

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 1
Type of Course	Core Courses	
Prerequisite		
Course Objective	1. Students would have studied about the gross morphology, structure and functions of cell, skeletal, muscular, cardiovascular system of the human body. 2. They would have understood the various homeostatic mechanisms and their imbalances. 3. Students would be able to identify the different types of bones in human body. 4. Students would be able to identify the various tissues of different systems of human body. 5. Students would learn about the various experimental techniques related to physiology. 6. They would have learnt various techniques like blood group determination, blood pressure measurement, blood cells counting	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction to human body Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. Cellular level of organization Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) contact dependent b) Paracrine c) Synaptic d) endocrine Tissue level of organization Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	10	20
2	Integumentary system Structure and functions of skin. Skeletal system: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction. Joints: Structural and functional classification, types of joints movements and its articulation	10	25
3	Body fluids and blood: Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system. Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system	10	25
4	Peripheral nervous system:	8	17



Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Special senses: Structure and functions of eye, ear, nose and tongue and their disorders.		
5	Cardiovascular system: Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the gross morphology, structure and functions of various organs of the human body.
CO2	To acquire knowledge about the various homeostatic mechanisms and their imbalances, coordinated working pattern of different organs of each system.
CO3	To understand various tissues and organs of different systems of human body.
CO4	To interpret various experiments related to special senses and nervous system.

Reference Books	
1.	Human Anatomy for Nursing & Allied Sciences (TextBook) By Dr. M.K.Anand, Dr. Meena Verma Arora Medical Publishers Pvt.Ltd 1
2.	Fattana, Human anatomy (TextBook) By Saunder's C P Prism, Pub. Year 1991
3.	Human Anatomy (TextBook) By B.D. Chaurasia
4.	Human Anatomy (TextBook) By Snell

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 1
Type of Course	Core Courses	
Prerequisite		
Course Objective	1. Learning this subject content will develop the ideas with the fundamental of analytical chemistry among the pupil. 2. It constructs the fundamental methodology to prepare different strength of solutions. 3. It facilitates the fellow pupil to predict the sources of mistakes and errors. 4. It helps to develop the fundamentals of volumetric analytical skills. 5. It pecculates the basic knowledge in the principles of electrochemical analytical techniques The student interpretation skills will be improve by the course content in terms of choice of analytical techniques to perform the estimation of different category drugs.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Pharmaceutical analysis, Errors, Pharmacopoeia. i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions-Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures Sources of impurities in medicinal agents, limit tests..	10	20
2	Acid base titration, Non aqueous titration, Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10	25
3	Precipitation titrations, Complexometric titration, Gravimetry Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. Basic Principles, methods and application of diazotisation titration.	10	25
4	Redox titrations (a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate	8	17
5	Electrochemical methods of analysis, Potentiometry, Polarography -	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Introduction, Conductivity cell, Conductometric titrations, applications. Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications.		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To Learn this subject content will develop the ideas with the fundamental of analytical chemistry.
CO2	To understand the theories of acids-bases and about the solvents used in the volumetric titration.
CO3	To develop the fundamentals ideas about the principle, methods, various indicators used and applications of Precipitation, Complexometric and Gravimetry Titration.
CO4	To acquire knowledge about the principles, concepts of oxidation and reduction, various types of redox titration and its applications.
CO5	To understand the basic knowledge about the principles, instrumentation and applications of electrochemical analytical techniques like conductometry, potentiometry and polarography.

Reference Books	
1.	Text Book of Quantitative Inorganic analysis By A.I. Vogel, London longmans, green & co., ltd.,
2.	Inorganic Pharmaceutical Chemistry By P. Gundu Rao, Vallabh Publications / Prakashan
3.	Textbook of Pharmaceutical Chemistry By Bentley and Driver's London, Oxford University Press
4.	Analytical chemistry principles By John H. Kennedy Saunders College Pub.,
5.	Indian pharmacopoeia By Indian Pharmacopoeia Committee Delhi : Manager of Publications

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 1
Type of Course	Core Courses	
Prerequisite		
Course Objective	Upon completion of this program the student will have fundamental knowledge in preparing conventional dosage forms	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Historical background and development of profession of pharmacy Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. Dosage forms: Introduction to dosage forms, classification and definitions Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	10	20
2	Pharmaceutical calculations Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions. Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques	10	25
3	Monophasic liquids Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. Biphasic liquids: Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	8	25
4	Suppositories	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<p>Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.</p> <p>Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples</p>		
5	<p>Semisolid dosage</p> <p>Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms</p>	7	13
Total		43	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To know the history of profession of pharmacy
CO2	To understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
CO3	To understand the professional way of handling the prescription
CO4	To prepare various conventional dosage forms

Reference Books	
1.	Pharmaceutical Dosage Form and Drug Delivery System, (TextBook) By H.C. Ansel et al., Lippincott Williams and Walkins, New Delhi.
2.	Dispensing for Pharmaceutical Students, By Carter S.J., Cooper and Gunn's CBS publishers, New Delhi.
3.	Pharmaceutics, The Science & Dosage Form Design, By M.E. Aulton, Churchill Livingstone, Edinburgh.
4.	Indian pharmacopoeia By Indian Pharmacopoeia Committee Delhi : Manager of Publications
5.	British pharmacopoeia By Medicines and Healthcare products Regulatory Agency TSO (The Stationery Office)
6.	Theory and Practice of Industrial Pharmacy By Lachmann Lea & Febiger Publisher, The University of Michigan.
7.	The Science and Practice of Pharmacy, By Alfonso R. Gennaro Remington Lippincott Williams, New Del
8.	Cooper and Gunn's. Tutorial Pharmacy, By Carter S.J., CBS Publications, New Delhi.
9.	Bentley's Text Book of Pharmaceutics, By E.A. Rawlins, English Language Book Society, Elsevier Health Sciences, USA
10.	Pharmaceutical Pelletization Technology, By Isaac Ghebre Sellassie: Marcel Dekker, INC, New York
11.	Pharmaceutical Emulsions and Suspensions, By Francoise Nieloud and Gilberte Marti-Mestres Marcel Dekker, INC, New York.

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 1
Type of Course	Core Courses	
Prerequisite		
Course Objective	1. Well acquainted with the principles of limit tests. 2. Familiar with different classes of inorganic pharmaceuticals and their analysis 3. Identification of different anions, cations and different inorganic pharmaceuticals. 4. Knowledge about the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals 5. understand the medicinal and pharmaceutical importance of inorganic compounds 6. To have been introduced to a variety of inorganic drug classes	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

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Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate General methods of preparation , assay for the compounds superscripted with asterisk (*) properties and medicinal uses of inorganic compounds belonging to the following classes	10	20
2	Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity. Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance. Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement	10	25
3	Gastrointestinal agents Cathartics, Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite. Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	10	25
4	Miscellaneous compounds:	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333 Astringents: Zinc Sulphate, Potash Alum		
5	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , & γ ; radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions & pharmaceutical application of radioactive substances.	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Students will be able to well acquainted with the sources of impurities, principles of limit tests and methods to determine the impurities in pharmaceuticals
CO2	Students will be able to know about preparation, properties, assay and applications of buffers, dental products, major extra cellular and intracellular electrolytes in Pharmacy.
CO3	Students will be able to know about preparation, properties, assay and applications of GIT agents.
CO4	Students will be able to know about preparation, properties, assay and applications of expectorants, emetics, antidotes and antimicrobial agents.
CO5	Students will be able to know about the concepts, principles, handling, storage and application of radiopharmaceuticals.

Reference Books	
1.	Text Book of Quantitative Inorganic analysis By A.I. Vogel, London longmans, green & co., ltd.,
2.	Inorganic Pharmaceutical Chemistry By P. Gundu Rao, Vallabh Publications / Prakashan
3.	Inorganic Pharmaceutical Chemistry By M.L Schroff, National Book Centre, Calcutta 1968
4.	Textbook of Pharmaceutical Chemistry By Bentley and Driver's London, Oxford University Press
5.	Inorganic Pharmaceutical Chemistry By Anand & Chatwal Himalaya Pub. House
6.	Indian pharmacopoeia By Indian Pharmacopoeia Committee Delhi : Manager of Publications

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 1
Type of Course	Skill Enhancement Courses	
Prerequisite		
Course Objective	This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
2	-	-	2	35	15	-	-	50

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Communication Skills, Barriers to communication, Perspectives in Communication Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment	7	23
2	Elements of Communication, Communication Styles Elements of Communication: Introduction, Face to Face Communication – Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	7	24
3	Basic Listening Skills, Effective Written Communication, Writing Effectively Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion Required, Shades of Meaning, Formal Communication Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	7	23
4	Interview Skills, Giving Presentations Interview Skills: Purpose of an interview, Do's and Dont's of an interview Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery	5	17
5	Group Discussion	4	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion		
Total		30	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To develop effective communication skills, recognize and address barriers to communication, and understand diverse perspectives in communication.
CO2	To develop effective communication skills by understanding and applying various elements of communication and adapting communication styles to different contexts.
CO3	To develop proficient basic listening skills and enhance effective written communication through the mastery of writing techniques.
CO4	To develop effective interview skills and presentation techniques for confident and impactful communication in professional settings.
CO5	To develop effective interview skills and presentation techniques for confident and impactful communication in professional settings.

Reference Books	
1.	Basic communication skills for Technology, By Andreja. J. Ruther Ford,
2.	Communication skills, By Sanjay Kumar, Pushpalata,
3.	Organizational Behaviour By Stephen .P. Robbins
4.	Brilliant- Communication skills By Gill Hasson
5.	The Ace of Soft Skills: Attitude, Communication and Etiquette for success, By Gopala Swamy Ramesh
6.	Developing your influencing skills, By Deborah Dalley, Lois Burton, Margaret, Green hall,
7.	Communication skills for professionals, By Konar nira,
8.	Personality development and soft skills, By Barun K Mitra
9.	Soft skill for everyone By Butter Field
10.	Soft skills and professional communication, By Francis Peters SJ,
11.	Effective communication, By John Adair
12.	Bringing out the best in people By Aubrey Daniels,

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 1
Type of Course	Basic Science	
Prerequisite		
Course Objective	The main aim of this course is to make aware the students to understand and learn about : 1. Cell biology (Basic Nature of Plant cell and Animal cell) 2. Classification System of both Plants & Animals 3. Various tissue system and organ system in plant and animals 4. Theory of evolution 5. Anatomy and Physiology of plants and animals	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
2	-	-	2	35	15	-	-	50

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Living world <ul style="list-style-type: none"> Definition and characters of living organisms; Diversity in the living world; Binomial nomenclature ; Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus. Morphology of Flowering plants: <ul style="list-style-type: none"> Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledones. 	7	20
2	Body fluids and circulation; <ul style="list-style-type: none"> Composition of blood, blood groups, coagulation of blood; Composition and functions of lymph; Human circulatory system; Structure of human heart and blood vessels; Cardiac cycle, cardiac output and ECG Digestion and Absorption: <ul style="list-style-type: none"> Human alimentary canal and digestive glands; Role of digestive enzymes; Digestion, absorption and assimilation of digested food. Breathing and respiration: <ul style="list-style-type: none"> Human respiratory system; Mechanism of breathing and its regulation; Exchange of gases, transport of gases and regulation of respiration ; Respiratory volumes 	7	25
3	Excretory products and their elimination:	7	25

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<ul style="list-style-type: none"> Modes of excretion; Human excretory system- structure and function; Urine formation; Rennin angiotensin system <p>Neural control and coordination:</p> <ul style="list-style-type: none"> Definition and classification of nervous system; Structure of a neuron; Generation and conduction of nerve impulse; Structure of brain and spinal cord; Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata. <p>Chemical coordination and regulation:</p> <ul style="list-style-type: none"> Endocrine glands and their secretions; Functions of hormones secreted by endocrine glands. <p>Human reproduction:</p> <ul style="list-style-type: none"> Parts of female reproductive system; Parts of male reproductive system; Spermatogenesis and Oogenesis; Menstrual cycle 		
4	<p>Plants and mineral nutrition:</p> <ul style="list-style-type: none"> Essential mineral, macro and micronutrients; Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation. <p>Photosynthesis:</p> <ul style="list-style-type: none"> Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. 	5	17
5	<p>Plant respiration:</p> <ul style="list-style-type: none"> Respiration, glycolysis, fermentation (anaerobic). <p>Plant growth and development:</p> <ul style="list-style-type: none"> Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators. <p>Cell - The unit of life:</p> <ul style="list-style-type: none"> Structure and functions of cell and cell organelles. Cell division. <p>Tissues:</p> <ul style="list-style-type: none"> Definition, types of tissues, location and functions. 	4	13
Total		30	100

Course Outcomes

At the end of this course, students will be able to:

CO1	To Know the classification and salient features of the plants and animals.
CO2	To understand the various tissue system and organ system in plant and animals like Circulatory, digestive and respiratory system.
CO3	To understand the various tissue system and organ system in plant and animals like Nervous, endocrine system and reproductive system.
CO4	To know and explain the Theory of evolution, Plants, mineral nutrients and photosynthesis process.
CO5	To identify and summarize the Anatomy and Physiology of plants and animals.

Reference Books

1.	Text book of Biology (TextBook) By S. B. Gokhale Nirali Prakashan
2.	A Text book of Biology By Dr. Thulajappa and Dr. Seetaram Expert Educational Publishers

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 2
Type of Course	Core Courses	
Prerequisite	23990101 - HUMAN ANATOMY AND PHYSIOLOGY I – THEORY	
Course Objective	This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Nervous System & Central Nervous System Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Meninges, ventricles of brain and cerebrospinal fluid. structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)	10	22
2	Digestive System & Energetics Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. Formation and role of ATP, Creatinine Phosphate and BMR.	6	13
3	Respiratory & Urinary System Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods. Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney	10	22
4	Endocrine System Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.	10	23
5	Reproductive System & Introduction to Genetics Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition. Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	9	20
Total		45	100



Course Outcomes

At the end of this course, students will be able to:

CO1	To study the gross morphology, structure and functions of various organs of the human body.
CO2	To identify the various tissues and organs of different systems of human body.
CO3	To perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
CO4	To understand experiments related to special senses and nervous system. to appreciate co-ordinated working pattern of different organs of each system.
CO5	To understand mechanism in the maintenance of normal function of human body.

Reference Books

1.	Essentials of Medical Physiology By K. Sembulingam and P. Sembulingam Jaypee brothers medical publishers, New Delhi
2.	Anatomy and Physiology in Health and Illness By Kathleen J.W. Wilson Churchill Livingstone, New York
3.	Physiological basis of Medical Practice By Best and Taylor Williams & Wilkins Co, Riverview, MI USA
4.	Text book of Medical Physiology (TextBook) By Arthur C. Guyton and John E. Hall Miamisburg, OH, U.S.A
5.	Principles of Anatomy and Physiology By Tortora Grabowski Palmetto, GA, U.S.A
6.	Textbook of Human Histology (TextBook) By Inderbir singh Jaypee brothers medical publishers, New Delhi

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 2
Type of Course	Core Courses	
Prerequisite		
Course Objective	<p>. Students would have studied about the gross morphology, structure and functions of nervous, respiratory, urinary and reproductive systems in the human body.</p> <p>2. They would have studied in detailed about energy and metabolism.</p> <p>3. Students would able to identify the various organs of different systems of human body.</p> <p>4. They would have performed and learnt about the experiments like neurological reflex, body temperature measurement</p> <p>5. They would have studied elaborate on interlinked mechanisms in the maintenance of normal functioning of human body</p> <p>6. They would have learnt and performed the experiments like Olfaction, gustation reflex and eye sigh</p>	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

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Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Classification, nomenclature and isomerism Classification of Organic Compounds. Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds	7	13
2	Alkanes*, Alkenes* and Conjugated dienes* SP ³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP ² hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement	10	23
3	Alkyl halides* Alcohols* SN ¹ and SN ² reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN ¹ versus SN ² reactions, Factors affecting SN ¹ and SN ² reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glyco	10	23
4	Carbonyl compounds* (Aldehydes and ketones) Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.	10	24

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
5	Carboxylic acids* Aliphatic amines* Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	8	17
Total		45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding
Weightage	35	65

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

Course Outcomes

At the end of this course, students will be able to:

CO1	To study of the classification, nomenclature, structure and the type of isomerism of the organic compound.
CO2	To understand important physical properties, reactions (and underlying mechanisms) and methods of preparation of various functional groups.
CO3	To understand the reactivity of compounds and intermediates forming in reactions.
CO4	To study the identification of organic compound.

Reference Books

1.	Textbook of Organic Chemistry By B. S. Bahl & Arun Bahl Sultan Chand & Sons
2.	Organic Chemistry By P. L. Soni Sultan Chand & Sons
3.	Organic Reaction Mechanism By V.K. Ahluwalia and R.K. Parashar, Narosa Publishing House, New Delhi.
4.	Reaction Mechanism and Reagents in Organic Chemistry By Chatwal Himalaya Pub. House-New Delhi

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 2
Type of Course	Core Courses	
Prerequisite	23990103 - PHARMACEUTICS I –THEORY	
Course Objective	This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Flow of fluids, Size Reduction, Size Separation: Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer. Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill. Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.	10	20
2	Heat Transfer, Evaporation, Distillation Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers. Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator. Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation	10	25
3	Drying, Mixing Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer. Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier.	8	20
4	Filtration, Centrifugation Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter Medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seitz filter. Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.	8	20

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
5	Materials of pharmaceutical plant construction Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic nonmetals, basic of material handling systems.	7	15
Total		43	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To study various unit operations used in Pharmaceutical industries.
CO2	To understand the material handling techniques.
CO3	To perform various processes involved in pharmaceutical manufacturing process.
CO4	To carry out various test to prevent environmental pollution.
CO5	To understand significance of plant lay out design for optimum use of resources.
CO6	To study the preventive methods used for corrosion control in Pharmaceutical industries.

Reference Books	
1.	Introduction to chemical engineering By Walter L Badger & Julius Banchemo
2.	Solid phase extraction, Principles, techniques and applications By Nigel J.K. Simpson Latest edition.
3.	Pharmaceutical engineering principles and practice (TextBook) By C.V.S Subrahmanyam et al., Latest edition
4.	Remington practice of pharmacy- By Martin, Latest edition.
5.	Physical pharmaceutics (TextBook) By C.V.S Subrahmanyam et al., Latest edition
6.	Theory and Practice of Industrial Pharmacy By Liberman H.A, Lachman C., MarcelDekkar Inc.
7.	Cooper and Gunn's. Tutorial Pharmacy, (TextBook) By Carter S.J., CBS Publications, New Delhi.
8.	Pharmaceutical engineering-I (TextBook) By Dr.G.K.Jani

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 2
Type of Course	Skill Enhancement Courses	
Prerequisite		
Course Objective	On completion of this course, the students will be able to: <ol style="list-style-type: none"> 1. Apply the knowledge of mathematics and computing fundamentals to pharmaceutical applications for any given requirement 2. Design and develop solutions to analyze pharmaceutical problems using computers. 3. Integrate and apply efficiently the contemporary IT tools to all Pharmaceutical related activities. 4. Solve and work with a professional context pertaining to ethics, social, cultural and regulations with regard to Pharmacy 	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	-	-	3	50	25	-	-	75

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Number system: Concept of Information Systems and Software : Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	6	20
2	Web technologies: Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	6	20
3	Application of computers in Pharmacy Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design,Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	6	20
4	Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	6	20
5	Computers as data analysis in Preclinical development: Chromatographic data analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMs)	6	20
Total		30	100

Course Outcomes

At the end of this course, students will be able to:

CO1	Apply the knowledge of mathematics and computing fundamentals to pharmaceutical applications for any given requirement
CO2	Design and develop solutions to analyze pharmaceutical problems using computers.
CO3	Integrate and apply efficiently the contemporary IT tools to all Pharmaceutical related activities.
CO4	To understand about ethics, social, cultural and regulations with regard to Pharmacy.

Reference Books

1.	Computer Application in Pharmacy By William E.Fassett –Lea and Febiger 600South Washington Square, USA, (215) 922-1330.
2.	Computer Application in Pharmaceutical Research and Development By Sean Ekins Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3.	Bioinformatics (Concept, Skills and Applications) By S.C.Rastogi CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani,
4.	Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath By Cary N.Prague Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 2
Type of Course	Basic Science	
Prerequisite		
Course Objective	This program shall create an awareness about environmental problems, develop an attitude towards of concern for the environment.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	-	-	3	50	25	-	-	75

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	The Multidisciplinary nature of environmental studies Natural Resources, Renewable and non-renewable resources: Natural resources and associated problems, a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources	10	34
2	Ecosystems Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	10	33
3	Environmental Pollution: Air pollution; Water pollution; Soil pollution	10	33
Total		30	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To study an awareness about environmental problems, develop an attitude towards of concern for the environment.
CO2	To understand multidisciplinary nature of environmental studies on natural resources Environmental pollution.
CO3	To understand types , characteristic features, structure and function of the ecosystem
CO4	To understand awareness about environmental problems & concern for the environment.

Reference Books

1.	Environmental Science By Y.K. Sing New Age International Pvt, Publishers, Bangalore
2.	Environmental Biology , By Agarwal, K.C. 2001 Nidi Publ. Ltd. Bikaner.
3.	Environmental Chemistry, By De A.K., Wiley Eastern Ltd
4.	The Biodiversity of India By Bharucha Erach, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India
5.	Marine Pollution By Clark R.S., Clanderson Press Oxford

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 3
Type of Course	Core Courses	
Prerequisite	23990202-T - PHARMACEUTICAL ORGANIC CHEMISTRY I – THEORY	
Course Objective	1. Basic knowledge regarding general methods of preparation of organic compounds. 2. Understand the reactions of some organic compounds. 3. To understand Reactivity of organic compounds. 4. Special emphasis on mechanisms and orientation of chemical reactions. 5. To acquire knowledge in heterocyclic compounds 6. To acquire knowledge about the electrophilic and nucleophilic reactions.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Benzene and its derivatives A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule B. Reactions of benzene-nitration, sulphonation, halogenation-reactivity, Friedelcrafts alkylation-reactivity, limitations, Friedelcrafts acylation. C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction D. Structure and uses of DDT, Saccharin, BHC and Chloramine	7	17
2	Phenols, Aromatic Amines, Aromatic Acids, Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts Aromatic Acids* -Acidity, effect of substituents on acidity and important reactions of benzoic acid.	10	23
3	Fats and Oils a. Fatty acids – reactions. b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value –significance and principle involved in their determination.	10	23
4	Polynuclear hydrocarbons: a. Synthesis, reactions b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives	10	24
5	Cyclo alkanes*	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Stabilities – Baeyer’s strain theory, limitation of Baeyer’s strain theory, Coulson and Moffitt’s modification, Sachse Mohr’s theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only		
Total		45	104

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the introduction, orbital picture, resonance, reactions and effects of substituent’s of benzene.
CO2	To acquire knowledge about acidity, effect of substituents, reaction and qualitative test of phenols & aromatic amines.
CO3	To Understand the theory and chemistry of fats and oils.
CO4	Knowledge of synthesis, reactions and structure and medicinal uses of some polynuclear hydrocarbons.
CO5	Understand the theory of cycloalkanes

Reference Books	
1.	Textbook of Organic Chemistry By B. S. Bahl & Arun Bahl Sultan Chand & Sons
2.	Organic Chemistry By P. L. Soni Sultan Chand & Sons

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 3
Type of Course	Core Courses	
Prerequisite	23990103 - PHARMACEUTICS I –THEORY	
Course Objective	Upon successful completion of the course, students will be able to: <ol style="list-style-type: none"> 1. State the physicochemical properties of drug molecules, pH, and solubility 2. Explain the role of surfactants, interfacial phenomenon and thermodynamics 3. Describe the flow behavior of fluids and concept of complexation 4. Analyze the chemical stability tests of various drug Products 5. Understand the physical properties of solutions, buffers, isotonicity, disperse systems and rheology. 6. Understand of physicochemical properties of drugs including solubility, distribution, adsorption, and stability 	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Solubility of drugs Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications	10	24
2	States of Matter and properties of matter States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols –inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism. Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	10	23
3	Surface and interfacial phenomenon: Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.	10	23
4	Complexation and protein binding: Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.	8	17
5	pH, buffers and Isotonic solutions:	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the physicochemical properties of drug molecules, pH, and solubility
CO2	To understand the role of surfactants, interfacial phenomenon and thermodynamics
CO3	Describe the flow behavior of fluids and concept of complexation
CO4	Analyze the chemical stability tests of various drug Products
CO5	Understand the physical properties of solutions, buffers, isotonicity, disperse systems and rheology.
CO6	Understand of physicochemical properties of drugs including solubility, distribution, adsorption, and stability.

Reference Books	
1.	Physical Pharmacy: By Alfred N. Martin. Lea & Febiger, 1966
2.	Experimental pharmaceuticals Eugene By L. Parrott and Witold Saski. Burges
3.	Cooper and Gunn's Tutorial pharmacy By Gunn Cooper S.J. Carter
4.	Pharmaceutical Calculations By Stocklosam J. Lea & Febiger, Philadelphia
5.	Pharmaceutical Dosage forms, By Tablets Volume-1 to 3 Liberman H.A, Lachman C.,
6.	Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. By Liberman H.A, Lachman C, Marcel Dekkar Inc.
7.	Physical Pharmaceutics By Ramasamy C and ManavalanR. PharmaMed Press/BSP Books

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 3
Type of Course	Core Courses	
Prerequisite	23990104 - PHARMACEUTICAL INORGANIC CHEMISTRY – THEORY	
Course Objective	1. Students understand the importance of metabolism of substrates. 2. Will acquire chemistry and biological importance of biological macromolecules. 3. They acquire knowledge in qualitative and quantitative estimation of the biological macromolecules. 4. They know the interpretation of data emanating from a Clinical Test Lab. 5. Students would be able to know how physiological conditions influence the structures and re-activities of biomolecules. 6. They would be able to understand the basic principles of protein and polysaccharide structure.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Biomolecules, Bioenergetics Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP	8	20
2	Carbohydrate metabolism, Biological oxidation Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis - Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers	10	25
3	Lipid metabolism, Amino acid metabolism, β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity. General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alpeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice	10	25
4	Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors	10	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
5	Enzymes Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	The student will understand about the key biomolecules, their interactions and the structure and function of essential biomolecules including carbohydrates, lipids, proteins, nucleic acids with their energetics.
CO2	The student will possess a deep understanding of in-depth exploration of carbohydrate metabolism and biological oxidation in living cell.
CO3	The students will be equipped with the knowledge of essential metabolic pathways application of Lipid and Amino acids in living organism.
CO4	The student will gather knowledge about structure and function of nucleic acids (RNA & DNA) with genetic code, genetic modification and their implications in health and disease.
CO5	The students will possess a comprehensive understanding of various enzyme and coenzymes with their biological modification and importance in biochemical function of life.

Reference Books	
1.	Harper's Biochemistry By Robert K. Murry, Daryl K. Granner and Victor W. Rodwell. Mcgraw-Hill Education / Medical;
2.	Biochemistry By Jeremy M Berg, John L Tymoczko, and Lubert Stryer. WH Freeman
3.	Biochemistry By Dr. Satyanarayan
4.	Textbook of Biochemistry By Rama Rao UBS Publishers Distributors Pvt. Limited,
5.	Textbook of Biochemistry By Deb New Central Book Agency

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 3
Type of Course	Core Courses	
Prerequisite	23990101-T - HUMAN ANATOMY AND PHYSIOLOGY I – THEORY	
Course Objective	<p>Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.</p> <p>Upon completion of the subject student shall be able to –</p> <ol style="list-style-type: none"> 1. To describe the etiology and pathogenesis of the selected disease states; 2. To name the signs and symptoms of the diseases; and 3. To mention the complications of the diseases 	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Basic principles of Cell injury and Adaptation Basic principles of Cell injury and Adaptation- Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis	10	23
2	Cardiovascular System: Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) Respiratory system: Asthma, Chronic obstructive airways diseases. Renal system: Acute and chronic renal failure	10	25
3	Haematological Diseases:	10	25

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease. Gastrointestinal system: Peptic Ulcer		
4	Inflammatory bowel diseases Inflammatory bowel diseases: Jaundice, hepatitis (A, B, C, D, E, F) alcoholic liver disease. Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout Principles of cancer: classification, etiology and pathogenesis of cancer Diseases of bones and joints Rheumatoid Arthritis, Osteoporosis, Gout Principles of Cancer: Classification, etiology and pathogenesis of Cancer	8	17
5	Infectious diseases: Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections Sexually transmitted diseases: AIDS, Syphilis, Gonorrhoea	7	13
Total		45	103

Course Outcomes	
At the end of this course, students will be able to:	
CO1	The student will understand about the basic principle of cell injury, cell damage, adaptation and disturbances in homeostasis. Students will be able to know about the basic mechanism of inflammation and repair.
CO2	The students will possess a deep understanding about the etiology and pathogenesis of different diseases of cardiovascular, respiratory and renal system.
CO3	The student will be equipped with the knowledge of etiology and pathogenesis of hematological diseases, endocrine system, nervous system, nervous system, gastrointestinal system.
CO4	The students will gather knowledge about different liver diseases, diseases of bones and joints, fundamental principles of cancer.
CO5	The students will possess a comprehensive understanding of various infectious diseases and sexually transmitted diseases.

Reference Books

1.	Pathologic Basis of Disease; (TextBook) By Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran South Asia edition; India; Elsevier; 2014
2.	Pathologic basis of disease (TextBook) By Cortran, Kumar, Robbins
3.	Text book of Pathology (TextBook) By Harsh Mohan;

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 3
Type of Course	Core Courses	
Prerequisite		
Course Objective	The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction to Pharmacognosy (a) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo-gum -resins). Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.	10	10
2	Cultivation, Collection, Processing and storage of drugs of natural origin Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants Conservation of medicinal plants	10	10
3	Plant tissue culture Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines	7	7
4	Pharmacognosy in various systems of medicine	10	10

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine. Introduction to secondary metabolites: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins		
5	Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs Plant Products: Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primarymetabolites: Carbohydrates: Acacia, Agar, Tragacanth, Honey Proteins and Enzymes : Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin). Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax Marine Drugs: Novel medicinal agents from marine sources	8	8
Total		45	45

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To acquire knowledge about different sources of crude drugs, qualitative parameters and their evaluation parameters.
CO2	To study Cultivation, Collection and importance of Conservation of medicinal plants.
CO3	To understand properties, methods of extraction, pharmaceutical and industrial applications of carbohydrates, lipids and proteins and their derived products.
CO4	To understand properties, methods of extraction, and systematic pharmacognostic study of crude drugs from Glycosides and Tannins.

Reference Books	
1.	"Trease and Evans' Pharmacognosy" By Trease, G.E. and Evans, W.C. WB Saunders Co.
2.	Text book of Pharmacognosy (TextBook) By C.K. Kokate, Purohit, Gokhlae
3.	Pharmacognosy and Phytochemistry (TextBook) By Mohammad Ali
4.	Pharmacognosy (TextBook) By Tyler, V.E., Brady, L.R. and Robbers, J.E.

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 4
Type of Course	Core Courses	
Prerequisite	23990202-T - PHARMACEUTICAL ORGANIC CHEMISTRY I – THEORY	
Course Objective	1. This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. 2. It also emphasizes on medicinal and other uses of organic compounds.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Stereo isomerism Optical isomerism –Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute	10	20
2	Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions	10	25
3	Heterocyclic compounds: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds /derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene	10	25
4	Synthesis, reactions and medicinal uses of following compounds /derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives	8	17
5	Reactions of synthetic importance Metal hydride reduction (NaBH ₄ and LiAlH ₄), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation	7	13
Total		45	100

Course Outcomes

At the end of this course, students will be able to:

CO1	To study the stereoisomerism & stereo chemical aspect of organic compounds
CO2	To achieve expertise about geometric isomerism. To ponder comprehension in nomenclature method for determination of geometric isomers. To gain dogma on stereoselective and stereospecific reactions. To extend knowledge about some heterocyclic rings and their preparations.
CO3	To acquire the knowledge of various heterocyclic compounds. To procure the insight about structure, preparation and reaction of various heterocyclic rings.
CO4	To understand the entire skeleton on mechanism of various name reactions.

Reference Books

1.	Organic Chemistry Vol-1 & 2 By I.L. Finar Pearson Publication
2.	A Textbook of Organic chemistry By Arun Bahl, B.S. Bahl S. Chand Publication
3.	Heterocyclic Chemistry By Raj K. Bansal New Age International Publishers
4.	Organic Chemistry By P. L. Soni Sultan Chand & Sons
5.	Heterocyclic Chemistry By T.L. Gilchrist Pearson Publication

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 4
Type of Course	Core Courses	
Prerequisite	23990301-T - PHARMACEUTICAL ORGANIC CHEMISTRY II – THEORY	
Course Objective	1. This subject is designed to impart fundamental knowledge on the structure chemistry and therapeutic value of drugs. 2. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. 3. The syllabus also emphasizes on chemical synthesis of important drugs under each class.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in relation to biological action , Drug metabolism Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects	10	20
2	Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters, Sympathomimetic agents, Adrenergic Antagonists, Alpha adrenergic blockers, Beta adrenergic blockers, Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: Sympathomimetic agents: SAR of Sympathomimetic agents, Adrenergic Antagonists:Alpha adrenergic blockers, Beta adrenergic blockers: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents <ul style="list-style-type: none"> Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*,Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol. Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline*, Phentolamine Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. Beta adrenergic blockers: SAR of beta blockers, Propranolol*,Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	10	25
3	Cholinergic neurotransmitters: Parasympathomimetic agents, Direct acting agents, Indirect acting/Cholinesterase inhibitors (Reversible & Irreversible):Cholinesterase reactivator:Cholinergic Blocking agents:Solanaaceous alkaloids and analogues, Synth	10	25

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<p>Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.</p> <p>Parasympathomimetic agents: SAR of Parasympathomimetic agents Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.</p> <p>Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorophate, Echothiophateiodide, Parathione, Malathion.</p> <p>Cholinesterase reactivator: Pralidoxime chloride.</p> <p>Cholinergic Blocking agents: SAR of cholinolytic agents Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.</p> <p>Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamideiodide, Ethopropazine hydrochloride.</p>		
4	Drugs acting on Central Nervous System, A. Sedatives and Hypnotics: Barbiturtes:Amides & imides:Alcohol & their carbamate derivatives:B. Antipsychotics, Phenothiazines:Ring Analogues of Phenothiazines:Fluro buterophenones:Benzamides:Beta amino keto	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<p>Drugs acting on Central Nervous System</p> <p>A. Sedatives and Hypnotics: Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem</p> <p>Barbiturtes: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital</p> <p>Miscellaneous:</p> <p>Amides & imides: Glutethimide.</p> <p>Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.</p> <p>Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.</p> <p>B. Antipsychotics Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.</p> <p>Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.</p> <p>Fluro buterophenones: Haloperidol, Droperidol, Risperidone.</p> <p>Beta amino ketones: Molindone hydrochloride.</p> <p>Benzamides: Sulpieride.</p> <p>C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action</p> <p>Barbiturates: Phenobarbitone, Methabarbital.</p> <p>Hydantoins: Phenytoin*, Mephenytoin, Ethotoin</p> <p>Oxazolidine diones: Trimethadione, Paramethadione</p> <p>Succinimides: Phensuximide, Methsuximide, Ethosuximide*</p> <p>Urea and monoacylureas: Phenacemide, Carbamazepine*</p> <p>Benzodiazepines: Clonazepam</p> <p>Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate</p>		
5	<p>Drugs acting on Central Nervous System</p> <p>General anesthetics: Inhalation anesthetics: Ultra short acting barbiturates: Dissociative anesthetics: Morphine and related drugs: Narcotic antagonists: Anti-inflammatory agents:</p>	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<p>Drugs acting on Central Nervous System</p> <p>General anesthetics:</p> <p>Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.</p> <p>Ultra short acting barbiturates: Methohexital sodium*, Thiomytal sodium, Thiopental sodium.</p> <p>Dissociative anesthetics: Ketamine hydrochloride. *Narcotic and non-narcotic analgesics</p> <p>Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.</p> <p>Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.</p> <p>Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone</p>		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the chemistry of drugs with respect to their pharmacological activity.
CO2	To understand the drug metabolic pathways, adverse effect and therapeutic value of drugs.
CO3	To know the Structural Activity Relationship (SAR) of different class of drugs
CO4	To impart fundamental knowledge on the structure chemistry and therapeutic value of drugs.
CO5	To impart fundamental knowledge on importance of physicochemical properties and metabolism of drugs

Reference Books

1.	Organic medicinal and Pharmaceutical Chemistry By Wilson and Giswold Lippincott Williams and Wilkins; 12th revised North American ed edition
2.	Foye's Principles of Medicinal Chemistry. By David A. Williams Lippincott Williams and Wilkins
3.	Medicinal Chemistry, Vol I to IV By Burger Wiley Interscience; a John Wiley and Sons Inc., Publication
4.	Introduction to principles of drug design By Smith and Williams CRC Press
5.	Pharmaceutical Sciences By Remington Lippincott Williams and Wilkins
6.	Extra pharmacopoeia By Martindale Pharmaceutical Press
7.	Organic Chemistry- Vol 2 By I.L. Finar Pearson Publication
8.	The Organic Chemistry of Drug Synthesis Vol 1-5 By Lednicer Wiley-Interscience
9.	Indian pharmacopoeia By Indian Pharmacopoeia Committee Delhi : Manager of Publications

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 4
Type of Course	Core Courses	
Prerequisite	19990112-T - PHARMACEUTICS - THEORY	
Course Objective	Upon completion of the course the student shall be able to 1. Understand various physicochemical properties of drug molecules in the designing the dosage forms 2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations 3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Colloidal dispersions Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.	7	7
2	Rheology Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus	10	10
3	Coarse dispersion Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.	10	10
4	Micromeritics Micromeritics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.	10	10
5	Drug stability	10	10

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention		
Total		47	47

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand physicochemical properties of drug and excipient molecules in designing the dosage forms.
CO2	To Distinguish the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
CO3	To Demonstrate use of physicochemical properties in evaluation of dosage forms.
CO4	To Understand physicochemical properties of drug molecules in formulation research and development.

Reference Books	
1.	Physical Pharmacy (TextBook) By Alfred Martin Peepee Publishers
2.	Tutorial Pharmacy By Cooper and Gunn's CBS Publishers and Distributors
3.	Pharmaceutical Calculations By Stocklosam J. Lea & Febiger, Philadelphia
4.	Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. (TextBook) By Liberman H.A, Lachman C, Marcel Dekkar Inc.
5.	Physical Pharmaceutics (TextBook) By Ramasamy C and ManavalanR. PharmaMed Press/BSP Books

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 4
Type of Course	Core Courses	
Prerequisite	23990101 - HUMAN ANATOMY AND PHYSIOLOGY I – THEORY	
Course Objective	Upon completion of the course the student shall be able to 1. Understand the pharmacological actions of different categories of drugs 2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels 3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases. 4. Observe the effect of drugs on animals by simulated experiments 5. Appreciate correlation of pharmacology with other bio medical sciences	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	General Pharmacology a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination.	8	8
2	General Pharmacology a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. b.Adverse drug reactions. c. Drug interactions (pharmacokinetic and pharmacodynamic) d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase,preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.	12	12
3	Pharmacology of drugs acting on peripheral nervous system a. Organization and function of ANS. b. Neurohumoral transmission,co-transmission and classification of neurotransmitters. c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). e. Local anesthetic agents. f. Drugs used in myasthenia gravis and glaucoma	10	10
4	Pharmacology of drugs acting on central nervous system	8	8

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. b. General anesthetics and pre-anesthetics. c. Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics e. Alcohols and disulfiram		
5	Pharmacology of drugs acting on central nervous system	7	7
	a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. b. Drugs used in Parkinsons disease and Alzheimer’s disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence		
Total		45	45

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To study the gather knowledge of Understand the pharmacological actions of different categories of drugs.
CO2	The understand the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
CO3	To acquire the knowledge of the basic pharmacological knowledge in the prevention and treatment of various diseases.
CO4	To study Observe the effect of drugs on animals by simulated experiments.
CO5	To Appreciate correlation of pharmacology with other bio medical sciences.

Reference Books	
1.	Pharmacology & Pharmacotherapeutics (TextBook) By RS Satoskar, SD Bhandakar & Nirmala N Rege
2.	Essential of Medical Pharmacology (TextBook) By KD Tripathi
3.	Basic and clinical Pharmacology (TextBook) By Bertram G Katzung

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 4
Type of Course	Core Courses	
Prerequisite	19990216-T - PHARMACY LAW AND ETHICS	
Course Objective	This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Drugs and Cosmetics Act, 1940 and its rules 1945: Objectives, Definitions, Legal definitions of schedules to the Act and Rules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties. Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license	10	20
2	Drugs and Cosmetics Act, 1940 and its rules 1945. Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts,Licensing authorities, controlling authorities, Drugs Inspectors	10	25
3	Pharmacy Act –1948: Medicinal and Toilet Preparation Act –1955: Narcotic Drugs and Psychotropic Substances Act-1985 and Rules: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties Objectives, Definitions,Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties. Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties	10	25
4	Study of Salient Features of Drugs and Magic Remedies Act and its rules: Prevention of Cruelty to animals Act-1960: National Pharmaceutical Pricing Authority:	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)		
5	Pharmaceutical Legislations Code of Pharmaceutical Ethics A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee <ul style="list-style-type: none"> • Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath • Medical Termination of Pregnancy Act • Right to Information Act • Introduction to Intellectual Property Rights (IPR) 	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To generalize the Pharmaceutical legislations related to import and manufacturing of drug with reference to Drug and cosmetic act 1940.
CO2	To study Pharmaceutical legislations related to selling, labelling and packaging of drug with reference to Drug and cosmetic act 1940 including the detail of regulatory authorities
CO3	To acquire the knowledge of Indian Pharmaceutical acts including Pharmacy council of India constitution.
CO4	To generalize regulations related to licensing procedure for manufacturing of medicinal and toilet preparations and narcotic and psychotropic substances.
CO5	To understand about regulations related to magic remedies, prevention of cruelty to animals, and price control of bulk drug and their formulations.
CO6	To study code of ethics of the pharmaceutical practice, Intellectual property rights and Medical termination of pregnancy.

Reference Books

1.	Forensic Pharmacy (TextBook) By B. Suresh 123 Birla Publication Pvt. Ltd
2.	A text book of Forensic Pharmacy By N.K. Jain Vallabh Prakashan
3.	Hand book of drug law By M.L. Mehra
4.	Text book of Forensic Pharmacy By B.M. Mithal Paperback Publication
5.	Drugs and Cosmetics Act/Rules Govt. of India publications
6.	Medicinal and Toilet preparations act 1955 Govt. of India publication
7.	Narcotic drugs and psychotropic substances act (TextBook) Govt. of India publications
8.	Drugs and Magic Remedies act Govt. of India publications
9.	Bare Acts of the said laws published Government. Reference books

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 5
Type of Course	Core Courses	
Prerequisite	23990501-T - MEDICINAL CHEMISTRY II – THEORY	
Course Objective	1. Helps in correlating between pharmacology of a disease and its mitigation or cure. 2. To write the chemical synthesis of some drugs. 3. To know the structural activity relationship of different class of drugs. 4. Knowledge about the mechanism pathways of different class of medicinal compounds. 5. To acquire knowledge about the chemotherapy for cancer. 6. To understand the chemistry of drugs with respect to their pharmacological activity.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Antihistaminic agents, H1-antagonists, H2-antagonists, Gastric Proton pump inhibitors, Anti-neoplastic agents, Alkylating agents, Antimetabolites, Antibiotics, Plant products, Miscellaneous Histamine, receptors and their distribution in the human body, Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium Cimetidine*, Famotidine, Ranitidine. Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole Meclorothamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepea Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin Etoposide, Vinblastin sulphate, Vincristin sulphate Cisplatin, Mitotane.	10	23
2	Anti-anginal, Vasodilators, Calcium channel blockers, Diuretics, Carbonic anhydrase inhibitors, Thiazides, Loop diuretics, Potassium sparing Diuretics, Osmotic Diuretics, Anti-hypertensive Agents, Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine. Acetazolamide*, Methazolamide, Dichlorphenamide. Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, Furosemide*, Bumetanide, Ethacrynic acid. Spironolactone, Triamterene, Amiloride. Mannitol Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.	10	24
3	Anti-arrhythmic Drugs, Anti-hyperlipidemic agents, Coagulant & Anticoagulants, Drugs used in Congestive Heart Failure Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide hydrochloride, Amiodarone, Sotalol. Clofibrate, Lovastatin, Cholesteramine and Cholestipol Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel Digoxin, Digitoxin, Nesiritide, Bosentan, Tezoseentan	10	23
4	Drugs acting on Endocrine system, Sex hormones, Drugs for erectile dysfunction, Oral contraceptives, Corticosteroids, Thyroid and antithyroid drugs, Nomenclature, Stereochemistry and metabolism of steroids Testosterone, Nandralone, Progesterones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol. Sildenafil, Tadalafil. Mifepristone, Norgestrel, Levonorgestrol Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.	8	17
5	Antidiabetic agents, Sulfonyl ureas, Biguanides, Thiazolidinediones, Glucosidase inhibitors, Local Anesthetics, Benzoic Acid derivatives, Amino Benzoic acid derivatives, Lidocaine/Anilide derivatives, Miscellaneous,	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Insulin and its preparations Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Metformin. Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Acarbose, Voglibose. SAR of Local anesthetics Cocaine, Hexylcaine, Mepylcaine, Cyclomethycaine, Piperocaine. Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate. Lignocaine, Mepivacaine, Prilocaine, Etidocaine. Phenacaine, Diperoxon, Dibucaine.		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the drugs including classification, nomenclature, SAR, mechanism of action, Synthesis and adverse effects of Antihistaminic drugs.
CO2	To understand about Anti-anginal, Diuretics and Anti-hypertensive Agents
CO3	To acquire knowledge about drugs including classification, nomenclature SAR, mechanism of action of Anti-arrhythmic drugs, anti-hyperlipidemic agents & drugs used in congestive heart failure
CO4	To study about effects of drugs acting on Endocrine system, Sex hormones, erectile dysfunction, Oral contraceptives & Corticosteroids.
CO5	To acquire knowledge about effects of Antidiabetic agents and Local Anesthetics agents

Reference Books	
1.	Burger's Medicinal Chemistry, Vol I to IV. By Donald J. Abraham, David P. Rotella Wiley-Blackwell
2.	Foye's Principles of Medicinal Chemistry. By David A. Williams Lippincott Williams and Wilkins
3.	Indian pharmacopoeia By Indian Pharmacopoeia Committee Delhi : Manager of Publications
4.	Introduction to principles of drug design By H. John Smith, Hywel Williams CRC Press
5.	Martindale's extra pharmacopoeia. By William Martindale, Wynn Westcott Pharmaceutical Press
6.	Organic Chemistry Volume- II By I.L. Finar (3rd.ed.) Longmans Green & Co. 1964
7.	Remington's Pharmaceutical Sciences By Arthur Osol And John E. Hoover Mack. Publishing Co
8.	The Organic Chemistry of Drug Synthesis, Vol. 1-5. By Daniel Lednicer, Lester A. Mitscher Wiley-Blackwell
9.	Vogel's text book of Practical Organic Chemistry By A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith Pearson Education
10.	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry By John M Beale, John Block Lippincott Williams and Wilkin

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 5
Type of Course	Core Courses	
Prerequisite	23990404-T - PHARMACOLOGY I – THEORY	
Course Objective	1. Students would have understood the mechanism of drug action and its relevance in the treatment of different diseases 2. They would be trained with isolation of different organs/tissues from the laboratory animals by simulated experiments 3. They would have observed the various receptor actions using isolated tissue preparation 4. Students would appreciate the correlation of pharmacology with related medical sciences 5. They would have understood the cell communication mechanism 6. They would appreciate the newer targets of several disease conditions for treatment.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Pharmacology of drugs acting on cardio vascular system a) Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure b) Anti-hypertensive drugs. c) Anti-anginal drugs. d) Anti-arrhythmic drugs. e) Anti-hyperlipidemic drugs.	10	23
2	Pharmacology of drugs acting on cardio vascular system 1. Pharmacology of drugs acting on cardio vascular system a) Drug used in the therapy of shock. b) Hematinics, coagulants and anticoagulants. c) Fibrinolytics and anti-platelet drugs d) Plasma volume expanders 2. Pharmacology of drugs acting on urinary system a) Diuretics b) Anti-diuretics	10	23
3	Autocoids and related drugs Autocoids and related drugs a) Introduction to autocoids and classification b) Histamine, 5-HT and their antagonists. c) Prostaglandins, Thromboxanes and Leukotrienes. d) Angiotensin, Bradykinin and Substance P. e) Non-steroidal anti-inflammatory agents f) Anti-gout drugs g) Antirheumatic drugs	10	24
4	Pharmacology of drugs acting on endocrine system	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Pharmacology of drugs acting on endocrine system a) Basic concepts in endocrine pharmacology. b) Anterior Pituitary hormones- analogues and their inhibitors. c) Thyroid hormones- analogues and their inhibitors. d) Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. e) Insulin, Oral Hypoglycemic agents and glucagon. f) ACTH and corticosteroids.		
5	Pharmacology of drugs acting on endocrine system Pharmacology of drugs acting on endocrine system a) Androgens and Anabolic steroids. b) Estrogens, progesterone and oral contraceptives. c) Drugs acting on the uterus. 6. Bioassay a) Principles and applications of bioassay. b) Types of bioassay c) Bioassay of insulin, oxytocin, vasopressin, ACTH, d tubocurarine, digitalis, histamine and 5-HT	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the pharmacological actions of different categories of drugs
CO2	To study in detailed about mechanism of drug action at organ system/sub cellular/ macromolecular levels
CO3	To understand the application of basic pharmacological knowledge in the prevention and treatment of various diseases.
CO4	To observed the effect of drugs on animals by simulated experiments

Reference Books	
1.	Essential of Medical Pharmacology (TextBook) By KD Tripathi
2.	Pharmacology & Pharmacotherapeutics (TextBook) By RS Satoskar, SD Bhandakar & Nirmala N Rege
3.	Goodman's & Gilman's the pharmacological basis of therapeutics (TextBook)

List of Practical

1.	Introduction to in-vitro pharmacology and physiological salt solutions.
2.	Effect of drugs on isolated frog heart
3.	Effect of drugs on blood pressure and heart rate of dog.
4.	Study of diuretic activity of drugs using rats/mice.
5.	DRC of acetylcholine using frog rectus abdominis muscle.
6.	Effect of physostigmine and atropine on DRC of acetylcholine using frog
7.	Bioassay of histamine using guinea pig ileum by matching method.
8.	Bioassay of oxytocin using rat uterine horn by interpolation method.
9.	Bioassay of serotonin using rat fundus strip by three point bioassay.
10.	Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11.	Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
12.	Determination of PD ₂ value using guinea pig ileum
13.	Effect of spasmogens and spasmolytics using rabbit jejunum
14.	Anti-inflammatory activity of drugs using carrageenan induced paw edema model
15.	Analgesic activity of drug using central and peripheral methods

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 5
Type of Course	Core Courses	
Prerequisite	23990305-T - PHARMACOGNOSY AND PHYTOCHEMISTRY I - THEORY	
Course Objective	1. This course is one of the most advanced introductions in Herbal Medicines that is offered. Will learn and get experience about 2. Herbs, and their Science. 3. Classification of Medicinal Plants, Phytochemistry, Carbohydrates, Lipids, Terpenes, Polyphenols, Alkaloids, 4. Pharmacology, Toxicity, Formulations and Preparations of Herbal Medicines. 5. How herbs influence our physiology and can be helpful against several disorders. 6. Relations between Phyto-therapy and the Elderly, Phytotherapy and Children, Understanding Herbal Action, and Understanding the Materia Medica. 7. The recognition of medicinal plants, identification of adulteration and Contamination. Ethnobotany & Ethnopharmacology in drug discovery process. 8. DNA Fingerprinting.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Metabolic pathways in higher plants and their determination 1. Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. 2. Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	7	15
2	General introduction, composition, chemistry & chemical classes, bio-sources, therapeutic uses and commercial applications of following secondary metabolites Alkaloids: Vinca, Rauwolfia, Belladonna, Opium, Phenyl propanoids and Flavonoids: Lignans, Tea, Ruta Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis Volatiles: Mentha, Clove, Cinnamon, Fennel, Coriander, Tannins: Catechu, Pterocarpus Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony Glycosides: Senna, Aloes, Bitter Almond Iridoids, Other terpenoids & Naphtha quinones: Gentian, Artemisia, taxus, carotenoids	14	31
3	Isolation, Identification and Analysis of Phytoconstituents 1. Terpenoids: Menthol, Citral, Artemisin 2. Glycosides: Glycyrrhetic acid & Rutin 3. Alkaloids: Atropine, Quinine, Reserpine, Caffeine 4. Resins: Podophyllotoxin, Curcumin	6	14
4	Industrial production, estimation and utilization of the following phytoconstituents Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine	10	24
5	Basics of Phytochemistry Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.	8	18
Total		45	102

Course Outcomes

At the end of this course, students will be able to:

CO1	To understand various secondary metabolites and metabolic pathways.
CO2	To understand and carryout isolation and purification of phytoconstituents.
CO3	To understand the industrial production of crude drugs.
CO4	To understand the basics of Phytochemicals.

Reference Books

1.	Trease and Evans Pharmacognosy, By W. C. Evans 16th Edition, W.B. Saunders & Co., London, 2009
2.	Pharmacognosy and Phytochemistry, By Mohammad Ali. CBS Publishers & Distribution, New Delhi.
3.	Rangari, V.D., Text book of Pharmacognosy and Phytochemistry By Vol. I , Carrier Pub., 200
4.	Herbal drug industry By R.D. Choudhary
5.	Essentials of Pharmacognosy By Dr.SH.Ansari
6.	Herbal Cosmetics By H.Pande Asia Pacific Business press, Inc, New Delhi
7.	Plant cell Biotechnology, By R Endress, Springer-Verlag, Berlin, 1994.
8.	Textbook of Industrial Pharmacognosy By A.N. Kalia, CBS Publishers, New Delhi, 2005
9.	Pharmacognosy & Pharmacobiotechnology By by James E. Robbers, Marilyn Speedie, Varo E. Tyler Lippincott Williams and Wilkins
10.	Remington's Pharmaceutical Sciences By Arthur Osol And John E. Hoover Mack. Publishing Co
11.	Text Book of Biotechnology By Vyas S. P and Dixit V. K. CBS
12.	Text Book of Biotechnology By R.C. Dubey. S. Chand Publishing

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 5
Type of Course	Core Courses	
Prerequisite	23990504-T - PHARMACEUTICAL MICROBIOLOGY – THEORY	
Course Objective	1. Students will be able to acquire, articulate, retain and apply specialized language and knowledge relevant to microbiology. 2. Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis. 3. Students will communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing. 4. Students will demonstrate isolation of and identification of microbes. 5. Students can able to design microbiology laboratory considering all the aspects of safety 6. Students will acquire knowledge about validating the microbiological equipment and reporting the observations	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction, history of microbiology Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.	10	24
2	Identification of bacteria using staining techniques Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators	10	23
3	Study of morphology Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.	10	23
4	Designing of aseptic area, laminar flow equipment Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.	8	17
5	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products,	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To identify and theories the knowledge of various microorganisms with its nutritional requirements, preparation and preservation for pure culture, cultivation and quantitative measurement of it using various microscopy
CO2	To detect various microorganisms using staining technique and carry out the knowledge of it for various sterilization methods in pharmaceutical processing and industries
CO3	To explain and specify the Microbial spoilage , animal cell culture technology and using it for stability of various pharmaceutical products
CO4	To integrate the sterilization methods, equipments and its validation
CO5	To extrapolate Fungi, Viruses and disinfectants, and organise sterility testing of pharmaceutical products.
CO6	To plan of Aseptic area and Interpret the different test of microbiological assays

Reference Books	
1.	Burrows Textbook of Microbiology (TextBook) By Bob A freeman W.B. Saunders 21, Pub. Year 1979
2.	A Text Book of Medical Microbiology (TextBook) By Anathanarayana & Panikar
3.	Anathanarayana & Panikar Medical Microbioloty (TextBook)
4.	A Text Book of Microbiology By P. Chakraborty

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 5
Type of Course	Core Courses	
Prerequisite	23990103-T - PHARMACEUTICS I –THEORY	
Course Objective	1. Students will understand the various techniques used in modern biotechnology. 2. Students can design research strategy with step-by-step instructions to address a research problem 3. Students can able to provide examples of current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, andForensic 4. Students can explain the concept and application of monoclonal antibody Technology 5. Students can demonstrate and Provide examples on how to use microbes and mammalian cells for the production of pharmaceutical products 6. Students can able to explain the general principles of generating transgenic plants, animals and microbes	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction to Biotechnology <ol style="list-style-type: none"> Brief introduction to Biotechnology with reference to Pharmaceutical Science Enzyme Biotechnology- Methods of enzyme immobilization and applicatio Biosensors- Working and applications of biosensors in Pharmaceutical Industrie Brief introduction to Protein Engineering. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering. 	10	23
2	Recombinant DNA technology <ol style="list-style-type: none"> Study of cloning vectors, restriction endonucleases and DNA ligase. Recombinant DNA technology. Application of genetic engineering in medicine. Application of r DNA technology and genetic engineering in the production of: <ol style="list-style-type: none"> Interferon Vaccines- hepatitis- B Hormones-Insulin. Brief introduction to PCR 	10	23
3	.	10	23

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Types of immunity- humoral immunity, cellular immunity 1. Structure of Immunoglobulins 2. Structure and Function of MHC 3. Hypersensitivity reactions, Immune stimulation and Immune suppressi 4. General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. 5. Storage conditions and stability of official vaccines 6. Hybridoma technology- Production, Purification and Applications Blood products and Plasma Substitutes.		
4	1. Immuno blotting techniques- ELISA, Western blotting, Southern blotting. 2. Genetic organization of Eukaryotes and Prokaryotes 3. Microbial genetics including transformation, transduction, conjugation, plasmids and tra 4. Introduction to Microbial biotransformation and applications 5. Mutation: Types of mutation/mutants.	8	17
5	1. Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. 2. Large scale production fermenter design and its various c 3. Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, 4. Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.	7	13
Total		45	99

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand basic Introduction of scope, Potential and achievements in biotechnology.
CO2	Understand the New concepts of Biotechnology, Genetic engineering techniques and recombinant DNA technology.
CO3	Study the examples of biotechnology derived products and transgenic animals, cryopreservation and germplasm storage.
CO4	Understand and Study steps involved in monoclonal antibody production, enzyme technology and fermentation technology.

Reference Books

1.	Molecular Biotechnology: Principles and Applications of Recombinant DNA By B.R. Glick and J.J. Pasternak: ASM Press Washington D.C.
2.	Kuby Immunology By Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis Immunology Kuby W H Freeman & Co
3.	Monoclonal Antibodies. By J.W. Goding Academic Press
4.	Molecular Biology and Biotechnology By J.M. Walker and E.B. Gingold: Royal Society of Chemistry.
5.	Immobilized Enzymes (TextBook) By Zaborsky CRC Press, Degraland, Ohio.
6.	Molecular Biotechnology (TextBook) By S.B. Primrose Blackwell Scientific Publication. 2nd Edition
7.	Principles of fermentation technology, (TextBook) By Stanbury F., P., Whitakar A., and Hall J., S., Aditya books Ltd., New Delhi 2nd edition

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 6
Type of Course	Core Courses	
Prerequisite	23990501-T - MEDICINAL CHEMISTRY II – THEORY	
Course Objective	1. They would able to develop an understanding of the physico-chemical properties of drugs. 2. Students able to understand how current drugs were developed by using pharmacophore modeling and docking technique. 3. They acquire knowledge in the chemotherapy for cancer and microbial diseases and different anti-viral agents. 4. They acquire knowledge about the mechanism pathways of different class of medicinal compounds. 5. They have been introduced to a variety of drug classes and some pharmacological properties. 6. They acquire knowledge on thrust areas fir further research	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Antibiotics , β-Lactam antibiotics: Aminoglycosides: Tetracyclines: Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams Streptomycin, Neomycin, Kanamycin, Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline	10	23
2	Antibiotics, Macrolide, Miscellaneous, Antimalarial, Quinolines, Biguanides and dihydro triazine Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. Erythromycin Clarithromycin, Azithromycin. Chloramphenicol*, Clindamycin. Prodrugs: Basic concepts and application of prodrugs design. Etiology of malaria. Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil. Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovoquone.	10	24
3	Anti-tubercular Agents, Urinary tract anti-infective agents, Quinolones, Antiviral agents, Synthetic antitubercular agents: Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Antitubercular antibiotics: Rifampicin, Rifabutin, Cycloserine, Streptomycin, Capreomycin sulphate. Urinary tract anti-infective agents. Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin. Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine. Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.	10	23
4	Antifungal agents, Antifungal antibiotics, Anthelmintic, Sulphonamides and Sulfones,	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*. Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin. Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine. Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole. Sulfones: Dapsone*		
5	Introduction to Drug Design, Combinatorial Chemistry	7	13
	Introduction to Drug Design, Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. Combinatorial Chemistry: Concept and applications of combinatorial chemistry: solid phase and solution phase synthesis		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To acquire knowledge on β -lactam antibiotics, aminoglycosides, tetracyclines, macrolide and miscellaneous antibiotics.
CO2	To understand detailed dogma about antitubercular agents, Urinary tract anti-infective agents and Antiviral agents.
CO3	To Extrapolate history and development and entire skeleton about Antifungal agents, Antiprotozoal agents, Anthelmintics, Sulphonamides and sulphones and Antimalarial agents.
CO4	To study in a detailed about drug design and combinatorial chemistry.

Reference Books	
1.	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry By John M Beale, John Block Lippincott Williams and Wilkin
2.	Foye's Principles of Medicinal Chemistry. By David A. Williams Lippincott Williams and Wilkins
3.	Burger's Medicinal Chemistry, Vol I to IV. By Donald J. Abraham, David P. Rotella Wiley-Blackwell
4.	Introduction to principles of drug design By H. John Smith, Hywel Williams CRC Press
5.	Remington's Pharmaceutical Sciences By Arthur Osol And John E. Hoover Mack. Publishing Co
6.	Martindale's extra pharmacopoeia. By William Martindale, Wynn Westcott Pharmaceutical Press
7.	Organic Chemistry Volume- II By I.L. Finar (3rd.ed.) Longmans Green & Co. 1964

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 6
Type of Course	Core Courses	
Prerequisite	23990602-T - PHARMACOLOGY III – THEORY	
Course Objective	1. Students would have studied elaborately on mechanism of drug action and its relevance in the treatment of different infectious diseases 2. They comprehended the principles of toxicology and treatment of various poisonings 3. They came across the methods of toxicity studies 4. They studied about symptoms of several poisonings 5. They studied about treatment of several poisonings 6. Students understood the toxicity profile of each drugs	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Pharmacology of drugs acting on Respiratory system <ol style="list-style-type: none"> Anti -asthmatic drugs Drugs used in the management of COPD Expectorants and antitussives d. Nasal decongestants Respiratory stimulants Pharmacology of drugs acting on the Gastrointestinal Tract <ol style="list-style-type: none"> Antiulcer age Drugs for constipation and diarrhoea. Appetite stimulants and suppressa Digestants and carminative Emetics and anti-emetics. 	10	23
2	Chemotherapy <ol style="list-style-type: none"> General principles of chemotherapy. Sulfonamides and cotrimoxazole. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminogl ycosides	10	23
3	Chemotherapy <ol style="list-style-type: none"> Antitubercular agents Antileprotic agents Antifungal agents Antiviral drugs Anthelmintics Antimalarial drugs Antiamoebic agent 	10	24
4	Chemotherapy	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	1. Urinary tract infections and sexually transmitted disease 2. Chemotherapy of malignancy. Immunopharmacology 1. Immunostimulants 2. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars		
5	Principles of toxicology 1. Definition and basic knowledge of acute, subacute and chronic toxicity. 2. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity 3. General principles of treatment of poisoning 4. Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning. Chronopharmacology 1. Definition of rhythm and cycle Biological clock and their significance leading to chronotherapy.	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the pharmacology of Respiratory drugs & Gastrointestinal Tract
CO2	To Extrapolate the mechanism of drug action at organ system.
CO3	To acquire the knowledge of the basic pharmacological knowledge in the prevention and treatment of chemotherapy.
CO4	To study the effect of drugs on animals by simulated experiments.
CO5	To study correlation of pharmacology with other bio medical sciences & toxicology

Reference Books	
1.	Essential of Medical Pharmacology (TextBook) By KD Tripathi
2.	Goodman's & Gilman's the pharmacological basis of therapeutics (TextBook)
3.	Pharmacology & Pharmacotherapeutics (TextBook) By RS Satoskar, SD Bhandakar & Nirmala N Rege
4.	Basic and clinical Pharmacology (TextBook) By Bertram G Katzung

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 6
Type of Course	Core Courses	
Prerequisite	23990305-T - PHARMACOGNOSY AND PHYTOCHEMISTRY I - THEORY	
Course Objective	<p>1. The aim of the degreecourse is to provide graduates with a good knowledge of the basic and applied know-how and professional skills in Herbal drug Science and Technology and the necessary training for admission to the postgraduate courses in this field.</p> <p>2. They will acquire operative know-how and be able to carry out technical and management tasks and professional activities in the areas of transformation of medicinal herbs, management of the quality of the processes, marketing of medicinal plants and derivatives for use in herbal, food and cosmetic products, Guaranteeing conformity with the national and EU laws in force.</p> <p>3. At the end of the course, the graduate will have acquired the following knowledge and skills: The recognition, collection and preservation of medicinal plants. Analyses and dosage of active ingredients. The biological effects of medicinal plants. The toxicological aspects of active ingredients and finished products.</p>	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Herbs as raw materials, Biodynamic Agriculture, Indian Systems of Medicine Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation, Source of Herbs, Selection, identification and authentication of herbal materials, Processing of herbal raw material, Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/ Bioinsecticides. Indian Systems of Medicine a. Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy b. Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.	11	15
2	Nutraceuticals, Herbal-Drug and Herb-Food Interactions Nutraceuticals General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina. Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.	7	31
3	Herbal Cosmetics, Herbal excipients, Herbal formulations	10	14

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<p>Herbal Cosmetics Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.</p> <p>Herbal excipients: Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.</p> <p>Herbal formulations : Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes.</p>		
4	<p>Evaluation of Drugs, Patenting and Regulatory requirements of natural products, Regulatory Issues</p> <p>Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.</p> <p>Patenting and Regulatory requirements of natural products: a. Definition of the terms: Patent, IPR, Farmers right, Breeder’s right, Bioprospecting and Biopiracy b. Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.</p> <p>Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drug & Cosmetics Act for ASU drugs.</p>	10	24
5	<p>General Introduction to Herbal Industry, Schedule T – Good Manufacturing Practice of Indian systems of medicine</p> <p>General Introduction to Herbal Industry Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.</p> <p>Schedule T – Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.</p>	7	18
Total		45	102

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand raw material as source of herbal drugs from cultivation to herbal drug product and traditional systems of medicines
CO2	To study the herbal cosmetics, natural sweeteners and nutraceuticals and formulations of each.
CO3	To Extrapolate the WHO and ICH guidelines for evaluation of herbal drugs
CO4	To acquire the knowledge about patenting of herbal drugs & GMP

Reference Books	
1.	Herbal Cosmetics By H.Pande Asia Pacific Business press, Inc, New Delhi
2.	Herbal drug industry By R.D. Choudhary

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 6
Type of Course	Core Courses	
Prerequisite	23990103-T - PHARMACEUTICS I –THEORY	
Course Objective	1. To understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance. 2. To use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination. 3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance. 4. To understand various pharmacokinetic parameters, their significance & applications.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction to Biopharmaceutics Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non per oral extra-vascular routes, Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs	10	23
2	Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.	10	23
3	Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. a) Intravenous Injection (Bolus) b) Intravenous infusion and c) Extra vascular administrations. Pharmacokinetics parameters - KE , $t_{1/2}$, V_d , AUC , K_a , Cl_t and CLR definitions methods of eliminations, understanding of their significance and application	10	23
4	Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
5	Nonlinear Pharmacokinetics: a) Introduction b) Factors causing Non-linearity. c) Michaelis-menton method of estimating parameters. Explanation with example of drugs	7	13
Total		45	99

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand the concept of ADME of drug in human body
CO2	Determine the various pharmacokinetic parameters from either plasma concentration or urinary excretion data for drug
CO3	To acquire the knowledge of Indian Pharmaceutical acts including Pharmacy council of India constitution
CO4	Apply the various regulations related to developing BA-BE study protocol for the new drug molecule

Reference Books	
1.	“Introduction to the principles of Drug Design By Smith HJ, Williams H, eds, Wright Boston
2.	A text book of Forensic Pharmacy (TextBook) By N.K. Jain Vallabh Prakashan
3.	Anatomy and Physiology By Smout and Mcdowell
4.	Bentley’s Text Book of Pharmaceutics, By E.A. Rawlins, English Language Book Society, Elsevier Health Sciences, USA
5.	Encyclopedia of Bioprocess Technology. By Flickinger, M. C. and Drew, S. W. Wiley- Interscience, New Jersey. (1999).

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 6
Type of Course	Core Courses	
Prerequisite	23990103 - PHARMACEUTICS I –THEORY	
Course Objective	1. After successful completion of the course student will be able to understand the various drug delivery system and its mechanisms. 2. Students will learn advanced drug delivery system early stage. 3. Developing a preparation of the drug which is both stable and acceptable to the patient. 4. They know very well about orally administered drugs, injectables, aerosol and semisolid preparations with standard protocols. 5. Formulated drugs are stored in a suitable container closure system for extended periods of time. 6. Also they know the stability study and its standard evaluation procedure for better storage condition	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Preformulation Studies Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. 1. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism 2. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.	7	13
2	Tablets Tablets: 1. Introduction, ideal characteristics of tablets, classification of table Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. 2. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. 3. Quality control tests: In process and finished product tests Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia	10	23
3	Capsules	8	17

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<p>Capsules: a) Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. b) Soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets</p>		
4	<p>Parenteral Products</p> <p>Parenteral Products:</p> <p>a) Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity</p> <p>b) Production procedure, production facilities and controls, aseptic processing</p> <p>c) Formulation of injections, sterile powders, large volume parenterals and lyophilized products.</p> <p>d) Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.</p> <p>Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations</p>	10	24
5	<p>Cosmetics</p> <p>Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.</p> <p>Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.</p> <p>Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.</p>	10	23
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand preformulation studies of tablets and capsule
CO2	Understand the knowledge to formulate, evaluate and label of tablets and capsules
CO3	To study the labels to suit regulatory requirements
CO4	To understand the survey and report its finding.

Reference Books

1.	Pharmaceutical Dosage forms, Tablets Volume-1 to 3 (TextBook) By Liberman H.A, Lachman C., MarcelDekkar Inc.
2.	Pharmaceutical Dosage forms, Parenteral medication, Volume-1 & 2 (TextBook) By Liberman H.A, Lachman C., MarcelDekkar Inc.
3.	Pharmaceutical Dosage forms. Disperse systems, volume 1 (TextBook) By Liberman H.A, Lachman C, Marcel Dekkar Inc.
4.	Modern Pharmaceutics By Gilbert S. Banker & C.T. Rhodes 3rd Edition
5.	Remington: The Science and Practice of Pharmacy, Pharmaceutical Science (RPS) 20th edition
6.	Theory and Practice of Industrial Pharmacy (TextBook) By Liberman H.A, Lachman C., MarcelDekkar Inc.
7.	Pharmaceutics- The science of dosage form design By M.E.Aulton, Churchill livingstone, Latest edition
8.	Introduction to Pharmaceutical Dosage Forms By H. C.Ansel, Lea &Febiger, Philadelphia 5thedition, Pub. Year 2005
9.	Drug stability - Principles and practice By Cartensen & C.J. Rhodes, Marcel Dekker Series, 3rd Edition



Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 7
Type of Course	Core Courses	
Prerequisite	23990701-T - INSTRUMENTAL METHODS OF ANALYSIS – THEORY	
Course Objective	<p>The student will learn to</p> <ol style="list-style-type: none"> 1. The basic theoretical knowledge of the instrumentation techniques available. 2. Theoretically understand the aspects of separation for multi components. 3. Practical skills for the analysis of drugs and excipients using various instrumentation techniques. 4. They able to make accurate analysis and report the results in defined formats. 5. They learn documentation and express the observations with clarity. 6. They understand the professional and safety responsibilities for working in the analysis laboratory. 	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	UV Visible spectroscopy & Fluorimetry Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications - Spectrophotometric titrations, Single component and multi component analysis .Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications	10	23
2	Spectroscopy Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications -Principle, interferences, instrumentation and applications. Principle, interferences, instrumentation and applications .Principle, instrumentation and applications	10	24
3	Introduction to chromatography Methodology, advantages, disadvantages and applications. Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications. Introduction, methodology, development techniques, advantages, disadvantages and applications ,Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications	10	23
4	GC & HPLC Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications Introduction, theory,instrumentation, advantages and application.	8	17
5	Chromatography	7	13



Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications Introduction, theory, instrumentation and applications Introduction, theory, instrumentation and applications		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To interpret fundamentals, Instrumentation, Working & use of UV and Fluorimetry.
CO2	To generalize fundamentals, Instrumentation, Working & use of different chromatographic techniques, and atomic absorption spectroscopy, Nepheloturbidometry and IR and Flame Photometry.
CO3	To extrapolate basic principle, Instrumentation, Working & factor affecting separation & applications of different types of Electrophoresis and TLC, Paper, Column and Gas chromatography.
CO4	To recall and transform basic principle, Instrumentation and Application of HPLC, Ion exchange, Gel and Affinity chromatography.

Reference Books	
1.	Instrumental Methods of Chemical Analysis By B.K Sharma Krishna Prakashan Media
2.	Organic spectroscopy By Y.R Sharma S Chand
3.	Text book of Pharmaceutical Analysis (TextBook) By Kenneth A. Connors Wiley India Pvt. Limited, 2007
4.	Text Book of Quantitative Inorganic analysis (TextBook) By A.I. Vogel, London longmans, green & co., ltd.,
5.	Practical Pharmaceutical Chemistry Vol I & II, By A.H. Beckett & J. B. Stenlake's, Stahlone Press of University of London
6.	Organic Chemistry Volume-I & II By I.L. Finar (3rd.ed.) Longmans Green & Co. 1964
7.	Organic spectroscopy By William Kemp Palgrave Macmillan, USA
8.	Quantitative Analysis of Drugs By Von D. C. Garrett in Zusammenarbeit mit L. Breal, C. A. Johnson, K. L. Smith und G. Sykes. 3. Ausgabe, 925 Seiten. Chapman & Hall Ltd., London 1964
9.	Quantitative Analysis of Drugs in Pharmaceutical Formulations By P. D. Sethi CBS Publishers & Distributors
10.	Spectrophotometric identification of Organic Compounds By Robert M. Silverstein, Francis X. Webster Wiley; Sixth edition

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 7
Type of Course	Core Courses	
Prerequisite	23990702-T - INDUSTRIAL PHARMACYII – THEORY	
Course Objective	1. They know the various pharmaceutical dosage forms and their manufacturing techniques. 2. Students would able to know various considerations in development of pharmaceutical dosage forms 3. They able to formulate solid, liquid and semisolid dosage forms and evaluate them for their quality.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Pilot plant scale up techniques General considerations-including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology	10	23
2	Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues	10	23
3	Regulatory affairs Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals. Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies	10	23
4	Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP	8	17
5	Indian Regulatory Requirements	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs		
Total		45	99

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Know the process of pilot plant and scale up of pharmaceutical dosage forms.
CO2	Understand the process of technology transfer from lab scale to commercial batch.
CO3	Know different Laws and Acts that regulate pharmaceutical industry.
CO4	Understand the approval process and regulatory requirements for drug products.

Reference Books	
1.	Industrial Pharmacy - II (TextBook) By By: Kosika Sandeep (Author) Publisher: Notion Press
2.	“Introduction to the principles of Drug Design By Smith HJ, Williams H, eds, Wright Boston
3.	Theory and Practice of Industrial Pharmacy By Lachmann Lea& Febiger Publisher, The University of Michigan.
4.	Theory and Practice of Industrial Pharmacy By Lachmann

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 7
Type of Course	Core Courses	
Prerequisite	23990703-T - PHARMACY PRACTICE – THEORY	
Course Objective	1. Students will demonstrate knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative aspects, health policy and legal issues in the practice of pharmacy. 2. Students will use knowledge of drug distribution methods in hospital and apply it in the practice of pharmacy. 3. Students will effectively apply principles of drug store management and inventory control to medication use. 4. Students will provide patient-centered care to diverse patients using the best available evidence and monitor drug therapy of patient through medication chart review, obtain medication history interview and counsel the patients, identify drug related problems. 5. Students will engage in innovative activities by making use of the knowledge of clinical trials	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	hospital and its organizationsb) Hospital pharmacy and its organizationc) Adverse drug reactiond) Community Pharmacy Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non-clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions. Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists. Classifications- Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.	10	23
2	Drug distribution system in a hospitalb) Hospital formularyc) Therapeutic drug monitoringd) Medication adherencee) Patient medication history interview Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs. Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary. Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring. Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.Need for the patient medication history interview, medication interview forms. Financial, materials, staff, and infrastructure requirements.	10	24
3	Pharmacy and therapeutic committee b) Drug information services c) Patient counseling e) Prescribed medication order and communication skillsd) Education and training program in the hospital	10	23

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation. Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information. Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education. Prescribed medication order-interpretation and legal requirements, and Communication skills- communication with prescribers and patients.		
4	Budget preparation and implementation b) Clinical Pharmacy c) Over the counter (OTC) sales	8	17
	Budget preparation and implementation Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. Introduction and sale of over the counter, and Rational use of common over the counter medications		
5	Drug store management and inventory control b) Investigational use of drugs c) Interpretation of Clinical Laboratory Tests	7	13
	Organization of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. Blood chemistry, hematology, and urinalysis		
Total		45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	21	21	20	20	12

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

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Students will demonstrate knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative aspects, health policy and legal issues in the practice of pharmacy.
CO2	Students will use knowledge of drug distribution methods in hospital and apply it in the practice of pharmacy.
CO3	Students will effectively apply principles of drug store management and inventory control to medication use.
CO4	Students will provide patient-centered care to diverse patients using the best available evidence and monitor drug therapy of patient through medication chart review, obtain medication history interview and counsel the patients, identify drug related problems.
CO5	Students will engage in innovative activities by making use of the knowledge of clinical trials

Reference Books

1.	A Textbook of clinical pharmacy practice-essential concepts and skills (TextBook) By Parthasarathi G, Karin Nyfory Hansen, Milap C Nhata 1st, Pub. Year 2004
2.	Hospital pharmacy (TextBook) By William E. Hassan. 5th ed. Philadelphia: Lea & Febiger; 1986.
3.	textbook of hospital pharmacy (TextBook) By merchant S.H and Dr. J.S Quardy 4th, Pub. Year 2001

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 7
Type of Course	Core Courses	
Prerequisite	23990705-T - QUALITY ASSURANCE – THEORY	
Course Objective	Upon completion of the course the student shall be able to 1. understand the cGMP aspects in a pharmaceutical industry 2. appreciate the importance of documentation 3. understand the scope of quality certifications applicable to pharmaceutical industries 4. Understand the responsibilities of QA & QC departments.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Quality Assurance and Quality Management concepts Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP.Total Quality Management (TQM): Definition, elements, philosophies ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines Quality by design (QbD): Definition, overview, elements of QbD program, tools.ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration.NABL accreditation : Principles and procedures	10	23
2	Organization and personnel Organization and personnel: Personnel responsibilities, training, hygiene and personal records.Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.	10	23
3	Quality Control Quality Control: Quality control test for containers, rubber closures and secondary packing materials.Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles,Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities	10	24
4	Complaints Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records	8	17
5	Calibration and Validation	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation. Warehousing: Good warehousing practice, materials management		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To acquire and integret the responsibilities of QA & QC departments including TQM, ICH guidelines, ISO and QbD.
CO2	To extrapolate knowledge about cGMP aspects in a pharmaceutical industry
CO3	To transform knowledge about GLP in a pharmaceutical industry.
CO4	To identify and interpret knowledge about importance of documentation and to recognize the scope of quality certifications applicable to pharmaceutical industries

Reference Books	
1.	How to Practice GMP's By P P Sharma.
2.	ISO 9000 and Total Quality Management By Sadhank G Ghosh
3.	Good laboratory Practices By Marcel Deckker Series
4.	A guide to Total Quality Management By Kaushik Maitra and Sedan K Ghosh

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Courses	
Prerequisite		
Course Objective	Upon completion of the course the student shall be able to 1. Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment) 2. Know the various statistical techniques to solve statistical problems 3. Appreciate statistical techniques in solving the problems	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction: Statistics, Biostatistics, Frequency distribution Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical Problems Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples	10	13
2	Regression: Curve fitting by the method of least squares, fitting the lines $y = a + bx$ and $x = a + by$, Multiple regression, standard error of regression- Pharmaceutical Examples Probability: Definition of probability, Binomial distribution, Normal distribution Poisson's distribution, properties – problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA,(One way and Two way), Least Significance difference	10	23
3	Non Parametric tests: Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test Introduction to Research: Need for research, Need for design of Experiments Experiential Design Technique, plagiarism Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.	10	24
4	Blocking and confounding system for Two-level factorials Regression modeling: Hypothesis testing in Simple and Multiple regression models Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach	8	17
5	Design and Analysis of experiments:	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Factorial Design: Definition, 22, 23design. Advantage of factorial design Response Surface methodology: Central composite design, Historical design, Optimization Techniques		
Total		45	90

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand applying statistical methods to analyze biological and health-related data, research design and methodology.
CO2	To study the various statistical techniques to solve statistical problems in pharmaceuticals research and drug development technology
CO3	To understand about parametric and non parametric test with their application and research modeling in pharmacy
CO4	To study about various advance software of Industrial and Clinical Trials.
CO5	To study the design different factorial model and Response Surface methodology in pharmaceutical research and education

Reference Books	
1.	Pharmaceutical statistics- Practical and clinical applications, By Sanford Bolton publisher Marcel Dekker Inc. NewYork
2.	Fundamental of Statistics By S.C.Gupta Himalaya Publishing House
3.	BIOSTATISTICS AND RESEARCH METHODOLOGY (TextBook) By Dr. Ashok A. Hajare Nirali Prakashan, Pub. Year 2022

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Courses	
Prerequisite		
Course Objective	Upon completion of the course the student shall be able to 1. Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide 2. Have a critical way of thinking based on current healthcare development 3. Evaluate alternative ways of solving problems related to health and pharmaceutical issues	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Concept of health and disease, Social and health education, Sociology and health : <ul style="list-style-type: none"> Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick. Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health. Personal hygiene and health care; avoidable habits. 	10	23
2	Preventive medicine: <ul style="list-style-type: none"> General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, Chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse. 	10	23
3	National health programs, its objectives, functioning and outcome of the following: <ul style="list-style-type: none"> HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme. 	10	24
4	National health programme: <ul style="list-style-type: none"> National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program. 	8	17
5	Community services in rural, urban and school health: <ul style="list-style-type: none"> Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school. 	7	13
Total		45	100

Course Outcomes

At the end of this course, students will be able to:

CO1	To understand the concept of health, disease and to know about Sociology, Health education, Hygiene and health.
CO2	To gather knowledge about the various diseases with its preventive medicine.
CO3	To develop ideas about the National Health Programme including its objectives and Functions.
CO4	To introduce about various National health intervention programme for mother and child including the role of WHO in Indian national program.
CO5	To study about the Community service, Functions of PHC, Health promotion and Education in school.

Reference Books

1.	Short Textbook of Preventive and Social Medicine By Prabhakara GN 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2.	Park Textbook of Preventive and Social Medicine, By K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS
3.	Essentials of Community Medicine—A Practical Approach (TextBook) By Hiremath Lalita D, Hiremath Dhananjaya A , 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
4.	Review of Preventive and Social Medicine (Including Biostatistics), By Jain Vivek 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
5.	Park Textbook of Preventive and Social Medicine, By K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS
6.	Community Pharmacy Practice, By Ramesh Adepu BSP publishers, Hyderabad

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990405-T - PHARMACEUTICAL JURISPRUDENCE – THEORY	
Course Objective	The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical , but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Knowhow of marketing management groom the people for taking a challenging role in Sales and Product management.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Marketing: Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior Pharmaceutical market: Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation & targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.	10	23
2	Product decision: Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.	10	23
3	Promotion: Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.	10	24
4	Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management. Professional sales representative (PSR): Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.	8	17
5	Pricing:	7	13



Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority). Emerging concepts in marketing: Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand the fundamental concepts of Pharmaceutical marketing.
CO2	To understand the different aspects of consumers in the pharmaceutical market.
CO3	Discussion about the concepts of the product management in Pharmaceutical Industry.
CO4	Discussion on various components of promotion of pharmaceutical products.
CO5	To study about different pharmaceutical marketing channels.
CO6	Discussion on the roles and responsibilities of pricing authorities in India.

Reference Books	
1.	2. Marketing Management – ASouth Asian Perspective By Philip Kotler, Kevin Lane Keller, Abraham Koshy & MithileshwarJha Pearson
2.	Marketing Strategy- Planning and Implementation By Walker, Boyd and Larreche Tata MC GrawHill, New Delhi.
3.	Marketing Management By Arun Kumar and N Menakshi: Vikas Publishing, India
4.	Marketing By Dhruv Grewal and Michael Levy Tata MC Graw Hill
5.	Marketing Management By Rajan Saxena Tata MC Graw-Hill (India Edition)
6.	Marketing Management By Ramaswamy, U.S & Nanakamari Global Perspective, IndianContext,Macmilan India, New Delhi
7.	Service Marketing (TextBook) By Shanker, Ravi Excell Books, New Delhi
8.	Pharmaceutical Marketing in India By Subba Rao Changanti (GIFT – Excel series) Excel Publications.



Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990705-T - QUALITY ASSURANCE – THEORY	
Course Objective	This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	New Drug Discovery and development Stages of drug discovery, Drug development process, pre-clinical studies, nonclinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.	10	13
2	Regulatory Approval Process Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. Regulatory authorities and agencies: Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)	10	23
3	Registration of Indian drug product in overseas market Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.	10	24
4	Clinical trials Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance – safety monitoring in clinical trials.	8	17
5	Regulatory Concepts Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book	7	13
Total		45	90



Course Outcomes

At the end of this course, students will be able to:

CO1	To understand the stages of drug discovery process and importance development of generic drugs.
CO2	To understand the regulatory approval process for Investigational new drug, regulatory process, organizational structure and functions of regulatory authority of India, United States, European Union, Australia, Japan, Canada.
CO3	To understand the procedure for the export of pharmaceutical products from India, different types of drug master file, Common technical document, and basic requirements of ACTD research.
CO4	To understand the basic ethical principles and ethical issues in clinical trials, the role of sponsors and investigators in clinical trials.
CO5	To understand the Regulatory Concepts Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book.

Reference Books

1.	Drug Regulatory Affairs By Sachin Itkar, Dr. N.S. Vyawahare Nirali Prakashan
2.	The Pharmaceutical Regulatory Process By Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informa Health care Publishers.
3.	New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
4.	Guidebook for drug regulatory submissions By Sandy Weinberg John Wiley & Sons. Inc.
5.	FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics By edited by Douglas J. Pisano, David Mantus.
6.	Generic Drug Product Development, Solid Oral Dosage forms, By Leon Shargel and Isader Kaufer Marcel Dekker series, Vol.143
7.	Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8.	Principles and Practices of Clinical Research, By Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9.	Drugs: From Discovery to Approval By Second Edition By Rick Ng

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990404-T - PHARMACOLOGY I – THEORY	
Course Objective	This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction to Pharmacovigilance: <ul style="list-style-type: none"> History and development of Pharmacovigilance Importance of safety monitoring of Medicine WHO international drug monitoring programme Pharmacovigilance Program of India(PvPI) Introduction to adverse drug reactions: <ul style="list-style-type: none"> Definitions and classification of ADRs Detection and reporting Methods in Causality assessment Severity and seriousness assessment Predictability and preventability assessment Management of adverse drug reactions Basic terminologies used in pharmacovigilance: <ul style="list-style-type: none"> Terminologies of adverse medication related events Regulatory terminologies 	10	23
2	Drug and disease classification: <ul style="list-style-type: none"> Anatomical, therapeutic and chemical classification of drugs International classification of diseases Daily defined doses International Non proprietary Names for drugs Drug dictionaries and coding in pharmacovigilance: <ul style="list-style-type: none"> WHO adverse reaction terminologies MedDRA and Standardised MedDRA queries Information resources in pharmacovigilance: <ul style="list-style-type: none"> WHO drug dictionary Eudravigilance medicinal product dictionary Basic drug information resources Establishing pharmacovigilance programme: <ul style="list-style-type: none"> Specialised resources for ADRs Establishing in a hospital Establishment & operation of drug safety department in industry Contract Research Organisations (CROs) Establishing a national programme 	10	23
3	Vaccine safety surveillance:	10	24

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<ul style="list-style-type: none"> Vaccine Pharmacovigilance Vaccination failure Adverse events following immunization Pharmacovigilance methods: <ul style="list-style-type: none"> Passive surveillance – Spontaneous reports and case series Stimulated reporting Active surveillance – Sentinel sites, drug event monitoring and registries Comparative observational studies – Cross sectional study, case control study and cohort study Targeted clinical investigations Communication in Pharmacovigilance: <ul style="list-style-type: none"> Effective communication in Pharmacovigilance Communication in Drug Safety Crisis management Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media 		
4	Safety data generation ICH Guidelines for Pharmacovigilance <ul style="list-style-type: none"> Pre clinical phase Clinical phase Post approval phase (PMS) ICH Guidelines for Pharmacovigilance: <ul style="list-style-type: none"> Organization and objectives of ICH Expedited reporting Individual case safety reports Periodic safety update reports Post approval expedited reporting Pharmacovigilance planning Good clinical practice in pharmacovigilance studies 	8	17
5	Pharmacogenomics of adverse drug reactions,, , <ul style="list-style-type: none"> Genetics related ADR with example focusing PK parameters. Drug safety evaluation in special population: <ul style="list-style-type: none"> Paediatrics Pregnancy and lactation Geriatrics CIOMS: <ul style="list-style-type: none"> CIOMS Working Groups CIOMS Form CDSCO (India) and Pharmacovigilance: <ul style="list-style-type: none"> D&C Act and Schedule Y Differences in Indian and global pharmacovigilance requirements 	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To develop the fundamental ideas about Pharmacovigilance and its development, basic terminologies and about the adverse drug reactions.
CO2	To clarify about the drug and its classification, dictionaries, coding, Information Resources and establishing pharmacovigilance programme.
CO3	To acquire knowledge about Vaccine safety surveillance, its methods and communication in pharmacovigilance.
CO4	To acquire knowledge on Safety data generation and ICH Guidelines for pharmacovigilance.
CO5	To understand about the Pharmacogenomics of adverse drug reactions, Drug safety, CIOMS, CDSCO.

Reference Books

1.	Textbook of Pharmacovigilance By S K Gupta, Jaypee Brothers Medical Publishers
2.	Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones Bartlett Publishers
3.	Mann's Pharmacovigilance By Elizabeth B. Andrews, Nicholas Wiley Publisher
4.	Stephens' Detection of New Adverse Drug Reactions By John Talbot, Patrick Walle WileyPublishers
5.	An Introduction to Pharmacovigilance By Patrick Waller WileyPublisher
6.	Cobert's Manual of Drug Safety and Pharmacovigilance By Barton Cobert Jones & BartlettPublishers.
7.	Textbook of Pharmacoepidemiolog By Brian L. Strom, Stephen E Kimmel, SeanHennessy WileyPublishers
8.	A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills By G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata NA
9.	National Formulary of India
10.	Text Book of Medicine By Yashpal Munjal
11.	Text book of Pharmacovigilance: concept and practice By GP Mohanta and PK Manna

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990603 - HERBAL DRUG TECHNOLOGY-THEORY	
Course Objective	In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines..	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Basic tests for drugs: Pharmaceutical substances, Medicinal plants materials and dosage forms WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use.	10	23
2	Quality assurance in herbal drug industry: cGMP, GAP, GMP and GLP in traditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.	10	23
3	EU and ICH guidelines: Guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines.	10	24
4	Stability testing of herbal medicines: Application of various chromatographic techniques in standardization of herbal products. Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.	8	17
5	Regulatory requirements for herbal medicines: WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias. Role of chemical and biological markers in standardization of herbal products.	7	13
Total		45	100

Course Outcomes

At the end of this course, students will be able to:

CO1	To understand guidelines for quality control and evaluation of safety and efficacy of herbal medicines.
CO2	To study guidelines for cGMP, GMP, GAP and GLP for quality assurance in herbal drug industry.
CO3	To understand the regulatory approval process and their registration in national and international markets.
CO4	To study WHO guidelines on safety monitoring of herbal medicine in pharmacovigilance systems.

Reference Books

1.	Pharmacognosy By Trease and Evans
2.	Pharmacognosy Kokate, By Purohit and Gokhale
3.	Rangari, V.D., Text book of Pharmacognosy and Phytochemistry By Vol. I , Carrier Pub., 200
4.	Herbal Drug Technology By Aggrawal, S.S. Universities Press, 2002
5.	EMA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products (TextBook)
6.	Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals By Mukherjee, P.W Business Horizons Publishers, New Delhi, India, 2002.
7.	Application of quality control principles to herbal drugs By Shinde M.V., Dhalwal K., Potdar K., Mahadik K. I nternational Journal of Phytomedicine 1(2009)
8.	WHO. Quality Control Methods for Medicinal Plant Materials,World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the
9.	Quality Specifications, 3rd edn. By World Health Organization Geneva, 1981 WHO. The International Pharmacopeia, Vol. 2:
10.	WHO. Quality Control Methods for Medicinal Plant Materials. By World Health Organization Geneva, 1999
11.	WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine By World Health Organization, Geneva, 2005 2 vol. set. Vol. 1 contains text and Vol. 2, maps
12.	WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990404 - PHARMACOLOGY I-THEORY	
Course Objective	Upon completion of the course, the student shall be able to understand Design and discovery of lead molecules The role of drug design in drug discovery process The concept of QSAR and docking Various strategies to develop new drug like molecules. The design of new drug molecules using molecular modeling software	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Introduction to Drug Discovery and Development Stages of drug discovery and development Lead discovery and Analog Based Drug Design Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation. Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies	10	23
2	Quantitative Structure Activity Relationship (QSAR) SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammett's substituent constant and Taft's steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.	10	23
3	Molecular Modeling and virtual screening Techniques Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening, Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design	10	24
4	Informatics & Methods in drug design Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases	8	17
5	Molecular Modeling Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination	7	13
Total		45	100

Course Outcomes

At the end of this course, students will be able to:

CO1	To understand the various stages of Drug Discovery and Development, various rational approaches to lead discovery, design the analogue synthesis using lead molecule.
CO2	To understand the Quantitative Structure Activity Relationship (QSAR) SAR versus QSAR, and experimental and theoretical approaches for the determination of physicochemical parameters.
CO3	To understand the Molecular and virtual screening techniques with the various docking and De novo drug design.
CO4	To understand about Informatics & Methods in drug design
CO5	To understand the molecular modelling and different methods and to explain the various Energy Minimization Methods.

Reference Books

1.	“Drug Action at the Molecular Level” By Robert GCK, ed University Park Press Baltimore
2.	Quantitative Drug Design By Martin YC Dekker, New York
3.	“Wilson & Gisvolds’s Text Book of Organic Medicinal & Pharmaceutical Chemistry” By Delgado JN, Remers WA eds Lippincott, New York
4.	“Principles of Medicinal chemistry ‘ By Lea & Febiger. Foye WO
5.	“Essentials of Medicinal Chemistry” By Koro Ikovas A, Burckhalter JH e Wiley Interscienc
6.	“The Basis of Medicinal Chemistry, By Burger’s Medicinal Chemistry” Wolf ME, ed JohnWiley& Sons, New York
7.	An Introduction to Medicinal Chemistry By Patrick Graham, L. Oxford University Press
8.	“Introduction to the principles of Drug Design By Smith HJ, Williams H, eds, Wright Boston
9.	“The organic Chemistry of Drug Design and Drug Action” By Silverman R.B Academic Press New York

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990201-T - HUMAN ANATOMY AND PHYSIOLOGY II – THEORY	
Course Objective	cell biology is a branch of biology that studies cell their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function. This is done both on microscopic and molecular level. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	a) Cell and Molecular Biology: Definitions theory and basics and Applications. b) Cell and Molecular Biology: History and Summation. c) Properties of cells and cell membrane. d) Prokaryotic versus Eukaryotic e) Cellular Reproduction f) Chemical Foundations – an Introduction and Reactions (Types)	10	23
2	a) DNA and the Flow of Molecular Information b) DNA Functioning c) DNA and RNA d) Types of RNA e) Transcription and Translation	10	23
3	a) Proteins: Defined and Amino Acids b) Protein Structure 173 c) Regularities in Protein Pathways d) Cellular Processes e) Positive Control and significance of Protein Synthesis	10	24
4	a) Science of Genetics b) Transgenics and Genomic Analysis c) Cell Cycle analysis d) Mitosis and Meiosis e) Cellular Activities and Checkpoints	8	17
5	a) Cell Signals: Introduction	7	13

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	b) Receptors for Cell Signals c) Signaling Pathways: Overview d) Misregulation of Signaling Pathways e) Protein-Kinases: Functioning		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To understand concept of molecular cell biology and its application.
CO2	To gather knowledge about molecular composition of genetic material.
CO3	To discuss the biomolecular composition of protein and aminoacid with their structure and application.
CO4	To study the science of genetics and cell cycle of biological organism.
CO5	To know the pathway of cell signaling, Protein-Kinases and Functioning.

Reference Books	
1.	Essentials of Biochemistry by U. Satyanarayana (TextBook)
2.	Pharmaceutical Microbiology By W.B. Hugo and A.D. Russel: Blackwell Scientific publications, Oxford London.
3.	Industrial Microbiology By Prescott and Dunn 4th edition , CBS Publishers & Distributors, Delhi
4.	Microbiology Industrial Microbiology Tata McGraw Hill edn By Tata McGraw Hill edn
5.	Pharmaceutical Microbiology By Malcolm Harris, Balliere Tindall and Cox
6.	Fundamentals of Microbiology By Alcomo, I.E. VI Edition, Jones and Bartlett Publishers. Sudbury. Massachusetts., Pub. Year 2001
7.	Rose: Industrial Microbiology
8.	Tutorial Pharmacy By Cooper and Gunn's CBS Publishers and Distributors
9.	Microbial Technology By Pepple
10.	Fundamentals of Microbiology (TextBook) By Edward Cartwright
11.	Pharmaceutical Microbiology By N.K.Jain
12.	Bergeys manual of systematic bacteriology By Williams and Wilkins- A Waverly company
13.	Molecular Biotechnology: Principles and Applications of RecombinantDNA By B.R. Glick and J.J. Pasternak:
14.	Kuby Immunology By RA Goldshy et. al.

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990103-T - PHARMACEUTICS I –THEORY	
Course Objective	Upon completion of the course the student shall be able to 1. To know and explain about cosmetics, and related sciences, cosmeceuticals (cosmetics with skin, hair and oral care benefits) and personal care and hygiene products. 2. To demonstrate practical skills in the area of biology, formulation science and analytical techniques required to scientifically design and develop various cosmetic products. 3. To describe about basic cosmetic problems associated with skin, hair and oral care etc.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Classification of cosmetic and cosmeceutical products Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs. Cosmetic excipients: Surfactants, rheologymodifiers, humectants, emollients, preservatives. Classification and application Skin: Basic structure and function of skin. Hair: Basic structure of hair. Hair growth cycle. Oral Cavity: Common problem associated with teeth and gums.	10	23
2	Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals. Antiperspirants & deodorants- Actives & mechanism of action. Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phenylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.	10	23
3	Sun protection, Classification of Sunscreens and SPF.	10	24

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	<p>Role of herbs in cosmetics: Skin Care: Aloe and turmeric</p> <p>Hair care: Henna and amla.</p> <p>Oral care: Neem and clove</p> <p>Analytical cosmetics: BIS specification and analytical methods for shampoo, skincream and toothpaste.</p>		
4	<p>Principles of Cosmetic Evaluation</p> <p>Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.</p>	8	17
5	<p>Oily and dry skin, causes leading to dry skin, skin moisturisation</p> <p>Basic understanding of the terms Comedogenic, dermatitis.</p> <p>Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic.</p> <p>Problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action</p>	7	13
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand the roles and interactions of ingredients, predicting compatibility and stability, ensuring informed ingredient selection for safe and effective products.
CO2	Design cosmetic products, balancing ingredient ratios, overcoming challenges, and creating prototypes with desired sensory attributes and performance outcomes.
CO3	Navigate regulations, assess ingredient risks, and conduct stability tests to develop compliant and safe cosmetic formulations.
CO4	Explore innovative trends like sustainable formulations, nanotechnology, and digital integration, adapting them to create forward-thinking cosmetic products.
CO5	Master consumer perception assessment, interpret data, and refine formulations to align with user preferences, ensuring products meet both scientific and consumer demands.

Reference Books

1.	Harry's Cosmeticology By Wilkinson, Moore Seventh Edition, George Godwin
2.	Cosmetics – Formulations, Manufacturing and Quality Control By P.P. Sharma 4th Edition, Vandana Publications Pvt. Ltd., Delhi
3.	Drugs and Cosmetics Act/Rules Govt. of India publications
4.	Poucher's Perfumes, Cosmetics and Soaps
5.	Handbook of Cosmetic Science and Technology 3rd Edition
6.	Pulok K. Mukherjee. Quality Control Herbal Drugs Business Horizons
7.	"Trease and Evans' Pharmacognosy" By Trease, G.E. and Evans, W.C. WB Saunders Co.

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990602-T - PHARMACOLOGY III – THEORY	
Course Objective	This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Laboratory Animals: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.	8	20
2	Introduction to preclinical studies: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study.	5	20
3	Preclinical screening models for drugs acting on CNS:- analgesic, antipyretic, anti-inflammatory, general anesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, nootropics, anti-Parkinsonism drugs, anti-Alzheimer drug. Preclinical screening models for drugs acting on eye and local anesthetics	12	24
4	Preclinical screening models for drugs acting on ANS Sympathomimetics, Sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants.	5	15
5	Preclinical screening models for drugs acting on CVS Antihypertensives, diuretics, antiarrhythmic, antidyslipidemic, anti aggregatory, coagulants, and anticoagulants. Preclinical screening models for antiulcer, antidiabetic, anticancer and antiasthmatic activities.	10	13
6	Research methodology and Bio-statistics Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students't' test and One-way ANOVA. Graphical representation of data.	5	11
Total		45	103

Course Outcomes

At the end of this course, students will be able to:

CO1	Appreciate the applications of various commonly used laboratory animals.
CO2	Appreciate and demonstrate the various screening methods used in preclinical research
CO3	Appreciate and demonstrate the importance of biostatistics and research methodology
CO4	Understanding Design and execute a research hypothesis independently

Reference Books

1.	Fundamentals of experimental Pharmacology (TextBook) By M.N.Ghosh
2.	Hand book of Experimental Pharmacology (TextBook) By S.K.Kulakarni
3.	CPCSEA guidelines for laboratory animal facility
4.	Drug discovery and Evaluation By Vogel H.G
5.	Drug Screening Methods By Suresh Kumar Gupta and S. K. Gupta
6.	Introduction to biostatistics and research methods By PSS Sundar Rao and J Richard

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990705-T - QUALITY ASSURANCE – THEORY	
Course Objective	Upon completion of the course the student shall be able to 1. Understand the advanced instruments used and its application in drug analysis 2. Understand the chromatographic separation and analysis of drugs 3. Understand the calibration of various analytical instruments 4. Know analysis of drugs using various analytical instruments	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	Nuclear Magnetic Resonance spectroscopy, Mass Spectrometry Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications - Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications	10	10
2	Thermal Methods of Analysis X-Ray Diffraction Methods: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) : Origin of X-rays, basic aspects of crystals, Xray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.	10	25
3	Calibration and validation, Calibration of following Instruments as per ICH and USFDA guidelines Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC	10	25
4	Radio immune assay, Extraction techniques: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay General principle and procedure involved in the solid phase extraction and liquid-liquid extraction	8	15
5	Hyphenated techniques LC-MS/MS, GC-MS/MS, HPTLC-MS.	7	15
Total		45	90

Course Outcomes

At the end of this course, students will be able to:

CO1	To interpret fundamentals, Instrumentation, Working & use of NMR and Mass Spectrometry.
CO2	To extrapolate fundamentals of calibration and validation of various analytical instruments as per ICH and USFDA guidelines.
CO3	To generalize fundamentals, Instrumentation, Working & use of Thermal Method of Analysis and X-ray diffraction Methods.
CO4	To recall and transform basic knowledge of Radio Immune assay, Extraction techniques and hyphenated techniques.

Reference Books

1.	Instrumental Methods of Chemical Analysis By B.K Sharma Krishna Prakashan Media
2.	Organic spectroscopy By Y.R Sharma S Chand
3.	Text book of Pharmaceutical Analysis By Kenneth A. Connors Wiley India Pvt. Limited, 2007
4.	Vogel's Text book of Quantitative Chemical Analysis By A.I. Vogel,
5.	Practical Pharmaceutical Chemistry Vol I & II, By A.H. Beckett & J. B. Stenlake's, Stahlone Press of University of London
6.	Organic Chemistry Vol-1 & 2 By I.L. Finar Pearson Publication
7.	Organic spectroscopy By William Kemp Palgrave Macmillan, USA
8.	Quantitative Analysis of Drugs By Von D. C. Garrett in Zusammenarbeit mit L. Brealy, C. A. Johnson, K. L. Smith und G. Sykes. 3. Ausgabe, 925 Seiten. Chapman & Hall Ltd., London 1964
9.	Quantitative Analysis of Drugs in Pharmaceutical Formulations By P. D. Sethi CBS Publishers & Distributors
10.	Spectrophotometric identification of Organic Compounds By by Robert M. Silverstein, Francis X. Webster Wiley; Sixth edition

Course	Bachelor of Pharmacy (B.Pharm.)	Semester - 8
Type of Course	Core Elective Courses	
Prerequisite	23990404 - PHARMACOLOGY I-THEORY	
Course Objective	<p>This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to:</p> <ol style="list-style-type: none"> 1. Understand the need of supplements by the different group of people to maintain healthy life. 2. Understand the outcome of deficiencies in dietary supplements. 3. Appreciate the components in dietary supplements and the application. 4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims. 	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				External Mark (T)	Internal Marks (T)	External Mark (P)	Internal Marks (P)	
3	1	-	4	75	25	-	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
1	a. Definitions of Functional foods a) Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc. b) Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community. c) Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds	7	20
2	Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following a) Carotenoids- α ; and β -Carotene, Lycopene, Xanthophylls, leutin b) Sulfides: Diallyl sulfides, Allyl trisulfide. c) Polyphenolics: Resveratrol d) Flavonoids- Rutin, Naringin, Quercetin, Anthocyanidins, catechins, Flavones e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum f) Phyto estrogens : Isoflavones, daidzein, Geobustin, lignans g) Tocopherols h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.	15	25
3	Introduction to free radicals: a) Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids. b) Dietary fibres and complex carbohydrates as functional food ingredients.	7	25
4	a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury,	10	15

Course Content		T - Teaching Hours W - Weightage	
Sr.	Topics	T	W
	a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing. b) Antioxidants: Endogenous antioxidants – enzymatic and non-enzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin Synthetic antioxidants: Butylated hydroxyl Toluene, Butylated hydroxyl Anisole. c) Functional foods for chronic disease prevention		
5	Regulatory Aspects;	6	15
	a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. c) Pharmacopoeia Specifications for dietary supplements and nutraceuticals.		
Total		45	100

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Knowledge about supplements by the different group of people to maintain or Improve healthy life.
CO2	Understand the outcome of deficiencies in dietary supplements.
CO3	Appreciate the components in dietary supplements and the application
CO4	Obligated the regulatory and commercial aspects of dietary supplements including health claims.

Reference Books	
1.	Role of dietary fibers and nutraceuticals in preventing diseases By K.T Agusti and P.Faiza
2.	Dietetics By Sri Lakshmi
3.	Advanced Nutritional Therapies By Cooper. K.A., (1996)
4.	The Food Pharmacy By Jean Carper, Simon & Schuster
5.	Prescription for Nutritional Healing By James F.Balch and Phyllis A.Balch
6.	2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in Essentials of Functional Foods
7.	Functional Foods. 1994
8.	2000 Functional foods
9.	Handbook of Nutraceuticals and Functional Foods
10.	Modern Nutrition in Health and Disease.

