarboxylic acid and nitro phenol) (6) <input type="checkbox"/> Melting point and Boiling point determination of given organic compound (3) <input type="checkbox"/> Derivatization of functional groups for above selected functional groups(6)
2.6	Identification of given unknown organic compounds for above compounds (9)

Books Recommended (Latest Editions):

1. Organic Chemistry, Robert T. Morrison and Robert N. Boyd, 6th Ed., Pearson Education, 2002.
2. Organic Chemistry, G. Marc Loudon, 4th Ed., Oxford University Press, 2004.
3. Organic Chemistry, Vol I and II by I. L. Finar, 6th Ed., Pearson Education, 2000.
4. Advanced Organic Chemistry, Jerry March, 4th Ed., Wiley India, 2007.
5. Vogel's textbook of practical organic chemistry, 5th Edition, Pearson Education Ltd., 2005
6. "Experimental Organic Chemistry" L. M. Harwood, L. J. Moody, J. M. Percy, 2nd Edition, Blackwell Science, 2005.
7. Techniques and Experiment of Organic Chemistry, Addison Ault, 6th Edition, University Science Books, 1998.
8. Introduction to Organic Laboratory Techniques, A Microscale Approach, Donald L. Pavia, Gary M. Lampman, George S. Kriz, 3rd Edition, Harcourt College Pub., 4th Edition, 2007.

Semester – III
TPathophysiology
Subject Code: BP305
Theory (2 Hours / Week; 2 Credits, 30 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
2	0	0	2	80	20	0	0

Objective of the Course:

- To make students familiar with the principles of Pathophysiology underlying diseases like cellular adaptation, injury and death, inflammation and repair.
- To make students learn basic concepts of pathogenesis related to major diseases including immunological disorders.

Student Learning Outcomes/ Objectives:

- At the end of the course, the student will be able to understand the concept of pathophysiology which is a prime requirement to understand the concepts of pharmacology.
- In addition they will be able to know about pathogenesis of common diseases.

Sr.	No.	Contact Hrs.
1	Basic concepts of Pathophysiology	1
2	Basic Principles of cell injury and adaptation and cell death including necrosis and apoptosis	3
3	Inflammation: <ul style="list-style-type: none"> • Definition, types and etiology of inflammation • Pathogenesis of acute and chronic inflammation 	2
4	Pathology of Tissue Repair Process	2
5	Immunological Disorders: <ul style="list-style-type: none"> • Hypersensitivity: Definition, classification with examples • Autoimmunity: Definition, classification and general mechanism of Autoimmune diseases 	2
6	Pathophysiology of common diseases/ disorders: <ul style="list-style-type: none"> • Cardiovascular diseases / disorders: Hypertension, Angina Pectoris, Myocardial Infarction, Congestive Heart failure, Cardiac arrhythmias, Atherosclerosis (CAD), Stroke • Endocrine disorders: Diabetes Mellitus, Thyroid & Parathyroid diseases, Adrenal gland diseases • Gastrointestinal disorders: Peptic ulcer disease, Inflammatory Bowel disease, Cirrhosis • Respiratory disorders: Bronchial asthma, Chronic Obstructive Pulmonary Disease • Central nervous system diseases / disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression, Migraine • Hematological disorders: Anemia • Communicable diseases: AIDS, Malaria, Tuberculosis, Amoebiasis • Cancer 	20

Recommended study materials:

1. Focus on Pathophysiology, 9th edition, 1999, Barbara A. Bullock and Reet L. Henze. Lippincott Williams & Wilkins, Philadelphia.
2. Basic Pathophysiology: A conceptual approach, 1979, B. Broer & Shekleton C. V. (Mosby Company)
3. Robbin's Pathologic Basis of Disease, 6th edition, 1999, Cotran R. S., Kumar V and Collins T. W. B. Saunders, Philadelphia.
4. Principles of Internal Medicine Vol. I & II ed. By Harrison.
5. The Merck Manual of Diagnosis and Therapy. 17th Ed. 1999-2004. Edited by Mark H. Beers and Robert Berkow. Published by: Merck & Co. Inc., USA.
6. Pathophysiology: P Maurice A. Mufson. 2nd edition, August 2001, McGraw-Hill companies.
7. Clinical Pharmacy & Therapeutics, 2nd edition, Roger Walker; Churchill Livingstone Publication.
8. Pathology and Therapeutics for pharmacists: A basis for clinical pharmacy practice, Green and Harris, Chapman and Hall publication.
9. Pharmacotherapy: A pathophysiologic approach – Joseph T. Dipiro et. al. Appleton & Lange.
10. Stefan Silbemagi, Florian Lang. Color Atlas of Pathophysiology. 1st Ed., June 2000, Thieme Medical Publishers.
11. Sylvia A. Price, Lorraine M. Wilson et al. Pathophysiology: Clinical Concepts of Disease Processes. 6th Edition, Oct. 2002, Elsevier Science Publishers.
12. Pathophysiology-Lippincott's Review Series 2nd Edition, Feb 1999. Ed. Catherine Paradiso.
13. Clinical Pharmacy and Therapeutics – Eric T. Herfindal, Williams and Wilkins Publication.
14. Gorgon C. Cook & Alimuddin Zumla, Manson's Tropical Diseases, twenty first edition.

Semester – III
Pharmacognosy-I
Subject code: BP306T
Theory (2 Hours / Week; 2 Credits, 30 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
2	0	3	5	80	20	80	20

Objective of the Course:

- The objective of the course is to make students familiar with the concept of Pharmacognosy, the scientific studies of the natural products utilized as drugs.
- To provide the knowledge about evaluation of crude drugs, probable types of adulteration and their detection in herbal drug samples.
- The students are introduced to the types of phytoconstituents, their physico chemical properties and the methods of their detection.
- To introduce the students to phytochemical and Pharmacognostic features of carbohydrate and lipid containing drugs.

Student Learning Outcomes / Objectives:

At the end of the course, the student should understand the preliminary basis of Pharmacognosy.

The students are expected to

- Understand different methods to cultivate the medicinal plants
- Differentiate between different types of the organs of medicinal plants
- Understand various options available- *in vivo* and *in vitro* to improve the quality of the phytoconstituents obtained from the natural sources.
- Understand different types of adulteration of crude drugs
- Understand different evaluation methods ascertain the presence or absence of adulteration
- Recognize the crude drugs mentioned in the course
- Learn the pharmacognostic aspects specifically, the sources, the preparation methods and utilization of those substances obtained from the natural sources.
- Learn different classes of phytoconstituents along with their exact definition and physico chemical properties and the preliminary chemical tests to detect those from plants/ plant extracts.

Sr No	Course Contents	Total Hrs
1	Definition, history, scope and development of Pharmacognosy.	2
2	Sources of drugs: Plant, Animal, Marine, Mineral and Biotechnology	3
3	Introduction to plant parts and tissue. a) Definition and function of leaf, stem, root, flower, fruit and seed. Classification of modification leaf, stem, root b) Definition, classification and functions of plant tissues. c) Classification and identification non-living cell contents d) Microscopic difference between mono cot and dicot leaf, stem and root	5
4	Classification of drugs: Alphabetical, Morphological, Taxonomical, Chemical and Pharmacological. Role of chemotaxonomy in classification.	3
5	Cultivation, collection, processing and storage of crude drugs a. Factors influencing cultivation of medicinal plants. b. Types of soils and fertilizers of common use. c. Plant hormones and their applications. d. Polyploidy, Mutation and Hybridization with reference to medicinal plants. e. Poly Houses/Green Houses for cultivation.	7
6	An introduction to active constituents of drugs and their classification, properties and chemical tests.	4
7	Evaluation of crude drugs by organoleptic, microscopic (including quantitative microscopy), physical, chemical, biological and other methods. Adulteration of crude drugs. WHO guidelines for evaluation of Herbal drugs.	6

8	<p>Carbohydrates and derived products: Definition, classification, physico-chemical properties, general methods of preparation, sources and systematic Pharmacognostic study of following drugs.</p> <ul style="list-style-type: none"> • Monosaccharide: Honey • Polysaccharides: Starch, Dextrin • Gums and Mucilage: Agar, Isabgol, Guar gum, Acacia, Tragacanth, Sodium Alginate, Stercuila • Carbohydrate derivatives: Chitin and Pectin 	6
9	<p>Lipids: Definition, classification, physico-chemical properties, general methods of preparation, sources and systematic Pharmacognostic study of following drugs.</p> <ul style="list-style-type: none"> • Fixed oil: Castor oil, Olive oil, Hydnocarpus oil, Sesame oil, Linseed oil, Mustard oil, Rape seed oil, Rice bran oil, Cod liver oil, Shark liver oil, Karanj oil • Fat: Lard, Cocoa butter, Kokum butter • Wax: Beeswax, Wool fat. 	9

Semester - III
Pharmacognosy-I
Subject Code : BP306P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr No	Course Contents
1	Use, Care and types of Microscopes, Techniques in microscopy.
2	Microscopy of plant tissues and their components.
3	Microscopy of monocot and dicot leaf, stem, root.
4	Study of chromosomes in Onion Cells (Polyploidy).
5	Microscopy of cell contents: Starch grains, Calcium oxalate crystals and Phloem
6	Quantitative microscopy (Determination of leaf constants).
7	Phytochemical Screening: General chemical test for primary and secondary
8	Carbohydrates: Study of crude drugs for morphology and chemical test for saccharides, gum and mucilage. Isolation of Potato starch. Microscopy of Maize, wheat, potato and rice starch.
9	Lipid: Study of crude drugs for morphology, chemical test, study of acid value, Iodine value and saponification value.

References Books:

1. Botany: A. C. Dutta, Calcutta Oxford University Press, New Delhi, 6th Revised Edition, 2010.
2. College botany Vol-I-III, Ganguly H.C., Das K.S., and Dutta C., New Central Book Agency [P] Lt., 2006.
3. Cultivation and Utilization of Medicinal Plants, Atal C. K. and Kapur B. M., RRL Jammu, 1st Edition, 1989.
4. Supplement to Cultivation and Utilization of Medicinal Plants, Handa, S.S. and Kaul, M.K., 1996. RRL, CSIR Publication, Jammu Tawi,
5. A Text book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmadabad. 15th Edition, 2009.
6. Textbook of Pharmacognosy: T. E. Wallis, CBS Publishers and Distributors, New Delhi, 5th Edition, reprinted, 2009.
7. Pharmacognosy: C. K. Kokate, A. P. Purohit, S. B. Gokhale, NiraliPrakashan Pune, 42nd edition, 2008.
8. Pharmacognosy: V. E. Tyler, L. R. Brady, J. E. Habbers, Lea and Febiger Philadelphia, 9th Edition, 1988.
9. Trease and Evans Pharmacognosy. 16h Edition, William Charles Evans, W. Saunders, Edinburg London New York Philadelphia St. Louis Sydney Toronto 2009.
10. Essentials of Pharmacognosy by Ansari S. H., Birla Publications Pvt. Ltd., 4th Edition, 2011.
11. Pharmacognosy of Powdered crude drugs - M. A. Lyenger (Manipal Power Press)
12. Practical Pharmacognosy, Technique and Experiment by C. K. Kokate and S. B.

Gokhale, NiraliPrakashan, Pune, 8th edition, 2005.

13. Quality Control, Herbal Drugs, An approach to evaluation of Botanicals. Dr. Pulok K. Mukherjee. Business Horizons Pharmaceutical Publishers; 2002
14. The Practical Evaluation of Phytopharmaceutics by Brain K. R. and Turner R. D., Wriqth-Sciencetchnics Bristol.
15. Malati G Chanhana & 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
16. Malati G Chauhan & A. P. G Pillai, "Microscopic profile of powdered drugs used in Indian systems of Medicine, Leaf Drugs, Vol. 2, 2007, Institute of P.G Teaching & Research in Ayurveda, Gujarat Ayurved University, Jamnagar.
17. 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,

Semester - III
MANAGEMENT PROCESS AND ORGANISATIONAL BEHAVIOUR
Subject code: MP301T
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theor		Practica	
				External	Internal	External	Internal
4	0	0	4	80	20	-	-

Objective of the Course:

This course will expose the students to the different functions performed by managers and the roles they have to assume for those functions. It will also provide an overview of the skills required by managers for the different roles and functions. In addition, the course will help students to understand human beings and what motivates them for higher performance in organizational settings.

The objectives of this course are:

- To expose the students to the different functions performed by managers, the roles they have to play for those functions , and the knowledge and skills they have to develop for the roles through real life examples and cases;
- To help the students develop an understanding of concepts and tools like MBO and SWOT to develop proficiency in the planning of activities of an organization.
- To enable the students to appreciate the importance of entrepreneurship, innovation and leadership and to help them realize the need for collaboration and networking in the management of any functional area of management;
- To provide the necessary foundation for all other courses based on management practices across the world
- To expose the students to the environmental and organisational context, cognitive processes and dynamics of organisational behavior; and
- To enable them to manage and lead for high performance with the human being at the centre of the organisation.

Student Learning Outcomes / Objectives:

At the end of the course, the participant should have clear exposure to the functional areas of management and the roles managers assume for managerial performance.

Detailed Syllabus:

Module No.	Title/Topic	Number of Hours
1	Foundations of Management <ul style="list-style-type: none"> • Managing • The Excellent Environment and Organizational Culture 	6

	<ul style="list-style-type: none"> • Managerial Decision Making 	
2	Planning and Strategizing <ul style="list-style-type: none"> • Planning and Strategic Management • Ethics, Ethical Behaviour in Organizations and Corporate Responsibility • International Management • Entrepreneurship 	8
3	Organizing <ul style="list-style-type: none"> • Organization Structure • Organizational Agility • Human Resource Management, Especially with Diverse Work Force • Types of Organizations and Basis for Choice of Different Types 	8
4	Leading <ul style="list-style-type: none"> • Leadership • Leadership Styles and Skills • Theories of Leadership • Teamwork and Negotiation 	8
5	Controlling <ul style="list-style-type: none"> • Managerial Control • Managing Technology and Innovation • Creating and Managing Change 	8
6	Organizational Culture <ul style="list-style-type: none"> • Organizational Theory • Creating and Maintaining Organizational Culture • Rewards and Recognition in Organizational Settings 	8
7	Cognitive Processes of Organizational Behaviour <ul style="list-style-type: none"> • Meaning and Types of Personality • Nature and Dimensions of Attitude • Organizational Commitment • Motives, Motivation and Theories 	7
8	Dynamics of Organizational Behaviour <ul style="list-style-type: none"> • Cause and Effect of Stress • Concept and Types of Conflict • Coping Strategies for Stress and Conflict • Political Implications of Power 	5
9	Contemporary Issues in Management	2
	Total	60

Reference Books:

1. Wehrich Heinz and Koontz Harold (2008), *Management: A Global and Entrepreneurial Perspective*, Tata McGraw-Hill
2. Stoner, Freeman & Gilbert Jr., *Management*, Prentice Hall of India
3. Kaul, Asha, *Business Communication*, PHI, New Delhi.
4. Kaul, Asha, *Effective Business Communication*, PHI, New Delhi.
5. Chaturvedi, P.D., and Mukesh Chaturvedi, *Business Communication*, Pearson Education
6. McGrath, E.H., *Basic Managerial Skills for All*, PHI, New Delhi
7. Slocum, Helrigel, *Organisational Behaviour*, Thomson/Cengage
8. Udai Pareek (2008), *Understanding Organisational Behaviour*, Oxford University Press

Journals/Magazines :

1. Harvard Business Review
2. Academy of Management Review
3. California Management Review
4. Vikalpa
5. IIMB Management Review
6. Decision
7. Indian Management
8. The Smart Manager
9. Business Newspapers
 - Business Standard
 - The Economic Times
 - Financial Express
 - Business Line

Semester - IV
Unit Operation - II
Subject code: BP401T
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

- 1) To study unit operations like size reduction, size separation, mixing and crystallization.
- 2) These Unit operations have applications in manufacturing and compounding of dosage forms. Some unit operations also have applications in manufacturing of bulk drugs.
- 3) It is also intended to make students familiar with process control systems, industrial hazards and safety precautions.

Student Learning Outcome

- 1) To develop skills with respect to applications of unit operations like size reduction, size separation, mixing and crystallization, compounding/preparation of pharmaceutical products at laboratory level.
- 2) To understand construction and working of equipment used for unit operation
- 3) To understand applications of these unit operations in manufacturing of drugs/dosage forms.

Sr. No.	Course Contents	Hours
1	Size reduction Objectives, importance and theory of size reduction. Factors affecting, energy requirements, mechanisms and methods (dry/wet grinding) of size reductions. Principle, material of construction, applications, advantages and disadvantages of various mills like cutter mill, hammer mill, roller mill, ball mill, fluid energy mill, colloid mill. Study of latest industrial mills used in manufacturing of various dosage forms and their application.	8
2	Size separation Principles of size separation, screen and its standards as per pharmacopoeia, screening equipments including shaking & vibrating screens, gyratory screens, sedimentation type industrial separators etc. Methods of determining size distribution. Fluid classification methods like sedimentation and elutriation, Principle, material of construction, applications, advantages	4

	and disadvantages of cyclone separator, sedimentation tank, etc.	
3	<p>Mixing</p> <p>Definition, objectives, mechanism and theory of mixing. Type of mixtures: liquid mixing, powder mixing, semi solids mixing. Principle, material of construction, applications, advantages and disadvantages of shaker mixer, propeller mixer, turbine mixer, paddle mixer, planetary mixer, double cone mixer, V mixer, sigma mixer and colloid mill, ultrasonic mixer, etc.</p>	7
4	<p>Crystallization</p> <p>Objectives, crystal lattice, types of crystal, crystal form, size and habit, formation of crystals, super saturation theory, factors affecting crystallization process and crystal growth. Study of various types of crystallizers including Swenson walker, tanks, agitated & batch, circulating magma, vacuum and crystal crystallizer etc. Methods for prevention of caking of crystals. Brief study of spherical crystallization process. Numerical problems on crystal yield.</p>	8
5	<p>Extraction and leaching</p> <p>Principle, theory and types of extraction. Solvents used for extraction, leaching and extraction equipments, small scale and large scale extraction methods, special extraction techniques-supercritical fluid extraction, applications in pharmaceutical industry.</p>	8
6	<p>Automated process control system</p> <p>Process variables - temperature, pressure, vacuum, flow level and their measurements. Elements of automatic process control systems. Elements of computer aided manufacturing. Introduction to latest process control systems used in pharmaceutical industry.</p>	6
7	<p>Industrial hazards and safety precautions</p> <p>Industrial hazards: mechanical, chemical, electrical, fire and dust hazards. Measures to prevent and combat the hazards. Accident records. Introduction to waste water system in industry.</p>	4

Semester - IV
UNIT OPERATION-II
Subject code: BP401P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Aim of the Experiment
1	Study of various process parameters during size reduction by various mills.
2	Study of various techniques to determine particle size distribution.
3	Determination of degree of mixing of solid-liquid and solid-solid mixing by different mixing equipments.
4	Study the effect of various factors (rate of cooling, rate of agitation, seeding, solvent, etc.) on crystallization of different salts.
5	Study of liquid-liquid and solid-liquid extraction of various materials by different extraction techniques like maceration, percolation, infusion and decoction.
6	Demonstration of handling hazardous chemicals and safety precautions.
7	Visit to Pharmaceutical industries/Pharmaceutical Instrument manufacturing units/Govt. laboratories/Indian Pharmaceutical Congress and other conferences/workshops/seminars for gaining practical knowledge

Books Recommended

1. Elementary Chemical Engineering - Max S. Peters, Published by McGraw Hill Book Company, New York, 1954
2. Perry's Chemical Engineer's Handbook - Robert H Perry, Green D. W., Maloney J. O. 7th Edition, 1998, McGraw - Hill Inc., New York.
3. Tutorial Pharmacy by Cooper & Gunn, ed. S. J. Carter, CBS Publishers & Distributors, Delhi, 6th Edition, 2000.
4. Unit Operations of Chemical Engineering, 5th edition - McCabe, Smith & Harriott, McGraw - Hill Inc., New York.
5. Pharmaceutics: The Science of Dosage Form Design - M. E. Aulton.
6. The Theory & Practice of Industrial Pharmacy - Lachman L., Lieberman H.A. & Kanjig J. L., 3rd edition, 1990 Varghese Publishing House, Bombay.
7. Alfonso G. Remington: The Science & Practice of Pharmacy. Vol. I & II. Lippincott, Williams & Wilkins Philadelphia.
8. Online resources can also be accessed.

Semester - IV
Forensic Pharmacy I
Subject code: BP402T
Theory (2 Hours / Week; 2 Credits, 30 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
2	0	0	2	80	20	-	-

Course Objectives

- 1) To familiarize a student with laws that influences the working of pharmacist in drug store/chemist and druggist/pharmacy or in pharmaceutical industry or in Food and Drug Administration or in an Educational Institute.
- 2) To familiarize a student with respect to code of ethics given by Pharmacy Council of India.

Student Learning Outcome

- 1) How to become a responsible person while discharging duty as a pharmacist in different facets of pharmacy profession.
- 2) To acquire certain knowledge related to laws that help in becoming a pharma entrepreneur.

Sr. No.	Course content	Total Hrs.
1	Pharmaceutical legislation-a brief review.	1
2	Drugs and pharmaceutical industry-a brief review.	1
3	Pharmaceutical education a brief review)	1
4	An elaborate (practical oriented) study of the following:	
	1. Pharmaceutical ethics	2
	2. Pharmacy Act 1948	3
	3. Medicinal and toilet preparations (excise duties) act, 1955	3
	4. Narcotic drugs and psychotropic substances act 1985 and rules	3
	5. Prevention of cruelty of Animal Act	2
	6. Poison Act, The insecticides Act	3
	7. Delhi Shop Establishment Act, The Factories Act, The industries (Development and Regulation) Act	3
	8. Drug Policy 2002	2
9. Drug and Cosmetic act (1940) and Rules (1945)	6	

NOTE: The teaching of all the above acts should cover the latest amendments.

Books Recommended

- 1) A text book of forensic pharmacy by B. M. Mithal, Vallabh Prakashan.

- 2) The patents act 1970 with patents rules 1972.
- 3) The narcotic drugs and psychotropic substance act, 1985 with the prevention of illicit traffic in narcotic drugs and psychotropic substance act, 1988 along with Allied rules and orders, 1993.
- 4) The medical termination of pregnancy act 1971, along with the medical termination of pregnancy rules 1975.
- 5) Insecticides act 1963 together with insecticides rules 1971 and insecticides (price, stock, display and submission of reports) order 1986 along with selected notifications (5th edition 1998).
- 6) The drugs (price control) order 1987 – along with new drug policy 1994 and drugs (price control) order 1995.
- 7) The opium act 1857 with opium act 1878 and opium and revenue laws act 1950.
- 8) The standards of weights and measures act 1976.
- 9) The Pharmacy Act 1998.
- 10) The prevention of illicit traffic in narcotic drugs and psychotropic substances act 1988.
- 11) The poisons act 1999.
- 12) The minimum wages act 1948.
- 13) The drug and cosmetics act 1940.
- 14) The medicinal and toilet preparation act 1955.
- 15) The factories act 1948.
- 16) Prevention of cruelty to animals act 1960.
- 17) Drugs and cosmetics act 1940 by Vijay Malik Eastern Book Company.
- 18) Pharmaceutical Jurisprudence by G.K. Jani, Atul Prakashan.

Semester - IV
Pharmaceutical Chemistry - V (Biochemistry - II)
Subject code: BP403T
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

Course objectives are to:

- 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	Proposed Hours
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	12

	biosynthesis, formation of bile pigments, hyperbilirubinemia, purine biosynthesis, purine nucleotide interconversion, pyridine biosynthesis	
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

Semester - IV
Pharmaceutical Chemistry - V (Biochemistry - II)
Subject code: BP403P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

1	Identification of various proteins (Gelatin, Casein, Albumin etc....)
2	Identification of various proteins (Peptone, Creatinine etc....)
3	To identify substances of physiological importance (Protein, Lactic Acid, HCl etc...).
4	To identify substances of physiological importance (Bile, Blood, Creatinine, Urea, Acetone, NaCl etc....)
5	To perform the tests for normal inorganic and organic constituent of urine.
6	To perform the qualitative analysis for pathological (abnormal) constituents in urine.
7	To estimate Creatinine in blood by colorimetric analysis.
8	To estimate total proteins in plasma by biuret method.
9	To perform the estimation of urea in blood by diacetyl method.
10	To perform estimation of chloride and phosphate in urine.
11	To determine titratable acidity and ammonia in urine.
12	To perform the estimation of Calcium and Magnesium in urine.
13	To perform biochemical analysis of bile.
14	Separation of Amino Acids (Proline, Glutamate, Aspartate, Glycine, Alanine etc...) by Paper Chromatography.
15	Separation of Amino Acids (Proline, Glutamate, Aspartate, Glycine, Alanine etc...) Thin Layer Chromatography (TLC).
16	To estimate calcium in serum.
17	Colourimetric analysis of Bilirubin and cholesterol in plasma.
18	Estimation of uric acid in urine.

Books recommended:

1. E. E. Conn and P. K. Stumpf, Outlines of biochemistry, John Wiley and Sons, New York.
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. M.Cohn, K.S. Roth, Biochemistry and disease. William and Wilkins co. Baltimore, Latest edn.
5. U.Satyanarayan, Biochemistry, Books and allied (P) ltd. Calcutta, latest edn.
6. G. F. Zubay, W. W. Parson, D. E. Vance, Principles of Biochemistry, WCB publishers, England, latest edn.
7. S.K. Sawhney, Randir Singh Eds, Introductory practical biochemistry, Narosa publishing house New Delhi.
8. D. T. Plummer, An introduction to practical biochemistry, Tata McGraw Hill New Delhi.
9. J. Jayaraman, Laboratory manual in biochemistry, Wiley eastern Ltd. New Delhi.
10. G. T. Mills, G. Leaf Practical Biochemistry, John Smith and Son Ltd.

11. Alan H. Gowenlock, Janet R. McMurray, Donald M. McLauchlan, Varley's Practical clinical biochemistry, Heinemann professional publishing.
12. P. G. Tikekar, Practical Biochemistry.

Semester - IV
Pharmaceutical Chemistry - VI (Organic Chemistry - II)
Subject code: BP404T
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

Course objectives are to:

- Introduce students to Organic- Chemistry with emphasis on basic organic chemistry with respect to chirality, optical activity, stereoisomers, racemic mixture etc.
- Cover areas of organic chemistry with respect to different functional groups, like amines, phenols, aldehyde, ketones etc.
- Study on nucleophilic substitution, heterocyclic compounds .
- Recent area of organic chemistry like nanochemistry, green chemistry and microwave synthesis.

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	Proposed Hours
1	Stereochemistry: <input type="checkbox"/> Chirality <input type="checkbox"/> Optical activity (dextro and leavo rotation concept) <input type="checkbox"/> Stereoisomerism <input type="checkbox"/> Enantiomers, Diastereomers, Mesomers with physical, chemical and biological properties of the same. <input type="checkbox"/> Geometrical isomers and its nomenclature. Physical and chemical properties of the same <input type="checkbox"/> Racemic mixture and its resolution methods. <input type="checkbox"/> Specification of configuration: Relative configuration (L and D), Absolute configuration (R and S) (CIP Rules) <input type="checkbox"/> Axial Chirality: Stereochemistry of Allene, spiran and Biphenyl. <input type="checkbox"/> Conformational isomers: Alkanes and Cyclohexane	08
2	Structure, properties, nomenclature, preparation and reactions of following class of functional groups <input type="checkbox"/> amines, <input type="checkbox"/> phenols, <input type="checkbox"/> aldehydes and ketones, <input type="checkbox"/> carboxylic acids and their derivatives.	22
3	Unsaturated carbonyl compounds, Nucleophilic aromatic substitution	02
4	Heterocyclic compounds: Chemistry, preparation and properties of <input type="checkbox"/> Furan, thiophene, pyrrol and pyridine <input type="checkbox"/> Pyrrazole, imidazole, oxazole, isoxazole and thiazole <input type="checkbox"/> Pyrazine, pyridazine and pyrimidine <input type="checkbox"/> Quinoline, isoquinoline and indole	10
5	Introduction, principles and applications of: - nanochemistry -microwave synthesis -green chemistry	03

Semester - IV
Pharmaceutical Chemistry - VI (Organic Chemistry - II)
Subject code: BP404P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

1	<p>Qualitative analysis of unknown organic compound according to the following list of organic compounds :</p> <p>1.1 – Identification and characterization of given unknown organic compound (Salts/Acids/Strong acidic Amphoterics)</p> <p>1.2 – Identification and characterization of given unknown organic compound (Phenolics/Basics)</p> <p>1.3 – Identification and characterization of given unknown organic compound (Neutrals)</p> <p>1.4 – Identification and characterization of given unknown organic compound (Salts/Acids/Strong acidic Amphoterics/Phenolic/Basics Neutrals)</p> <p>1.5 – Identification and characterization of given unknown organic compound (Salts/Acids/Strong acidic Amphoterics/Phenolic/Basics/Neutrals)</p> <p>List of organic compounds:</p> <p>a. Salts: Sodium benzoate, Sodium salicylate etc.</p> <p>b. Acidics: Benzoic acid, Salicylic acid, Cinnamic acid, Acetyl salicylic acid, Phthalic acid etc.</p> <p>c. Strong acidic Amphoterics: p-Aminobenzoic acid, o-Aminobenzoic acid, Sulphanilic acid etc.</p> <p>d. Weak acidic Amphoterics: Sulphanilamide etc.</p> <p>e. Phenolics: o/m/p-nitrophenol, alpha/beta-naphthol, o/m/p-cresol etc.</p> <p>f. Basics: Aniline, N-Methyl aniline, N,N-Dimethyl aniline, o/m/p-Anisidine, o/m/p-Nitroaniline, p-Chloroaniline, o/m/p toluidine etc.</p> <p>g. Neutrals: Acetophenone, Benzaldehyde, m-Dinitrobenzene, Nitrobenzene, Chlorobenzene, Bromobenzene, Acetanilide, Benzamide, Anthracene, Naphthalene, Benzophenone isopropyl alcohol, tert butyl alcohol etc</p>	15
2	<p>Introduction and detailed demonstration to various synthetic techniques and apparatus used therein:</p> <p>2.1 Heating and cooling methods, distillation, reaction work-up, filtration and extraction.</p> <p>2.2 Purification and identification</p>	06

3	<p>3.1 Synthesis and purification of selected organic compounds:</p> <ol style="list-style-type: none"> 1. Synthesis of p-nitroacetanilide from acetanilide (Nitration) 2. Synthesis of p-bromoacetanilide from acetanilide (Halogenation) 3. Synthesis of p-nitroaniline from p-nitroacetanilide (Hydrolysis) 4. Synthesis of p-bromoaniline from p-bromoacetanilide (Hydrolysis) 5. Synthesis of benzil from benzoin (Oxidation) 6. Synthesis of benzylidene acetophenone (Chalcone) from acetophenone and benzaldehyde (Condensation reaction) 7. Synthesis of Magneson-II from p-nitroaniline (Diazotization). <p>Monitoring progress of reaction by Thin Layer Chromatography (TLC) with the help of any one of above selected reaction.</p>	21
4	Introduction to the use of stereomodels	03

Reference Books:

1. Organic Chemistry, Robert T. Morrison and Robert N. Boyd, 6th Ed., Pearson Education, 2002.
2. Organic Chemistry, G. Marc Loudon, 4th Ed., Oxford University Press, 2004.
3. Organic Chemistry, Vol I and II by I. L. Finar, 6th Ed., Pearson Education, 2000.
4. Advanced Organic Chemistry, Jerry March, 4th Ed., Wiley India, 2007.
5. Vogel's textbook of practical organic chemistry, 5th Edition, Pearson Education Ltd., 2005
6. "Experimental Organic Chemistry" L. M. Harwood, L. J. Moody, J. M. Percy, 2nd Edition, Blackwell Science, 2005.
7. Techniques and Experiment of Organic Chemistry, Addison Ault, 6th Edition, University Science Books, 1998.
8. Introduction to Organic Laboratory Techniques, A Microscale Approach, Donald L. Pavia, Gary M. Lampman, George S. Kriz, 3rd Edition, Harcourt College Pub., 4th Edition, 2007.

Semester – IV
Pharmacology-I
Subject Code: BP405T
Theory (2 Hours / Week; 2 Credits, 30 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
2	0	3	5	80	20	80	20

Objective of the Course:

- To make students aware about basic terminologies and principles of pharmacology.
- To make students understand the actions of various drugs on body systems like ANS and PNS, and respiratory system.

Student Learning Outcomes/ Objectives:

- At the end of the course, the student will be able to understand basic concepts of pharmacology like how drug acts and how body reacts to drug at receptor and molecular level.
- In addition, Students will be aware of effect of drugs on different systems of body.

Sr.	No.	Contact Hrs.
1	General Pharmacology <ul style="list-style-type: none"> • Definition, scope and branches of Pharmacology. • Routes of drugs administration and drug delivery systems. • Pharmacokinetics of absorption, distribution, biotransformation and elimination of drugs, concept of Half life & Bioavailability • Pharmacodynamics : Mechanisms of drugs action, drug receptors and cellular signalling systems, Dose response relationship • Factors modifying drug dosage and action • Adverse drug effects, Iatrogenic diseases. • Drug interactions: Overview 	16
2	Drugs acting on Autonomic nervous system <ul style="list-style-type: none"> • Neurohumoral transmission • Parasympathomimetics and Parasympatholytics • Sympathomimetics, adrenergic receptor and neurone blocking agents • Ganglion stimulants, blockers, Neuromuscular blocking agents 	8

	<ul style="list-style-type: none"> • Local anaesthetics 	
3	Autocoids: <ul style="list-style-type: none"> • Histamine,5-HT and their antagonists • Prostaglandins, Thromboxanes, Leukotrienes and PAF. • Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and Substance P. • Cytokines 	3
4	Drugs Acting on Respiratory System <ul style="list-style-type: none"> • Expectorants and Antitussive • Drugs used in Bronchial asthma 	3

Semester - IV
Pharmacology-I
Subject Code: BP405P
Practical (3 Hours / Week; 3 Credits, 45 Hours)

Sr. No.	Topic
1	Introduction to Experimental Pharmacology, some basic Instruments, Laboratory Animals, Standard techniques of drug administration, blood collection, preparation of drug solutions, Euthanasia, Legal aspects related to experiments on animals (CPCSEA).
Isolated Tissue Experiments:	
2	To find out pD ₂ value of Acetylcholine using rat ileum/ chicken ileum.
3	To study competitive and non competitive antagonism using rat ileum.
4	To identify the nature of given unknown drug using rat ileum / chicken ileum.
5	To study the effect of neostigmine on Concentration Response Curve (CRC) of Acetylcholine using rat ileum/ chicken ileum.
6	To record Concentration Response Curve (CRC) of Acetylcholine using rat ileum/ chicken ileum.
Demonstration Experiments	
7	To study the effect of autonomic drugs on rabbit.
8	To study hepatic microsomal enzyme induction & inhibition activity of drugs.
9	To evaluate local anaesthetics using different animal models
10	To find out plasma protein binding of given drug.
11	Alternative to animal experimentation: Use of Ex Pharma Pro software

Recommended study materials:

1. Goyal R. K. Practicals in pharmacology. M/s B. S. Shah Prakashan, Ahmedabad.
2. Sheth U.K. et al –Selected topics in experimental pharmacology. The Kothari Book Depot, Mumbai.
3. Kulakarni S. K.- Handbook of experimental pharmacology. Vallabh Prakashan, New Delhi.
4. Ghosh M. N- Essential of experimental pharmacology scientific book agency, Calcutta.
5. Rang H. P., Dale M. M., et al –Pharmacology. Churchill Livingstone, USA.
6. Satokar R.S et al., Pharmacology and Pharmacotherapeutics. Popular Prakashan, Mumbai.
7. Harval, R.A., Champe P.C. et al., Pharmacology Lippincott- Raven Company, Philadelphia, New York.
8. Craig C.R., Stitzel, R.E- Modern Pharmacology, Little brown and Company, USA.
9. Goodman and Gilman's –the pharmacological basis of therapeutics. Pergamon Press, Singapore.
10. Seth, S.D. Text Book of pharmacology, B. I. Churchill
11. Bertram G. Katzung, Basic & Clinical Pharmacology, MC Graw Hill.
12. K.D.Tripathi, Essentials of medical Pharmacology.

Semester - IV
Pharmacognosy-II
Subject Code: BP406T
Theory (2 Hours / Week; 2 Credits, 30 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
2	0	3	5	80	20	80	20

Objective of the Course:

To make students familiar with Pharmacognostic study of tannin, resin and volatile oil containing crude drugs, utilized as medicine.

Student Learning Outcomes:

The students are expected to

- Learn the pharmacognostic aspects specifically, the sources, the preparation methods and utilization of tannin, resin and volatile oil 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 Contents	Total Hrs
1	<p>Volatile Oils: Definition, classification, physico-chemical properties, general methods for isolation, source, cultivation, collection, commercial varieties and systematic pharmacognostic study of volatile oils containing drugs</p> <ul style="list-style-type: none"> • Alcohol: Coriander, Geranium, Sandal wood • Esters and Alcohol: Rose, Mentha • Aldehyde: Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Eucalyptus, Cumin • Ketone: Caraway, Dill • Phenol: Clove, Tulsi, Ajowan • Ether: Star Anise, Fennel, Nutmeg, Cardamom <p>Others: Gaultheria, Valerian, Vaj, Vetiver, Nagarmotha, Garlic, Saffron, Vanilla</p>	25

2	<p>Resins: Definition, classification, Physico-chemical properties, general methods for isolation, source, cultivation, collection, commercial varieties and their systematic pharmacognostic study of following drugs</p> <ul style="list-style-type: none"> ● Acid resin: Colophony ● Resin Alcohol & Phenols: Balsam, Cannabis ● Ester Resin: Benzoin ● Oleo gum resin: Asafoetida, Myrrh, Guggul, Salaiguggul ● Oleo-resin: Ginger, Turmeric ● Glyco-resin: Kaladana, Podophyllum, Nishoth <p>Other: Vidang, Capsicum</p>	13
3	<p>Tannins: Definition, classification, Physico-chemical properties, general methods for isolation, source, cultivation, collection, commercial varieties and their systematic pharmacognostic study</p> <ul style="list-style-type: none"> ● Hydrolysable: Amla, Harde, Behda, Galls ● Condensed: Pale catechu, Black catechu, Ashoka, Bael, Pterocarpus 	7

Semester - IV
Pharmacognosy-II (Practical)
Subject Code: BP406P
Practical (3 Hours / Week; 3 Credits,45 Hours)

1	Demonstration of methods for isolation of volatile oil from crude drugs.
2	Study the Morphology of Volatile oil containing following drugs. Perform Microscopy (TS and Powder) and TLC of underlined drugs <ul style="list-style-type: none"> • Leaf drugs: <u>Mentha</u>, <u>Eucalyptus</u>, Lemon grass, Gaultheria, Tulsi, Basil, Geranium, Rosemary, Thyme • Bark and Peel: <u>Cinnamon</u> (Ceylon and Chinese), Orange peel, Lemon peel, Star anise • <u>Umbelliferous</u> fruits: <u>Fennel</u>, <u>Coriander</u>, Dill, Ajowan, Caraway, Cumin • Flower drugs: <u>Clove</u> and Rose • Seed and wood: <u>Cardamom</u>, Nutmeg, Sandal wood • Rhizome: <u>Vaj</u>, Valerian, Nagarmoth, Garlic
3	Study of Morphology and Microscopy (TS and powder drugs) of <u>Amla</u> , <u>Ashoka</u> Pale catechu, Black catechu, Galls, Harde, Behda, Bael, Pterocarpus
4	Isolation of oleoresin, identification (Chemical test) and study of Morphology and Microscopy (TS and powder drugs) from Colophony, Balsam, Benzoin, Myrrh, Asafoetida, Guggul, <u>Ginger</u> , Turmeric, Vidang, Kaladana
5	Isolation of tannins from crude drugs and extract. Removal of tannin from drugs and extract. Tests for tannins
6	Isolation of Thymol / Eugenol / Menthol

References Books:

1. Cultivation and Utilization of Aromatic Plants, Atal C. K. and Kapur B. M., RRL Jammu, 1st Edition, 1989.
2. Cultivation and Utilization of Medicinal Plants, Atal C. K. and Kapur B. M., RRL Jammu, 1st Edition, 1989
3. Supplement to Cultivation and Utilization of Medicinal Plants, Handa, S.S. and Kaul, M.K., 1996. RRL, CSIR Publication, Jammu Tawi,
4. Supplement to Cultivation and Utilization of Aromatic Plants, Handa, S.S. and Kaul, M.K., 1996. RRL, CSIR Publication, Jammu Tawi
5. A Text book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmadabad. 15th Edition, 2009.
6. Textbook of Pharmacognosy: T. E. Wallis, CBS Publishers and Distributors, New Delhi, 5th Edition, reprinted, 2009.

7. Pharmacognosy: C. K. Kokate, A. P. Purohit, S. B. Gokhale, Nirali Prakashan Pune, 42nd edition, 2008.
8. Trease and Evans Pharmacognosy. 16h Edition, William Charles Evans, W. Saunders, Edinburg London New York Philadelphia St. Louis Sydney Toronto 2009.
9. Essentials of Pharmacognosy by Ansari S. H., Birla Publications Pvt. Ltd., 4th Edition, 2011.
10. Pharmacognosy of Powdered crude drugs - M.A. Lyenger. (Manipal Power Press) Practical Pharmacognosy, Technique and Experiment by C. K. Kokate and S. B. Gokhale, Nirali Prakashan, Pune, 8th edition, 2005
11. Quality Control, Herbal Drugs, An approach to evaluation of Botanicals. Dr. Pulok K. Mukherjee. Business Horizons Pharmaceutical Publishers; 2002
12. The Practical Evaluation of Phytopharmaceutics by Brain K. R. and Turner R. D., Wrigth-Sciencetchnics Bristol.
13. Malati G Chanhan & 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.
14. Malati G Chauhan & A.P.G Pillai, "Microscopic profile of powdered drugs used in Indian systems of Medicine, Leaf Drugs, Vol 2, 2007, Institute of P.G Teaching & Reearch in Ayurveda, Gujarat Ayurved University, Jamnagar.
15. 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

Semester - IV
Micro and Macro Economics (MME)
Subject Code: MP401
Theory (4 Hours / Week; 4 Credits, 60 Hours)

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
4	0	0	4	80	20	-	-

Objectives of Course:

The objectives of this course are:

- To enable the students to understand the principles underlying the structure and functioning of markets;
- To help them apply economic theory for optimal decision-making at the firm level in the context of market constraints, through real-life examples from across the globe and real cases of firms; and
- To provide them sufficient exposure to the world of industry, trade and commerce, so as to make them feel comfortable reading and understanding daily economic and financial news about firms, and engaging in critical discussion on economic issues affecting firms.

Student Learning Outcomes:

At the end of the course, the student should have developed:

- An appreciation of the principles of micro-economics and their potential for firm level decision-making; and
- A keen desire for reading news of economic and financial changes/developments on a regular basis, and engaging in discussion and critical evaluation of such developments.

Detailed Syllabus:

Module No.	Title/Topic	Classroom Contact Hours
1	Introduction <ul style="list-style-type: none"> • <i>Ten Principles of Economics</i> • <i>Firms and its Objective</i> • <i>Micro-economics & Macro-economics Indicators</i> 	8

Module No.	Title/Topic	Classroom Contact Hours
2	Understanding Markets Forces <ul style="list-style-type: none"> • <i>The Market Forces of Supply and Demand</i> • <i>Elasticity, Types and Applications</i> • <i>Supply, Demand and Government Policies</i> • <i>The Theory of Consumer Choice</i> • <i>Demand Forecasting and Analysis</i> 	10
3	Markets and Welfare <ul style="list-style-type: none"> • <i>Consumers, Producer, and Market Efficiency</i> • <i>Externalities and Public Goods</i> • <i>The Design of the Tax System (with specific reference to India)</i> 	10
4	Firm Behaviour and The Organisation of Industry <ul style="list-style-type: none"> • <i>The Cost of Production</i> • <i>Market Structures</i> <ul style="list-style-type: none"> ○ <i>Firms in Competitive Markets</i> ○ <i>Monopoly</i> ○ <i>Oligopoly</i> ○ <i>Monopolistic Competition</i> 	10
5	Macroeconomic Environment <ul style="list-style-type: none"> • <i>Macroeconomics Aggregates</i> • <i>Fiscal, Monetary and Exchange Rate Policies</i> • <i>Behavioural and Technology Functions</i> 	10
6	The Economics of Labour Markets <ul style="list-style-type: none"> • <i>Factor Markets</i> • <i>Earnings and Discrimination</i> • <i>Income Inequality and Poverty</i> 	8
7	Sector Specific Issues <ul style="list-style-type: none"> • <i>Pharmacy / Engineering</i> • <i>Contemporary Issues</i> 	4
	Total	60

Reference Material

Text Books:

1. Principles of Economics – By George Mankiw, Thomson Publication.

Reference Books:

1. Salvatore Dominick (Seventh Edition), *Managerial Economics - Principles and Worldwide Applications* (Adapted Version), Oxford University Press
2. D. Salvatore & Ravikesh Srivastava (Seventh Edition), *Managerial Economics in a Global Economy*, Oxford University Press
3. H. L. Ahuja (2007), *Managerial Economics*, S. Chand
4. Suma Damodaran(2006), *Managerial Economics*, Oxford University Press
5. Geetika, Piyali Ghosh, Purba Roy Choudhary (Second Edition), *Managerial Economics*, Mc Graw Hill
6. Douglas Bernheim, Michael Winston (2008), *Microeconomics*, Tata McGraw-Hill
7. Mankiw (Forth Edition), *Principles of Microeconomics*, Cengage Learning
8. Ravindra H. Dholakia and Ajay N. Oza(Second Edition), *Microeconomics for Management Students*, Oxford University Press
9. *Macroeconomics* – By Goodwin, Nelson & Harris, PHI Learning Pvt. Ltd
10. *Principles of Macroeconomics* – By Rangarajan & Dholakia, Tata McGraw Hill Pub.
11. *Macroeconomics* – By Olivier Blanchard, Pearson Education
12. *Macroeconomics* – By G. S. Gupta, Tata McGraw Hill Pub

List of Journals:

1. Margin- The Journal of Applied Economic Research
2. South Asia Economic Journal
3. Global Business Review
4. Asian Journal of Management Cases
5. Global Journal of Emerging Market Economics

List of Magazines:

1. Economist
2. Economical and Political Weekly

List of Newspapers:

1. Economic Times
2. Business Standard