HAND BOOK: 2021-22
B.PHARMACY
K L COLLEGE OF PHARMACY

KL University Vision

To be a globally renowned university.

K L University Mission:

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

M1 - To impart quality higher education

M2 - To undertake research and extension with emphasis on application and innovation

M3- Cater to the emerging societal needs through all-

round development of students of all sections

M4 - To be globally competitive and socially

responsible citizens with intrinsic values.

KL University Academic Goals

1. To offer academic flexibility by means of Choice based credit systems and the like
2. To identify and introduce new specializations that offer programs in emerging areas therein.
3. To incorporate into the curriculum the application orientation and use high standards of competence for academic delivery
4. To design and implement educational system adhering to outcome based international models
5. To introduce and implement innovation in teaching and learning process to strengthen academic delivery
6. To offer academic programs at UG, PG, Doctoral, Post-Doctoral which are industry focused and incorporates trans-discipline, inter- discipline aspects of the education system.
7. To deliver higher education that includes technologies and meeting the global requirements

Vision and Mission of the Department

Vision: Lead the future of global healthcare and well-being of the communities we serve.

Mission: To produce quality Pharmacy professionals having strong theoretical foundation, innovative ideas, good design experience by bridging industry-academic gap in Pharma Sector through the use of technology and innovative teaching and exposure to research and progress with social ethics.

Mission Statements

M1. Education: Provide the most comprehensive and highest quality education for pharmaceutical sciences in a learning environment that embraces diversity, equity, integrity, ethics, moral courage and accountability.

M2. Community service: Conduct health education programs to the community to prevent disease and improve public health and well-ness by fostering an environment that promotes the safe, efficacious, and cost-effective use of medications.

M3. Research: Develop a passion for discovery and innovations with multidisciplinary collaborative research and engage in creative partnerships locally and globally to advance health education, research, and practice.

M4. Entrepreneurship: Encourage and support resourcefulness, originality, imagination, ingenuity, and vision in our students, faculty, and staff. Foster the development of entrepreneurs who have the ability to dream, inspire and innovate and courage to envisage the commercial success and socio economic productivity of innovations

Program Educational Objectives (PEOs)

PEO No	PROGRAMME EDUCATION OBJECTIVES (PEOs)
1	To produce pharmacist workforce competent for the society.
2	To produce pharmacy graduates with employable skills and high technical competence in pharmaceutical industry and health care sectors
3	To inculcate research activity and develop passion for discovery and innovations
4	To develop entrepreneurship qualities that support growth of pharmaceutical intellectual property and contribute for economic development throughout the world.

Program Outcomes(POs)

PO No	PARTICULARS	PROGRAMME OUTCOME (PO)
1	**Pharmacy Knowledge**	Provide basic knowledge for understanding the principles and their applications in the area of Pharmaceutical Sciences and Technology.
2	**Technical Skills**	Develop an ability to use various instrument and equipment with an in depth knowledge on standard operating procedures for the same.
3	**Modern tool usage**	Develop/apply appropriate techniques, resources, and IT tools including prediction and modeling to complex health issues and medicine effect with an understanding of the limitations.
4	**Research and Development**	To demonstrate knowledge of identifying a problem, critical thinking, analysis and provide rational solutions in different disciplines of Pharmaceutical Sciences and Technology.
5	**Lifelong Learning**	Develop an aptitude for continuous learning and professional development with ability to engage in pharmacy practice and health education programs.
6	**Communication**	Communicate effectively on health care activities with the medical community and with society at large, to comprehend drug regulations, write health reports and provide drug information.
7	**The Pharmacist and Society**	Apply reasoning informed by the contextual knowledge to comprehend medical prescription, perform patient counselling and issue or receive clear instructions on drug safety and the consequent responsibilities relevant to the professional pharmacy practice.

8	**Ethics Program Outcomes(POs)**	Follow the code of ethics and commit to professional values and responsibilities and norms of the pharmacy practice.
PSO No.		
1	**Pharmaceutical product development**	To apply the knowledge of manufacturing, formulation and quality control of various pharmaceutical and cosmetic products in the form of powders, tablets. capsules, parenteral, solutions, suspensions, emulsions, creams, lotions and aerosols etc.
2	**Invention and Entrepreneurship**	Find the application of modern tools to integrate health care systems, design an effective product with commercial advantage and societal benefit, perform risk analysis and become entrepreneur.

Mapping of PEOs and POs

	PEO1	PEO2	PEO3	PEO4
PO1	✓		✓	
PO2	✓		✓	
PO3				
PO4		✓		✓
PO5	✓			✓
PO6	✓		✓	
PO7	✓			✓
PO8		✓	✓	

Academic Goals

G1	To offer academic flexibility by means of Choice based credit systems and the like.
G2	To identify and introduce new specializations and offer programs in emerging areas therein
G3	To incorporate into the curriculum the Application orientation and use high standards of competence for academic delivery
G4	To design and implement educational system adhering to outcome based international models.
G5	To introduce and implement innovation in teaching and learning process to strengthen academic delivery
G6	To offer academic programs at UG, PG, doctoral, post-Doctoral which are industry focused, and incorporates Trans-discipline, inter-discipline aspects of the education system
G7	To deliver higher education that includes technologies and meeting the global requirements

MAPPING OF GOALS WITH MISSION:

	M1	M2	M3	M4
G1	✓		✓	
G2	✓		✓	
G3				
G4		✓		✓
G5	✓			✓
G6	✓		✓	
G7	✓			✓
G8		✓	✓	

MAPPING OF PEOs WITH GOALS

	G1	G2	G3	G4	G5	G6	G7
PEO1	✓	✓		✓			
PEO2	✓	✓		✓			
PEO3			✓				✓
PEO4			✓		✓	✓	✓

Thrust Areas of Pharmacy			
Local	Regional	National	Global
• Community Pharmacy services • Pharmacy Practice	• Regulatory Pharmacy • Industrial Pharmacy	• Research in Modern Biology • Hospital Pharmacy • Community Pharmacy • Manufacturing Pharmacy	• Global Pharmacovigilance • Signal Detection • Pharmacovigilance communications
https://appharmacycouncil.gov.in/site/index	http://www.ipa-india.com/	http://www.ipa-india.com/ https://www.ccmb.res.in/	https://www.who-umc.org/

Local, Regional, National and Global Need		**Courses introduced in 2020-21 curriculum as per identified needs**
Local Needs	Community Pharmacy services	21PY4135T –Pharmacy Practice 21PY4239T-Social and Preventive Pharmacy
	Pharmacy Practice	21PY4135T –Pharmacy Practice 21PY2220T-Pharmacology-1 21PY2220P-Pharmacology-1 21PY3124T-Pharmacology-II 21PY3124P-Pharmacology-II 21PY3228T-Pharmacology-III 21PY3238P-Pharmacology-III
Regional Needs	• Regulatory Pharmacy	21PY4241ET-Pharmaceutical Regulatory Science 21PY1102T-Pharmaceutical Analysis-I 21PY1102P-Pharmacuticl analysis Practical 21PY1103T-General Pharmaceutics-I
	• Industrial Pharmacy	21PY3123T Industrial Pharmacy-1 21PY4134T-Industrial Pharmacy-II 21PY2116T-Pharmaceutical Engineering
National needs	• Research in Modern Biology	21PY4245ET-Cell and Molecular Biology
	• Hospital Pharmacy	21PY4135T-Pharmacy Practice
	• Community Pharmacy	21PY4135T- Pharmacy Practice 21PY4240T-Social and Preventive Pharmacy
Global Needs	• Global Pharmacovigilance	21PY4242ET-Pharmacovigilance
	• Signal Detection	21PY4135T-Pharmacy Practice

	• Pharmacovigilance communications	21PY4250PW-Project Work 210PY4242ET-Pharmacovigilance

Local, Regional, National and Global Need		Mission statements			
		M1	M2	M3	M4
Local Needs	Areas				
	Community Pharmacy services	✓	✓		
	Pharmacy Practice				
Regional Needs	• Regulatory Pharmacy	✓			
	Manufacturing Pharmacy	✓		✓	
	Community Pharmacy	✓	✓		
National needs	• Research in Modern Biology				✓
	• Hospital Pharmacy	✓			
	• Community Pharmacy	✓		✓	
	• Preventive Pharmacy	✓			
Global Needs	• Global Pharmacovigilance	✓			✓
	• Signal Detection	✓			✓
	• Pharmacovigilance communications	✓			✓

S.No	Description of PEOs	Key Components of Mission			
		M 1	**M 2**	**M 3**	**M 4**
		High quality Education	Community service	Research and Development	Enterprene urship
PEO 1	To produce pharmacist workforce competent for the society	✓	✓		
PEO 2	To produce pharmacy graduates with employable skills and high technical competence in pharmaceutical industry and health care sectors	✓			✓
PEO 3	To inculcate research activity and develop passion for discovery and innovations			✓	
PEO 4	To develop entrepreneurship qualities that support growth of pharmaceutical intellectual property and contribute for economic development throughout the world.				✓

Mapping of PO'S with PEO's

	Key Components	PEO1	PEO2	PEO3	PEO4
PO1	**Pharmacy Knowledge**	✓		✓	
PO2	**Technical Skills**	✓		✓	
PO3	**Communication**				
PO4	**Research and Development**		✓		✓
PO5	**Lifelong Learning**	✓			✓
PO6	**Modern tool usage**	✓		✓	
PO7	**The Pharmacist and Society**	✓			✓
PO8	**Ethics**		✓	✓	

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES (POs) and PROGRAM SPECIFIC OUTCOMES (PSOs)

					Program Outcomes									
S.NO	Course Code	Course Title	Course Outcomes (COs)	Course Description	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
1	21PY1101T	HUMAN ANATOMY AND PHYSIOLOGY-I	CO1	Understand the gross morphology	2									
			CO2	Understanding anatomy and physiological concepts	2									
			CO3	Understanding physiology of body fluids	2									
			CO4	Understand the gross morphology of PNS	2									
2	21PY1101P	HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)	CO1	Application of gross morphology of body organs using microscope	2			2						
			CO2	Applying the concepts of haemaocytometry	2			2						
			CO3	Determination of various blood parameters	2			2						
			CO4	Determination of heart rate, BP	2			2						
3	21PY1102T	PHARMACEUTICAL ANALYSIS	CO1	Understand the principles of volumetric and electro chemical analysis	1			2						
			CO2	Understand the theories and classifications of volumetric titrations	2			2						
			CO3	Understanding the Importance of complexometry, masking and demasking agents. Concepts of Redox-titrations.	2			2						
			CO4	Understanding the concepts of electrochemical methods for analysis	2			2						
4	21PY1102P	PHARMACEUTICAL ANALYSIS	CO1	Application of volumetric and electro chemicalanalysis	2			2						
			CO2	Analysing volumetric titrations	2			2						
			CO3	Analysing he Importance of complexometry	2			2						
			CO4	Analysing the concepts of electrochemical methods for analysis	2			2						
5	21PY1103T	PHARMACEUTICS (Theory)	CO1	Understand the history and development of profession of pharmacy	2			2						
			CO2	Apply the knowledge on pharmaceutical calculations	2			2						
			CO3	Understand the principles involved in the formulation development	2			2						
			CO4	Understand the principles involved in the formulation development of semisolid dosage forms	2			2						
			CO1	Apply the knowledge of preparation and dispending of monophasic liquid dosage forms		3								

6	**21PY1103P**	**PHARMACEUTICS (Practical)**	CO2	Apply the knowledge of preparation and dispending of biphasic liquid dosage forms		3							2	
			CO3	Apply the knowledge of preparation and dispending of powder dosage forms		3								
			CO4	Apply the knowledge of preparation and dispending of biphasic liquid dosage forms		3								2
7	**21PY1104T**	**PHARMACEUTICAL INORGANIC CHEMISTRY**	CO1	Understand inorganic compounds, sources of Impurities and test for purity of Impurities	2									
			CO2	Understand the monograph study of various inorganic compounds	2									
			CO3	Understand the monograph study of various inorganic compounds belongs to Dental products & Gastro-intestinal agents	2									
			CO4	Understand the monograph study of various inorganic compounds belongs to Miscellaneous agents & Radiopharmaceuticals	2									
8	**21PY1104P**	**PHARMACEUTICAL INORGANIC CHEMISTRY**	CO1	Test for “Limit tests “for the ions	3									
			CO2	Test for “Limit tests “for the ions	2									
			CO3	Determination of purity of various inorganic compounds	3									
			CO4	Preparation of inorganic pharmaceuticals	3									
9	**21PY1106RB**	**REMEDIAL BIOLOGY**	CO1	Introduce biology to non-biology students	1									
			CO2	Know the classification and salient features of five kingdoms of life	1									
			CO3	Understand the basic components of anatomy & physiology of plant	1									
			CO4	Understand the basic components of anatomy & physiology animal	1									
10	**21PY1106RBP**	**REMEDIAL BIOLOGY**	CO1	Demonstration of experiments in biology		2								
			CO2	Application of Insilico models to demonstrate experiments on frog				3						
			CO3	Identification of tissues				3						
			CO4	Determination of BP,Blood group and TV				3						
11	**21PY1106RMT**	**REMEDIAL MATHEMATICS**	CO1	Understand the essentials of mathematics	2			2						
			CO2	Know theory and applications of Mathematics	2			2						
			CO3	Solve problems applying theoretical concepts	2			2						
			CO4	Application of Pharmacy in Life sciences	3			2						
	21PY1105T	**Communication skills**	CO1	Apply the practical knowledge of using action words in sentenceconstruction	1			1						
			CO2	Apply and analyse the right kind of pronunciation with regards to speech sounds and able to get different	1			1		3				

12				types of pronunciations.										
			CO3	Apply the concept of fundamental principle of counting to solvethe problems	1			1		3				
			CO4	Analyze the given conditions and finding out all the possible arrangements in linear & circular order	1			1		3				
13	**21PY1105P**	**Communication skills (Practical)**	CO1	Understand Basic communication	1					3				
			CO2	Understand Pronunciations						3				
			CO3	Application of advanced learning						3				
			CO4	Application of handling skills						3				
14	**21UC1102**	**Design Thinking and Innovation**	CO1	Understand the basics of design thinking and its implications in product or service development	2									
			CO2	Understand and Analyse the requirements of a typical problem		2								
			CO3	Plan the necessary activities towards solving the problem through ideation and prototyping				2	2					
			CO4	Evaluate the solution and refine them based on the customer feedback			2							
15	**21PY1207T**	**HUMAN ANATOMY AND PHYSIOLOGY-II**	CO1	Understand the gross morphology, structure and functions of Central Nervous system and Brain	3									
			CO2	Understand the gross morphology, structure and functions of digestive system.	3									
			CO3	Understand the gross morphology, structure and functions of respiratory and urinary system.	3									
			CO4	Understand the gross morphology, structure and functions of endocrine and reproductive system	3									
16	**21PY1207P**	**HUMAN ANATOMY AND PHYSIOLOGY-II**	CO1	Apply the knowledge to perform various physiology experiments		2								
			CO2	Demonstration of various Sensory activities				2						
			CO3	Demonstration of various physiological activities				2						
			CO4	Examining physiological fiunctions				2						
17	**21PY1208T**	**PHARMACEUTICAL ORGANIC CHEMISTRY –I**	CO1	Understand the structure, name and the type of isomerism of the organic compound	2			2						
			CO2	Understand the name of the reaction and orientation of reactions	2			2						
			CO3	Understand the reactivity /stability of compund	2			2						
			CO4	Understand the Named reactions in Organic chemistry	2			2						
18	**21PY1208 P**	**PHARMACEUTICAL ORGANIC CHEMISTRY –I**	CO1	Test for organic compounds and detection of elements				2						
			CO2	Test for functional groups	2			2						
			CO3	Identification of unknown compounds	2			2						
			CO4	Preparation of derivatives	2			2						

19	**21PY1209T**	**BIOCHEMISTRY**	CO1	Understand The Principles Of Chemistry in biology	2			2						
			CO2	Understand the catalytic role of enzymes	2			2						
			CO3	Understand the metabolism of nutrient molecules in physiological and pathological conditions	2			2						
			CO4	Understand the genetic organization of mammalian genome	2			2						
20	**21PY1209P**	**BIOCHEMISTRY**	CO1	Qualitative and quantitative analysis of carbohydrates, proteinsand cholesterol			2							
			CO2	Determination of blood cholesterol, and measurement of pH			2							
			CO3	Preparation of buffer solution			2							
			CO4	Enzymatic hydrolysis of biomolecules and salivary enzymeactivity			2							
21	**21PY1210T**	**PATHOPHYSIOLOGY**	CO1	Understand the conditions leading to a disease	2			2						
			CO2	Understand the mechanism of inflammation	2			2						
			CO3	Understand the etiology and pathogenesis of the selected disease states	2			2						
			CO4	Understanding the principles of selected diseases	2			2						
22	**21PY1211T**	**COMPUTER APPLICATIONS IN PHARMACY**	CO1	Apply the knowledge of Numbering system and its calculations Understand the concepts of Information System and software				2						
			CO2	Apply the knowledge using HTML, XML, CSS, MS access languages. Understand the concepts of web technologies					2					
			CO3	Understand the various types of application of computers in pharmacy					3					
			CO4	Applying knowledge on Data analysis in preclinical development Understand the concept of Bioinformatics					3					
23	**21PY1211P**	**COMPUTER APPLICATIONS IN PHARMACY**	CO1	pply knowledge on creating a HTML web page										
			CO2	Apply knowledge on creating mailing labels Using Label Wizard					3					
			CO3	Apply knowledge for Drug information storage and retrieval using MSAccess					3					
			CO4	Apply knowledge Creating and working with queries in MS Access					3					
24	**21PY1212T**	**ENVIRONMENTAL SCIENCES**	CO1	Understand the importance of Environmental education and conservation of natural resources	1			2						
			CO2	Understand the importance of ecosystems and biodiversity	1			2						

			CO3	Apply the environmental science knowledge on solid waste management, disaster management and EIAprocess	1			2						
			CO4											
25	**21UC1101**	**INTEGRATED PROFESSIONAL ENGLISH**	CO1	Understand Basic English Sounds						2				
			CO2	Understand Oral Communication						3				
			CO3	Understand Non-Verbal Communication						3				
			CO4	Communication Skills and Inter Professional Collaboration						3				
26	**21UC1203**	**DESIGN THINKING AND INNOVATION-II**	CO1	Understand the problem statement, requirements and formulating approaches to solve real world problems.	2									
			CO2	Implementing Design Thinking Framework.		2								
			CO3	Develop innovative thinking ability through design thinking and also develop metrics for successful implementation of Design Thinking.			2	2	2					
			CO4	Understand the copyright, IPR, Trademark, Patent and license agreement policies for protecting own R&D innovations and enhancing brand image.			2							
27	**21PY2113T**	**PHARMACEUTICAL ORGANIC CHEMISTRY –II**	CO1	Understand Aromatic nature and type of chemical reactions of organic compound	2									
			CO2	Understand account for reactivity of Polycyclic Aromatic compounds and different Strain theories	2									
			CO3	Understand the preparation and properties of aromatic compounds	2									
			CO4	Application of SAR on medical uses of selected drugs	2									
28	**21PY2113P**	**PHARMACEUTICAL ORGANIC CHEMISTRY –II**	CO1	Application of laboratory techniques		2								
			CO2	Determination of oil values				2						
			CO3	Preparation of various Organic compound				2						
			CO4	Synthesis of various organic compounds				2						
29	**21PY2114T**	**PHYSICAL PHARMACEUTICS-I**	CO1	Understand the Solubility of drugs and mechanisms of solute solvent interactions	2									
			CO2	Understand the Principles involved in States of Matter and properties of matter and Physicochemical properties of drug molecules	2									
			CO3	Understand the Concepts involved in Surface and interfacial phenomenon.	2									
			CO4	Application of Complexation and protein binding and determination of PH in biological systems	2									
			CO1	Application of the principles of physical chemistry in			3							

30	**21PY2114P**	**PHYSICAL PHARMACEUTICS-I (PRACTICAL)**		development of colloidal systems										
			CO2	Understand the different types of liquids based on the viscosity			3							
			CO3	Design a stable suspension / emulsion by using principles of dispersed systems			3							
			CO4	Application of surface properties of solids, importance of particle size and particle size determination technique			3							
31	**21PY2115T**	**PHARMACEUTICAL MICROBIOLOGY**	CO1	Understand methods of identification, cultivation and preservation of various microorganisms	2			2						
			CO2	Understand the importance and implementation of sterilization in pharmaceutical processing and industry	2			2						
			CO3	Understand sterility testing of pharmaceutical products	2			2						
			CO4	Understand microbiological standardization of Pharmaceuticals.	2			2						
32	**21PY2115P**	**PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)**	CO1	Study of different equipments used in experimental microbiology, to perform the preparation of culture media and sterilization of glassware		3								
			CO2	Applying the knowledge of sterilization techniques and isolation of Pure Cultures		3								
			CO3	Apply the staining techniques of bacteria, demonstration of bacterial motility by hanging drop technique		3								
			CO4	Perform the microbiological assays of antibiotics, sterility testing of pharmaceuticals		3								
33	**21PY2116T**	**PHARMACEUTICAL ENGINEERING**	CO1	Understand the concept of flow of fluids and various principles and equipment involved in size separation and size reduction techniques		2								
			CO2	Understand the concept of Heat transfer and principles and equipment involved in evaporation and distillation		2								
			CO3	Apply the concepts of drying and mixing in operation of pharmaceutical manufacturing dosage forms		2								
			CO4	Understand various materials involved in pharmaceutical manufacturing process		2								
34	**21PY2116P**	**PHARMACEUTICAL ENGINEERING (PRACTICAL)**	CO1	To know various unit operations used in Pharmaceutical industries		2								
			CO2	To understand the material handling techniques		2								
			CO3	Understand various processes involved in pharmaceutical manufacturing process		2								
			CO4	Apply knowledge on operation of pharmaceutical manufacturing equipment		3								

35	**21UC1202**	**ENGLISH PROFICIENCY**	CO1	Demonstrating different interpersonal skills for employability								2		
			CO2	Distinguishing business essential skills								2		
			CO3	Classifying social media and corporate communication skills								2		
			CO4	Applying analytical thinking skills								2		
36	**21PY2217T**	**PHARMACEUTICAL ORGANIC CHEMISTRY –III**	CO1	Describes stereoisomerism and racemic modification of compound				2						
			CO2	Account for stereo specific reactions and its nomenclatutre of given organic compounds				2						
			CO3	Detail study of Heterocyclics, its nomenclature, synthesis and its reactions				2						
			CO4	Description of preparative methods, medicinal uses of heterocyclicdrugs and Studyof Named reactions.				2						
37	**21PY2217P**	**PHARMACEUTICAL ORGANIC CHEMISTRY –III (PRACTICAL)**	CO1	Understanding the corealtion of pharmacology with physico chemical properties	2			2						
			CO2	Understanding the chemistry,metabolic pathways and structure activity relationship of cholinergic drugs	2			2						
			CO3	Understanding the chemistry,metabolic pathways and structure activity relationship of adrenergic drugs	2			2						
			CO4	Understanding the chemistry,metabolic pathways and structure activity relationship of cholinergic drugs	2			2						
38	**21PY2218T**	**MEDICINAL CHEMISTRY – I**	CO1	Preparation of drugs and drug intermediates	2			2						
			CO2	Assay of drugs and knowing how to determine the Partition coefficientof any two drugs.	2			2						
			CO3	Preparation of drugs and drug intermediates.	2			2						
			CO4	Assay of drugs and knowing how to determine the Partition coefficientof any two drugs	2			2						
39	**21PY2218P**	**MEDICINAL CHEMISTRY – I (PRACTICAL)**	CO1	Preparation of drugs and drug intermediates.	2			2						
			CO2	Assay of drugs and knowing how to determine the Partition coefficientof any two drugs.	2			2						
			CO3	Preparation of drugs and drug intermediates	2			2						
			CO4	Assay of drugs and knowing how to determine the Partition coefficientof any two drugs.	2			2						
40	**21PY2219T**	**PHYSICAL PHARMACEUTICS-II**	CO1	Understanding the principles of Physical chemistry										
			CO2	Understanding various physicochemical properties										
			CO3	Know the principles of kinetics										
			CO4	Understanding the use of Physical chemistry										
41	**21PY2219P**													

		PHYSICAL PHARMACEUTICS-II (PRACTICAL)	CO1	Apply various methods of determining viscosity of liquids			3								
			CO2	Apply the principles of dispersed systems and determine the stability of suspensions			3								
			CO3	Apply the principles of kinetics for detection of rate constants			3								
			CO4	Apply the concepts of Accelerated stability studies			3								
42	**21PY2220T**	**PHARMACOLOGY-I**	CO1	Understand the pharmacological actions of different categories of drugs	3										
			CO2	Understand the mechanism of action of drugs	3										
			CO3	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases				2							
			CO4	Understand the effect of drugs on physiological systems	3										
43	**21PY2220P**	**PHARMACOLOGY-I (PRACTICAL)**	CO1	Understanding the pharmacological actions of different categories of drugs				2							
			CO2	Application of Insilco models to demonstrate effect of drugs				3							
			CO3	Analyze the effect of drugs using rabbit animal model				2							
			CO4	Analyze the effect of drugs using rat animal model				2							
44	**21PY2221T**	**PHARMACOGNOSY AND PHYTOCHEMISTRY I**	CO1	Understand the importance of the basic metabolic pathways occurring in higher plants	2										
			CO2	Understand the importance of biological sources of various crude drugs		1									
			CO3	Understand the extraction procedures of crude drugs		1									
			CO4	Production of the phytoconstituents and identification of it.		1									
45	**21PY2221P**	**PHARMACOGNOSY AND PHYTOCHEMISTRY I**	CO1	Identification of phytoconstituents in the crude drug by chemical tests	2										
			CO2	Application of Pharmacognostical study of crude drugs				2							
			CO3	Isolation of phytoconstituents from the crude drugs.				2							
			CO4	Detection of Phytoconstituents by chromatographic techniques				2							
46	**21PY3122T**	**MEDICINAL CHEMISTRY – II**	CO1	Understanding the nomenclature, chemistry, metabolism, structure-activity relationship, mechanism of action, synthesis (few drugs	2										
			CO2	Understanding the nomenclature, chemistry, metabolism, structure-activity relationship ,mechanism of action, synthesis(few drugs)and uses of anti-anginal, Antihypertensive and diuretic drugs	2										
			CO3	Applying the knowledge of the nomenclature, chemistry, metabolism, structure-activity relationship, mechanism	2										

				of action, synthesis (few drugs) and uses of Anti arrhythmic drugs										
			CO4	Applying the knowledge of the nomenclature, chemistry, metabolism, structure-activity relationship, mechanism of action, synthesis (few drugs) and uses of Antidiabetic drugs, hormones and steroid drugs	2									
47	**21PY3123T**	**INDUSTRIAL PHARMACY I**	CO1	Understand about Physicochemical properties of drug that influences the performance of drug and dosage from		2							2	2
			CO2	Understand the formulation, manufacturing, evaluation of tablets, liquid orals, capsules and pelletization.		2								
			CO3	Understand different considerations related to parenterals and ophthalmic products		2							2	2
			CO4	Apply the formulation, preparation and evaluation of cosmetics and aerosols		2								
49	**21PY3123P**	**INDUSTRIAL PHARMACY I (PRACTICAL)**	CO1	Applying the Preformulation studies on paracetamol/aspirin/or any other drug		2								
			CO2	Applying the preparation and evaluation of capsules and coated tablets.		2								
			CO3	Analysing the preparation and evaluation of injections			3							
			CO4	Analysing the evaluation of creams			3							
50	**21PY3124T**	**PHARMACOLOGY-II**	CO1	Understanding Pharmacology of cardio vascular system drugs: congestive heart failure drugs, Anti-hypertensive drugs, Anti-anginal drugs, Anti-arrhythmic drugs, Anti-hyperlipidemic drugs	2									
			CO2	Understanding the pharmacology of shock, Hematinics, coagulants and anticoagulants, Fibrinolytics and anti-platelet drugs, diuretics and autocoids	2									
			CO3	Understand the Pharmacology of drugs acting on endocrine system. Anterior Pituitary hormones, Thyroid hormones, Insulin, Oral Hypoglycemic agents and glucagon, ACTH and corticosteroids.	2									
			CO4	Applying the principles of Bio-Assays				2						
51	**21PY3124P**	**PHARMACOLOGY-II (PRACTICAL)**	CO1	Analyzing the pharmacological activity of drugs on Cardiac and Renal system		2								
			CO2	Analysing dose responses on isolated tissues (Insilico		2								
			CO3	Examining the potency of drugs by Bioassays			2							
			CO4	Analysing the effect of drugs on analgesic and inflammation			2							
	21PY3125T		CO1	Understand the importance of the basic metabolic pathways occurring in higher plants	2									

52		**PHARMACOGNOSY AND PHYTOCHEMISTRY II**	CO2	Understand the importance of biological sources of various crude drugs	2									
			CO3	Understand the extraction procedures of crude drugs		2								
			CO4	Production of the phytoconstituents and identification of it.		2								
53	**21PY3125T**	**PHARMACOGNOSY AND PHYTOCHEMISTRY II (PRACTICAL)**	CO1	Identification of phytoconstituents in the crude drug by chemical tests	2									
			CO2	Application of Pharmacognostical study of crude drugs	2									
			CO3	Isolation of phytoconstituents from the crude drugs		2								
			CO4	Detection of Phytoconstituents by chromatographic techniques		2								
54	**21PY3126T**	**PHARMACEUTICAL JURISPRUDENCE**	CO1	Understanding the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.										
			CO2	Understanding Various Indian pharmaceutical Acts and Laws	2									
			CO3	Understanding the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	2							2		
			CO4	Understanding the code of ethics during the pharmaceutical practice								3		
55	**21PY3227 T**	**MEDICINAL CHEMISTRY – III**	CO1	Understand the importance of drug design and different techniques of drug design	2			2						
			CO2	Understand the chemistry of drugs with respect to their biological activity	2			2						
			CO3	Understanding the metabolism, adverse effects &therapeutic value of drugs.	2			2						
			CO4	Applying the concepts of SAR of drugs	2			2						
56	**21PY3227P**	**MEDICINAL CHEMISTRY – III (PRACTICAL)**	CO1	Perform synthesisof drugs and intermediates				2						
			CO2	Performing Assay of drugs				2						
			CO3	Preperation of medicinally important compounds				2						
			CO4	Analyzing the structures using Chem draw				2						
57	**21PY3228T**	**PHARMACOLOGY-III (PRACTICAL)**	CO1	Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases	2			2						
			CO2	Comprehend the principles of toxicology and treatment of various poisonings	2			2						
			CO3	Appreciate correlation of pharmacology with related medical sciences	2			2						
			CO4	Applying the concepts of pharmacodynamics of medicinal agents	2			2						
58														

	21PY3228P	**PHARMACOLOGY-III**	CO1	Demonstration of various insilico experiments	2										
			CO2	Understanding various pharmacokinetic calculations				2							
			CO3	Analysing Pharmacological effects				2							
			CO4	Application of biostatistics in experimental pharmacology				2							
58	**21PY3229T**	**HERBAL DRUG TECHNOLOGY**	CO1	Apply the knowledge on formulation of Ayurvedic dosage form understand raw material as source of herbal drugs from cultivation to herbal drug product				2							
			CO2	Understand the concept of Nutraceuticals and their role in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastrointestinal diseases				2							
			CO3	Apply the knowledge on formulation of Herbal Cosmetics using Herbal excipients				2							
			CO4	Understand the WHO and ICH guidelines for evaluation of herbal drugs. Understand Regulatory Issues - Regulations in India and Schedule T				2							
59	**21PY3229P**	**HERBAL DRUG TECHNOLOGY (PRACTICAL)**	CO1	Test for preliminary phytochemical screening	2										
			CO2	Determination of phytochemical constituents				2							
			CO3	Evaluation of natural origins				2							
			CO4	Application of herbal products in cosmetics				2							
60	**21PY3230 T**	**BIOPHARMACEUTICS AND PHARMACOKINETICS**	CO1	Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance	2										
			CO2	To understand the concepts of bioavailability and bioequivalence of drug products and their significance	2										
			CO3	Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.	2										
			CO4	Understand various pharmacokinetic parameters, their significance & applications.	2										
61	**21PY3231T**	**PHARMACEUTICAL BIOTECHNOLOGY**	CO1	Understanding the importance of Immobilized enzymes in Pharmaceutical Industries	2			2							
			CO2	Applications of genetic engineering in relation to production of pharmaceuticals	2			2							
			CO3	Understanding Importance of Monoclonal antibodies in Industries	2			2							
			CO4	Appreciate the use of microorganisms in fermentation technology	2			2							
63		**PHARMACEUTICAL QUALITY**	CO1	Understand the importance of quality assurance in Production of quality pharmaceutical production industry	2										

	21PY3232T	**ASSURANCE**	CO2	Understand the importance of good manufacturing Practices in a pharmaceutical industry	2									
			CO3	Understand the importance of good laboratory practices in a pharmaceutical industry	2									
			CO4	Applying the concepts of documentation and validation	2									
64	**21PY4133T**	**INSTRUMENTAL METHODS OF ANALYSIS**	CO1	Understand the process of pilot plant and scale up of pharmaceutical dosage forms	2			2						
			CO2	Estimation of samples by using Flame photometry	2			2						
			CO3	Application of Paper chromotography	2			2						
			CO4	Application of Electrophoresis	2			2						
65	**21PY4133P**	**INSTRUMENTAL METHODS OF ANALYSIS**	CO1	Understand the process of pilot plant and scale up of pharmaceutical dosage forms		2		3						
			CO2	Estimation of samples by using Flame photometry		2		3						
			CO3	Application of Paper chromotography		2		3						
			CO4	Application of Electrophoresis		2		3						
66	**21PY4134T**	**INDUSTRIAL PHARMACY II**	CO1	Understand the process of pilot plant and scale up of pharmaceutical dosage forms	2			2						2
			CO2	Understand the process of technology transfer from lab scale to commercial batch	2			2						2
			CO3	Understand different Laws and Acts that regulate pharmaceutical industry	2			2						2
			CO4	Application of the approval process and regulatory requirements for drug products	2			2						2
67	**21PY4135T**	**PHARMACY PRACTICE**	CO1	Understand various drug distribution methods in a hospital	2			2						
			CO2	Appreciate the pharmacy stores management and inventory control	2			2						
			CO3	Examining patient drug therapy	2			2						
			CO4	Application of communication skills in patient counselling	2				3					
68	**21PY4136T**	**NOVEL DRUG DELIVERY SYSTEMS**	CO1	Understand the Various approaches of controlled drug delivery system and Microspheres	2			2						
			CO2	Understand the various approaches for development of Mucosal drug delivery systems, implantable, buccal drug delivery sytem	2			2						
			CO3	Understand the approaches and Evaluation of Transdermal, Gastro retentive and Naso pulmonary drug delivery system.	2			2						
			CO4	Apply the concept and approaches ocular and targeting methods such as liposomes, niosomes, and nanoparticles	2			2						
69	**21PY4137T**	**PRACTICE SCHOOL**	CO1	Educational initiatives seeking to introduce industry perspective in education	3									

			CO2	To acquire learning by applying the knowledge and the skills they possess		2	3							
			CO3	Simulation of the Industry environment into the process of education				3						
			CO4	Industrial training through experimental and cooperative learning				3						
			CO5	Promotes Partnership and intellectual exchange between academia and industry						3				
70	**21UC0010**	**UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS**	CO1	Realize the basic aspiration and understanding harmony in the human being								3		
			CO2	Realize the purpose of family and understand about relationship								3		
			CO3	Realize ways to attain harmony in nature								3		
			CO4	Realize the definitiveness of human conduct								3		
71	**21PY4238 T**	**BIOSTATISITCS AND RESEARCH METHODOLOGY**	CO1	Understand the importance of statistics in research	2			2						
			CO2	Understanding the regression, probability and parametric tests	2			2						
			CO3	Know the importance of non-parametric tests	2			2						
			CO4	Case studies and practical approach	2			2						
72	**21PY4239T**	**SOCIAL AND PREVENTIVE PHARMACY 20PY4239T**	CO1	Understand the importance of health ,balanced diet and disease	2									
			CO2	Understand the importance of prevention of communicable and non –communicable diseases	2									
			CO3	Understand the importance of National level health care programs	2									
			CO4	Understand the importance of Universal health care programs	2									
73	**21PY4240ET**	**PHARMA MARKETING MANAGEMENT**	CO1	To provide an understanding of sales and marketing of pharmaceutical products	2			2						
			CO2	Know about various policies for drug inventory management	2			2						
			CO3	Know about retail and wholesale marketing	2			2						
			CO4	Understand business potential and development in product sales and manufacturing	2			2						
74	**21PY4241ET**	**PHARMACEUTICAL REGULATORY SCIENCE**	CO1	Know about legal aspects and quality policies for drugmanufacturing	2			2						
			CO2	Know about the process of drug discovery and development	2			2						
			CO3	Know the regulatory authorities and agencies	2			2						

				governing the manufacture and sale of pharmaceuticals										
			CO4	Know the regulatory approval process and their registration in Indian and international markets	2			2						
75	**21PY4242ET**	**PHARMACOVIGILANCE**	CO1	Know about the history, basic terminologies & development of Pharmacovigilance & highlight the importance of monitoring in drug safety	2									
			CO2	Applications of the principles of Medra coding & establishing Pharmacovigilance programme in India & providing criteria for			2							
			CO3	Analyse identified problems and communicate effectively with the regulatory bodies& other stake holders pertaining to the vaccine Pharmacovigilance.				2						
			CO4	Application of ICH Guidelines and clear instructions to follow the practice of Pharamcovigilance in GMP environment.							2			
76	**21PY4243ET**	**QUALITY CONTROL AND STANDARDIZATION OF HERBALS**	CO1	know WHO guidelines for quality control of herbal drugs	2			2						
			CO2	know Quality assurance in herbal drug industry	2			2						
			CO3	know the regulatory approval process and their registration inIndian and international markets	2			2						
			CO4	appreciate EU and ICH guidelines for quality control of herbal drugs	2			2						
77	**21PY4244ET**	**COMPUTER AIDED DRUG DESIGN**	CO1	Design and discovery of lead molecules	2			3						
			CO2	Application of of drug design in drug discovery process	3			3						
			CO3	Application of the concept of QSAR and docking	3			3						
			CO4	Understand various strategies to develop new drug like molecules	3			3						
78	**21PY4245ET**	**CELL AND MOLECULAR BIOLOGY**	CO1	Summarize cell and molecular biology history	2			2						
			CO2	Summarize cellular functioning and composition	2			2						
			CO3	Describe the chemical foundations of cell biology	2			2						
			CO4	Summarize the DNA properties of cell biology	2			2						
79	**21PY4246ET**	**COSMETIC SCIENCE**	CO1	Principles of formulation and building blocks of skin careproducts	2			2						
			CO2	Principles of formulation and building blocks of Hair care products	2			2						
			CO3	Role of herbs in cosmetics	2			2						
			CO4	Principles of Cosmetic Evaluation	2			2						
80	**21PY4247ET**	**EXPERIMENTAL PHARMACOLOGY**	CO1	Appreciate the applications of various commonly usedlaboratory animals	2									
			CO2	Appreciate and demonstrate the various screening		2		2	2					

				methods used in preclinical research											
			CO3	Appreciate and demonstrate the importance of biostatistics and research methodology	2	2									
			CO4	Design and execute a research hypothesis independently		2			2						
81	**21PY4248 ET**	**ADVANCED INSTRUMENTATION TECHNIQUES**	CO1	Understand the advanced instruments used and its applications in drug analysis	2		2								
			CO2	understand the chromatographic separation and analysis of drugs.		2			3						
			CO3	Understand the calibration of various analytical instruments		2			3						
			CO4	Application of analysis of drugs using various analytical instruments		2			3						
82	**21PY4249ET**	**DIETARY SUPPLEMENTS AND NUTRACEUTICALS**	CO1	Understand the need of supplements by the different group of people to maintain healthy life..	2			2							
			CO2	Understand the outcome of deficiencies in dietary supplements	2			2							
			CO3	Appreciate the components in dietary supplements and the application	2			2							
			CO4	Appreciate the regulatory and commercial aspects of dietary supplements including health claims.	2			2							
83	**21PY4250PW**	**PROJECT WORK**	CO1	Application of Pharmacy in clinical settings							2				
			CO2	Application of modern tools usage			3								
			CO3	Application of pharmacy knowledge in communication skills and ethics						3		3			
			CO4	Application of Pharmacy knowledge in research development				3							

Program Articulation Matrix (Mapping of Courses with POs)

S.No.	Course Code	Course Name	Category	L	T	P	S	Cr	PO								PSO	
									1	2	3	4	5	6	7	8	1	2
1.	**21PY1101T**	**Human Anatomy and Physiologyl (Theory)**	PC	3	1	0	0	4	2									
2.	**21PY1101P**	**Human Anatomy and Physiologyl (Practical)**	PC	0	0	4	0	2	2			2						
3.	**21PY1102T**	**Pharmaceutical Analysis I(Theory)**	PC	3	1	0	0	4	2			2					1	

4.	21PY1102P	Pharmaceutical Analysis I(Practical)	PC	0	0	4	0	2	2			2					1	
5.	21PY1103T	Pharmaceutics I (Theory)	PC	3	1	0	0	4	3			2					2	
6.	21PY1103P	Pharmaceutics I(Practical)	PC	0	0	4	0	2		3							2	
7.	21PY1104T	Pharmaceutical InorganicChemistry (Theory)	PC	3	1	0	0	4	2									
8.	21PY1104P	Pharmaceutical InorganicChemistry	PC	0	0	4	0	2	3									
9.	21PY1105T	Communication skills * (Theory)	HSS	2	0	0	0	2	1			1		3				
10.	21PY1105P	Communication skills* (Practical)	HSS	0	0	2	0	1						3				
11.	21PY1106RBT/ 21PY1106RMT	Remedial Biology/RemedialMathematics* (Theory)	BSS	2	0	0	0	2	1									
12.	21PY1106RBP	Remedial Biology* (Practical)	BSS	0	0	2	0	2			2							
13.	21PY1207T	Human Anatomy and PhysiologyII (Theory)	PC	3	1	0	0	4	3									
14.	21UC1102	Design Thinking and Innovation-I	BSS	1	0	0	4	2	2				2		2			
15.	21PY1207P	Human Anatomy and PhysiologyII (Practical)	PC	0	0	4	0	2		2		2						
16.	21PY1208T	Pharmaceutical Organic	PC	3	1	0	0	4	2			2						
17.		Chemistry I (Theory)	PC															
18.	21PY1208P	Pharmaceutical Organic Chemistry I (Practical)	PC	0	0	4	0	2	2			2						
19.	21PY1209T	Biochemistry (Theory)	PC	3	1	0	0	4	2			2						
20.	21PY1209P	Biochemistry (Practical)	PC	0	0	4	0	2	2			2						
21.	21PY1210T	Pathophysiology (Theory)	PC	3	1	0	0	4	2			2						
22.	21PY1211T	Computer Applications in Pharmacy* (Theory)	BSS	3	0	0	0	3					2					1
23.	21PY1211P	Computer Applications in Pharmacy* (Practical)	BSS	0	0	2	0	1			3		3					1
24.	21PY1212T	Environmental sciences * (Theory)	BSS	3	0	0	0	3	1			2						
25.	20UC1203	Design Thinking and Innovation-II	BSS	1	0	0	4	2		2			2		2			
26.	20PY2113T	Pharmaceutical Organic Chemistry II (Theory)	PC	3	1	0	0	4	2									
27.	21PY2113P	Pharmaceutical Organic Chemistry II (Practical)	PC	0	0	4	0	2		2		2						
28.	21PY2114T	Physical Pharmaceutics I (Theory)	PC	3	1	0	0	4	2									
29.	21PY2114P	Physical Pharmaceutics I (Practical)	PC	0	0	4	0	2			3							
30.	21PY2115T	Pharmaceutical Microbiology (Theory)	PC	3	1	0	0	4	2			2						
31.	21PY2115P	Pharmaceutical Microbiology (Practical)	PC	0	0	4	0	2		3								
32.	21PY2116T	Pharmaceutical Engineering (Theory)	PC	3	1	0	0	4	2									

33.	**21PY2116P**	**Pharmaceutical Engineering (Practical)**	PC	0	0	4	0	2	2									
34.	**21UC1202**	**English Proficiency**	HSS	0	0	4	0	2						2				
35.	**21PY2217T**	**Pharmaceutical Organic Chemistry III (Theory)**	PC	3	1	0	0	4				2						
36.	**21PY2218T**	**Medicinal Chemistry I (Theory)**	PC	3	1	0	0	4	2			2						
37.	**21PY2218P**	**Medicinal Chemistry I (Practical)**	PC	0	0	4	0	2	2			2						
38.	**21PY2219T**	**Physical Pharmaceutics II (Theory)**	PC	3	1	0	0	4	2			2						
39.	**21PY2219P**	**Physical Pharmaceutics II (Practical)**	PC	0	0	4	0	2			3							
40.	**21PY2220T**	**Pharmacology I (Theory)**	PC	3	1	0	0	4	3			2						
41.	**21PY2220P**	**Pharmacology I (Practical)**	PC	0	0	4	0	2	2			2						
42.	**21PY2221T**	**Pharmacognosy and Phytochemistry I (Theory)**	PC	3	1	0	0	4	2	1								1
43.	**21PY2221P**	**Pharmacognosy and Phytochemistry I (Practical)**	PC	0	0	4	0	2				2						1
44.	**21PY3122T**	**Medicinal Chemistry II (Theory)**	PC	3	1	0	0	4	2									
45.	**21PY3123T**	**Industrial Pharmacy I (Theory)**	PC	3	1	0	0	4		2								2
46.	**21PY3123P**	**Industrial Pharmacy I (Practical)**	PC	0	0	4	0	2		2		3						2
47.	**21PY3124T**	**Pharmacology II (Theory)**	PC	3	1	0	0	4	2			2						
48.	**21PY3124P**	**Pharmacology II (Practical)**	PC	0	0	4	0	2		2	3							
49.	**21PY3125T**	**Pharmacognosy and Phytochemistry II (Theory)**	PC	3	1	0	0	4	2	2								1
50.	**21PY3125P**	**Pharmacognosy and Phytochemistry II (Practical)**	PC	0	0	4	0	2	2	2								1
51.	**21PY3126T**	**Pharmaceutical Jurisprudence (Theory)**	PC	3	1	0	0	4	2									
52.	**21PY3227T**	**Medicinal Chemistry III (Theory)**	PC	3	1	0	0	4	2			2						
53.	**21PY3227P**	**Medicinal chemistry III (Practical)**	PC	0	0	4	0	2				2						
54.	**21PY3228T**	**Pharmacology III (Theory)**	PC	3	1	0	0	4	2			2						
55.	**21PY3228P**	**Pharmacology III (Practical)**	PC	0	0	4	0	2	2			2						
56.	**21PY3229T**	**Herbal Drug Technology (Theory)**	PC	3	1	0	0	4	2			2						3
57.	**21PY3229P**	**Herbal Drug Technology (Practical)**	PC	0	0	4	0	2	2	3								3
58.	**21PY3230T**	**Biopharmaceutics and Pharmacokinetics (Theory)**	PC	3	1	0	0	4		2								
59.	**21PY3231T**	**Pharmaceutical Biotechnology (Theory)**	PC	3	1	0	0	4	2			2						
60.	**21PY3232T**	**Quality Assurance (Theory)**	PC	3	1	0	0	4	2									
61.	**21PH3206P**	**Campus to Hospitality/Industry**	HSS	0	0	4	0	2										
62.	**21PY4133T**	**Instrumental Methods of Analysis (Theory)**	PC	3	1	0	0	4	2			2						
63.	**21PY4133P**	**Instrumental Methods of Analysis (Practical)**	PC	0	0	4	0	2	2			2						
64.	**21PY4134T**	**Industrial Pharmacy II (Theory)**	PC	3	1	0	0	4	2			2						
65.	**21PY4135T**	**Pharmacy Practice (Theory)**	PC	3	1	0	0	4	2			2			2			
66.	**21PY4136T**	**Novel Drug Delivery System (Theory)**	PC	3	1	0	0	4	2			2						2
67.	**21UC0010**	**Universal Human values and Professional Ethics**	HSS	2	0	0	0	2								3		
68.	**21PY4137PS**	**Practice School***	PC	0	0	12	0	6	2					2	2	3	3	
69.	**21PY4238T**	**Biostatistics and Research Methodology (Theory)**	PC	3	1	0	0	4	2			2						

70.	**21PY4239T**	**Social and Preventive Pharmacy (Theory)**	PC	3	1	0	0	4	2							2		
71.	**21PY4240ET**	**Pharma Marketing Management (Theory)**	PE	3	1	0	0	4	2			2						2
72.	**21PY4241ET**	**Pharmaceutical Regulatory Science (Theory)**	PE	3	1	0	0	4	2			2						
73.	**21PY4242ET**	**Pharmacovigilance (Theory)**	PE	3	1	0	0	4	2			2						2
74.	**21PY4243ET**	**Quality Control and Standardization of Herbals (Theory)**	PE	3	1	0	0	4	2			2						
75.	**21PY4244ET**	**Computer Aided Drug Design (Theory)**	PE	3	1	0	0	4	2			2						2
76.	**21PY4245ET**	**Cell and Molecular Biology (Theory)**	PE	3	1	0	0	4	2			2						
77.	**21PY4246ET**	**Cosmetic Science (Theory)**	PE	3	1	0	0	4	2			2						2
78.	**21PY4247ET**	**Experimental Pharmacology (Theory)**	PE	3	1	0	0	4	2			2						
79.	**21PY4248ET**	**Advanced Instrumentation Techniques**	PE	3	1	0	0	4										
80.	**21PY4249ET**	**Dietary Supplements and Neutraceuticals**	PE	3	1	0	0	4										
81.	**21PY4250ET**	**Project work**	PE	3	1	0	0	4		3		3			2	2		

21PY1101T -HUMAN ANATOMY AND PHYSIOLOGY-I(Theory)

L-T-P-S: 3-1-0-0 **Credits:4** **ContactHours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the gross morphology, structure and functions of various organs of the human body.	1	2
CO2	Understanding anatomy and physiological concepts of Integumentary and skeletal system	1	2
CO3	Understanding physiology of body fluids: Blood and lymph and anatomy of CVS and lymphatic system.	1	2
CO4	Understand the gross morphology of PNS and special senses	1	2

Introduction to human body, Cellular level of organization, tissue level of organization, Integumentary system, Skeletal system, Joints, Body fluids and blood, Lymphatic system, Peripheral nervous system, Special senses, Cardiovascular system

Syllabus

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 function s of epithelial, muscular and nervous and connective tissues.

Integumentary system and skeletal 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.

Body fluids and blood Lymphatic system and CVS Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticuloendothelial system. Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system.

Cardiovascular system: Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of the conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

Peripheral nervous system: Classification of the peripheral nervous system: Structure and functions of the 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.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brother's medicalpublishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, NewYork
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA.
4. Text book of Medical Physiology- Arthur Guyton andJohn.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 by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother'smedical publishers, New Delhi.

Reference Books (Latest Editions)

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA.
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A..
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata.

21PY1101P– HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)

L-T-P-S:0-0-4-0 **Credits:2** **Contact Hours: 4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Application of gross morphology of body organs using microscope	1,4	3
CO2	Applying the concepts of hematocytometry in determine blood cell count	1,4	3
CO3	Determination of various blood parameters	1,4	3
CO4	Determination of heart rate, BP	4	3

1 Study of compound microscope
2 Microscopic study of epithelial and connective tissue
3 Microscopic study of muscular and nervous tissue
4 Identification of axial bones
5 Identification of appendicular bones
6 Introduction to hemocytometry
7 Enumeration of white blood cell (WBC) count
8 Enumeration of total red blood corpuscles (RBC) count
9 Determination of bleeding time
10 Determination of clotting time
11 Estimation of hemoglobin content
12 Determination of blood group
13 Determination of erythrocyte sedimentation rate (ESR)
14 Determination of heart rate and pulse rate

15 Recording of blood pressure

21PY1102T - PHARMACEUTICAL ANALYSIS (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the principles of volumetric and electro chemical analysis	1,4	2
CO2	Understand the theories and classifications of volumetric titrations	1,4	2
CO3	Understanding the Importance of complexometry, masking and demasking agents. Concepts of Redox-titrations.	1,4	2
CO4	Understanding the concepts of electrochemical methods for analysis	1,4	2

Scope of Pharmaceutical analysis, expression of concentration, Preparation and standardization of various molar and normal solutions, Errors, pharmacopeias standards. Acid base titration, Non aqueous titration, Precipitation titrations, Gravimetry. Complexometric titration, Redox titrations, diazotizationtitration. Electrochemical methods of analysis, Conductometry, Potentiometry and Polarography.

Syllabus

Pharmaceutical analysis- Definition and scope, Different techniques of analysis, Methods of expressing concentration, Primary and secondary standards. 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. **Errors:** Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.

Acid base 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.

Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl. **Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. **Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Basic Principles, methods and application of diazotisation titration. **Redox titrations:** Concepts of oxidation and reduction.

Types of redox titrations (Principles and applications). Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

Electrochemical methods of analysis: Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications. **Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicatorelectrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications.

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press ofUniversity of London

2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

21PY1102P.PHARMACEUTICALANALYSIS(Practical)

L-T-P/S:0-0-4-0 Credits:2 ContactHours:4

Mapping of Course Outcomes with PO/PSO:

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Application of volumetric and electro chemical analysis	1,4	3
CO2	Analysing volumetric titrations	1,4	4
CO3	Analysing he Importance of complexometry, masking and demasking agents. Concepts of Redox-titrations.	1,4	4
CO4	Analysing the concepts of electrochemical methods for analysis	1,4	4

Syllabus:

Preparation and standardization of Sodium hydroxide, Sulphuric acid, Sodium thiosulfate, Potassium permanganate & Ceric ammonium sulphate.

Assay of the following compounds along with Standardization of Titrant: Ammonium chloride by acid base titration, Ferrous sulphate by Cerimetry, Copper sulphate by Iodometry, Calcium gluconate by complexometry, Hydrogen peroxide by Perman- ganometry, Sodium benzoate by non-aqueous titration & Sodium Chloride by precipitation titration

Determination of Normality by electro-analytical methods: Conductometric titration of strong acid against strong base, Conductometric titration of strong acid and weak acid against strong base & Potentiometric titration of strong acid against strong base

21PY1103T-PHARMACEUTICS-I(Theory)

L-T-P-S:3-1-0-0 Credits:4 ContactHours:4

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO	BTL
CO1	Understand the history and development of profession of pharmacy	1	2
CO2	Apply the knowledge on pharmaceutical calculations and understand the concepts of powders	1	3
CO3	Understand the principles involved in the formulation development of monophasic and biphasic liquid dosage forms	1	2
CO4	Understand the principles involved in the formulation development of semisolid dosage forms and gain knowledge of pharmaceutical incompatibilities	1	2

Pharmacy education, different dosage forms. Prescription, Dose Calculations, Powders,

Liquid dosage forms (both monophasic and biphasic), suppositories, semisolid dosage forms, Pharmaceutical incompatibilities.

Syllabus

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.

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 disadvantagesof liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.

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. **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples. **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 semisolid dosages forms

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams andWalkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University ofMichigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, NewDelhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier HealthSciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres:
13. Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

21PY1103P:Pharmaceutics I

L-T-P-S:0-0-4-0 **Credits:2** **Contact Hours: 4**

CO#	Course Outcome	PO	BTL
CO1	Apply the knowledge of preparation and dispending of monophasic liquid dosage forms	2	3
CO2	Apply the knowledge of preparation and dispending of biphasic liquid dosage forms	2	3
CO3	Apply the knowledge of preparation and dispending of powder dosage forms	2	3
CO4	Apply the knowledge of preparation and dispending of biphasic liquid dosage forms	2	3

Syllabus:

1 **Syrups : Syrup IP'66 & Compound syrup of Ferrous Phosphate BPC'68**
2 **Elixirs:** Piperazine citrate elixir & Paracetamol pediatric elixir
3 **Linctus:** Terpin Hydrate Linctus IP'66 & Iodine Throat Paint (Mandles Paint)
4 **Solutions: Strong solution of ammonium acetate, Cresol with soap solution & Lugol's solution**
5 **Suspensions:** Calamine lotion, Magnesium Hydroxide mixture & Aluminimum Hydroxide gel
6 **Emulsions:** Turpentine Liniment & Liquid paraffin emulsion
7 **Powders and Granules:** ORS powder (WHO) & Effervescent granules c)Dusting powderd)Divded powders
8 **Suppositories:** Glycero gelatin suppository, Coca butter suppository & Zinc Oxide suppository
9 **Semisolids:** Sulphur ointment & Non staining-iodine ointment with methyl salicylate
10 **Carbopal gel Gargles and Mouthwashes:** Iodine gargle & Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams andWalkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University ofMichigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, NewDelhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier HealthSciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres:
13. Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

21PY1104T-PHARMACEUTICALINORGANICCHEMISTRY(Theory)

L-T-P-S:3-1-0-0 Credits:4 ContactHours:4

Mapping of Course Outcomes with PO/PSO:

CO No:	CO	PO/PSO	BTL
CO1	Classify various inorganic compounds, sources of Impurities and test for purity of Impurities	**1, PSO1**	**1**
CO2	Understand the monograph study of various inorganic compounds belongs to Acid base regulators, Intra & Extracellular Electrolytes	**1, PSO1**	**2**
CO3	Understand the monograph study of various inorganic compounds belongs to Dental products & Gastro-intestinal agents	**1, PSO1**	**2**
CO4	Understand the monograph study of various inorganic compounds belongs to Miscellaneous agents & Radiopharmaceuticals	**1, PSO1**	**2**

Syllabus:

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.

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.

Gastrointestinal agents: 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.

Miscellaneous compounds: 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**: ZincSulphate, Potash Alum. **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I^{131},Storage conditions, precautions & pharmaceutical application of radioactive substances.

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press ofUniversity of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry

7. Indian Pharmacopoeia

21PY1104P-PHARMACEUTICALINORGANICCHEMISTRY(Practical)

L-T-P-S:0-0-4-0 **Credits:2** **ContactHours:4**

CO No:	CO	PO/PSO	BTL
CO1	Test for "Limit tests "for the ions	**1, PSO1**	**4**
CO2	Identification tests	**1, PSO1**	**3**
CO3	Determination of purity of various inorganic compounds	**1, PSO1**	**5**
CO4	Preparation of inorganic pharmaceuticals	**1, PSO1**	**4**

Syllabus:

1 **Limit tests for following ions:** Limit test for Chlorides and Sulphates. Modified limit test for Chlorides and Sulphates. Limit test for Iron. Limit test for Heavy metals. Limit test for Lead. Limit test for Arsenic

2 **Identification test:** Magnesium hydroxide, Ferrous sulphate, Sodium bicarbonate, Calcium gluconate, Copper sulphate

3 **Test for purity:** Swelling power of Bentonite, Neutralizing capacity of aluminum hydroxide gel, Determination of potassium iodate and iodine in potassium Iodide

4 **Preparation of inorganic pharmaceuticals:** Boric acid, Potash alum & Ferrous sulphate

21PY1105T-COMMUNICATIONSKILLS(Theory)

L-T-P-S:2-0-0-0 **Credits:2** **ContactHours:2**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply the practical knowledge using action verbs.	1,4	2
CO2	Analyze the pronounciations.	1,4	4
CO3	Applying the concept ofprobability.	1,4	2
CO4	Analyze the given conditions and finding out all the possible arrangements in linear & circular order.	1,4	2

Concept of communication skills, its barriers, perspectives, elements and styles. Understanding basic listening skills, writing skills and interview skills.

Syllabus

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

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

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

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.

Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education,2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh,5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st EditionUniverse of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals –PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

21PY1105P - COMMUNICATION SKILLS (Practical)

L-T-P-S: 0-0-2-0 **Credits: 1** **Contact Hours:2**

CO#	CourseOutcome	PO/PSO	BTL
CO1	Apply the practical of basic communication.	1,4	2
CO2	Analyze the pronounciations.	1,4	4
CO3	Applying the concept ofprobability.	1,4	2
CO4	Analyze the given conditions and finding out all the possible arrangements in linear & circular order.	1,4	2

Syllabus:

1. Basic communication covering the following topics: Meeting People, Asking Questions, Making Friends, What did you do? Do's and Don'ts
2. Pronunciations covering the following topics: Pronunciation (Consonant Sounds), Pronunciation and Nouns, Pronunciation (Vowel Sounds)
3. Advanced Learning: Listening Comprehension / Direct and Indirect Speech, Figures of Speech, Effective Communication, Writing Skills, Effective Writing, Interview Handling Skills, E-Mail etiquette, Presentation Skills.

21PY1106RBT-REMEDIALBIOLOGY(Theory)

L-T-P/S:2-0-0-0 Credits:2 ContactHours:2

Mapping of Course Outcomes with PO/PSO

CO No	Course Outcome (CO)	PO/PSO	BTL
CO1	Introduce biology to non-biology students	PO1	2
CO2	Know the classification and salient features of five kingdoms of life	PO1	1
CO3	Understand the basic components of anatomy & physiology of plant	PO1	2
CO4	Understand the basic components of anatomy & physiology animal with special reference to human.	PO1	2

Living organisms, Morphology of Flowering plants, Body fluids and circulation, Digestion andAbsorption, Breathing and respiration, Excretory products and their elimination, Neural control and coordination, Chemical coordination and regulation, Human reproduction, Plants and mineral nutrition,Plant growth and development, Tissues.

Syllabus

Living world: 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, Potista, Fungi, Animalia and Plantae, Virus. **Morphology of Flowering plants:** Morphology of different parts of flowering plants – Root, stem,inflorescence, flower, leaf, fruit, seed. General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones.

Body fluids and circulation: 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:** Human alimentary canal and digestive glands. Role of digestive enzymes. Digestion, absorption and assimilation of digested food. **Breathing and respiration:** Human respiratory system. Mechanism of breathing and its regulation. Exchange of gases, transport of gases and regulation of respiration. Respiratory volumes

Excretory products and their elimination: Modes of excretion, Human excretory system-structure and function, Urine formation, Rennin angiotensin system. **Neural control and coordination:** 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 medullaoblongata. **Chemical coordination and regulation:** Endocrine glands and their secretions,Functions of hormones secreted by endocrine glands. **Human reproduction:** Parts of female reproductive system, Parts of male reproductive system, Spermatogenesis and Oogenesis, Menstrual cycle

Plants and mineral nutrition: Essential mineral, macro and micronutrients, Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation. **Photosynthesis:** Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. **Plant respiration:** Respiration, glycolysis, fermentation (anaerobic). **Plant growth and development:** Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators. **Cell - The unit of life:** Structure and functions of cell and cell organelles. Cell division. **Tissues:** Definition, types of tissues, location and functions.

Text Books

1. Text book of Biology by S. B. Gokhale
2. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.
3. A Text book of Biology by B.V. Sreenivasa Naidu
4. A Text book of Biology by Naidu andMurthy
5. Botany for Degree students By A.C.Dutta.
6. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.

7. A manual for pharmaceutical biology practical byS.B. Gokhale and C. K. Kokate
8. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
9. Biology practical manual according to National core curriculum. Biologyforum of Karnataka. Prof.M.J.H.Shafi

I/ IV B. Pharmacy Odd Semester
21PY1106RBP - REMEDIAL BIOLOGY (Practical)

L-T-P-S: 0-0-2 **Credits: 1** **Contact Hours:2**

Credits: 1 **Contact Hours:2**

Mapping of CourseOutcomes with PO/PSO:

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
1	Demonstration of experiments in biology	2	2
2	Application of Insilico models to demonstrate experiments on frog	4	3
3	Identification of tissues	4	3
4	Determination of BP,Blood group and TV	4	5

Syllabus:

1 Introduction to experiments in biology: Study of Microscope, Section cutting techniques,Mounting and staining, Permanent slide preparation
2 Study of cell and its inclusions
3 Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4 Detailed study of frog by using computer models
5 Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruitand flower
6 Identification of bones
7 Determination of blood group
8 Determination of blood pressure
9 Determination of tidal volume

Text Books

1. Text book of Biology by S. B. Gokhale
2. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.
3. A Text book of Biology by B.V. Sreenivasa Naidu
4. A Text book of Biology by Naidu andMurthy
5. Botany for Degree students By A.C.Dutta.
6. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
7. A manual for pharmaceutical biology practical byS.B. Gokhale and C. K. Kokate
8. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
9. Biology practical manual according to National core curriculum. Biologyforum of Karnataka. Prof.M.J.H.Shafi.

21PY1106RMT - REMEDIAL MATHEMATICS (Theory)

L-T-P-S: 2-0-0 **Credits: 2** **Contact Hours:2**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Introduce essential of mathematics to biology students.	1,4	2
CO2	Know the theory and their application in Pharmacy	1,4	2
CO3	Solve the different types of problems by applying theory	1,4	2
CO4	Appreciate the important application of mathematics in Pharmacy	1,4	2

Study of partial fractions, logarithms, functions, matrices, determinants, calculus differentiation, analytical geometry and differential equation and their application in clinical kinetics and pharmacokinetics.

Syllabus

Partial fraction: Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics. **Logarithms:** Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems. **Function***:* Real Valued function, Classification of real valued functions,**Limits and continuity:** Introduction , Limit of a function, Definition of limit of a function ($\in$ - δ definition) ,

$$\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}, \qquad \lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1,$$

Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non- singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.

Calculus Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivativeof a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n *w.r.t*x, where *n* is any rational number, Derivative of e^x,, Derivative of $\log_e x$, Derivative of a^x, Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application. **Analytical Geometry Introduction:** Signs of the Coordinates, Distance formula, **Straight Line**: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept formof a straight line. **Integration:**

Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application.

Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations. Laplace Transform**: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, **Application in solving Chemical kinetics and Pharmacokinetics equations**

Recommended Books (Latest Edition)

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan
4. Higher Engineering Mathematics by Dr.B.S.Grewal

20UC1102: DESIGN THINKING AND INNOVATION – 1

COURSE OUTCOMES (CO – PO MAPPING):

CO No	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Understand the basics of design thinking and its implications in product or service development	PO1	2
CO2	Understand and Analyse the requirements of a typical problem	PO2	4
CO3	Plan the necessary activities towards solving the problem through ideation and prototyping	PO4, PO5, PO11	4
CO4	evaluate the solution and refine them based on the customer feedback	PO3, PO9	5

SYLLABUS:

Overview of Design Thinking: Define Design Thinking, Differentiate Design Thinking from Design, Get an Overview of the Design Thinking Process, **Empathize and Understand**: Explain how empathy influences the outcomes of Design Thinking, List Different Empathy Research Techniques, Define the Guidelines for an Empathetic Research,

Defining Needs: Explain how PoV can be used in defining the design problem; Use a structured approach to arrive at a PoV,

Ideation for Solutions: List the best practices for conducting a successful ideating session, Describe the techniques for evaluating and prioritizing ideas, **Prototyping**: Define prototyping, Explain how prototyping aids in communicating ideas effectively, List various tools for prototyping,

Testing the Solution: Define the steps of a successful testing approach, Demonstrate the process of gathering and responding to user feedback.

REFERENCE BOOKS:

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems.

21PY1207T - HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

L-T-P-S: 3-1-0-0 Credits: 4 Contact Hours:4

Mapping of Course Outcomes with PO/PSO:

CO NO	Course Outcome (CO)	PO/PSO	BTL
CO1	Understand the gross morphology, structure and functions of Central Nervous system and Brain.	PO1	2
CO2	Understand the gross morphology, structure and functions of digestive system. Formation and role of ATP, Creatinine Phosphate and BMR	PO1	2

CO3	Understand the gross morphology, structure and functions of respiratory and urinary system.	PO1	2
CO4	Understand the gross morphology, structure and functions of endocrine and reproductive system. Introduction to genetics	PO1	2

Syllabus

Nervous system: Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. **Central nervous system:** 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)

Digestive system: 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. **Energetics:** Formation and role of ATP, Creatinine Phosphate and BMR.

Respiratory 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. **Urinary system:** 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.

Endocrine system: Classification of hormones, mechanism of hormone action, structure and functionsof pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders. **Reproductive system:** 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. **Introduction to genetics:** Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medicalpublishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, NewYork
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology byTortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother'smedical publishers, New Delhi.

Reference Books:

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH,

U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

21PY1207P - HUMAN ANATOMY AND PHYSIOLOGY (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO /PSO	BTL
CO1	Apply the knowledge to perform various physiology experiments	2	3
CO2	Demonstration of various Sensory activities	4	2
CO3	Demonstration of various physiological activities	4	2
CO4	Examining physiological functions	4	4

Syllabus:

1 To study the integumentary and special senses using specimen, models, etc.
2 To study the nervous system using specimen, models, etc.,
3 To study the endocrine system using specimen, models, etc
4 To demonstrate the general neurological examination
5 To demonstrate the function of olfactory nerve
6 To examine the different types of taste.
7 To demonstrate the visual acuity
8 To demonstrate the reflex activity
9 Recording of body temperature
10 To demonstrate positive and negative feedback mechanism.
11 Determination of tidal volume and vital capacity.
12 Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13 Recording of basal mass index .
14 Study of family planning devices and pregnancy diagnosistest.
15 Demonstration of total blood count by cellanalyser
Permanent slides of vital organs and gonads

21PY1208T - PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	CourseOutcome	PO/PSO	BTL
CO1	Understand the structure, name and the type of isomerism of the organic compound	1,4	2

CO2	Understand the name of the reaction and orientation of reactions	1,4	2
CO3	Understand the reactivity /stability of compound	1,4	2
CO4	Understand the Named reactions in Organic chemistry	1,4	2

Classification of organic compounds, Alkanes, Alkenes, Conjugated, Alkyl halides, Alcohols, Carbonyl compounds* (Aldehydes and ketones), Carboxylic acids & Its derivatives, and Aliphatic amines.

Syllabus

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

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 carbo-cations, 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 **Alkyl halides*:** SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions. Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. **Alcohols*-** Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

Carbonyl compounds* (Aldehydes and ketones): Nucleophilic addition, Electrometric 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. **Carboxylic acids*:** 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. **Aliphatic amines* -** Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

21PY1208P - PHARMACEUTICAL ORGANIC CHEMISTRY –I (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Test for organic compounds and detection of elements	4	4
CO2	Test for functional groups	1,4	4
CO3	Identification of unknown compounds	1,4	3
CO4	Preparation of derivatives	1,4	5

1 Systematic qualitative analysis of unknown organic compounds like

1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc
2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
3. Solubility test
4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
5. Melting point/Boiling point of organic compounds
6. Identification of the unknown compound from the literature using melting point/ boiling point.
7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
8. 8. Minimum 5 unknown organic compounds to be analyzed systematically. Preparation of suitable solid derivatives from organic compound Construction of molecular models

21PY1209T: BIOCHEMISTRY (Theory)

L-T-P-S: 4-0-0-0 Credits: 4 Contact Hours:4

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/ PSO	BTL
CO1	Understand the principles of Chemistry in Biology	1,4	2
CO2	Understand the Catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes	1,4	2
CO3	Understand the metabolism of nutrient molecules in physiological and pathological conditions.	1,4	
CO4	Understand the genetic organization of mammalian genome and functions of the synthesis of RNSs and Proteins.	1,4	2

Syllabus

Biomolecules: Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. **Bioenergetics:** 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

Carbohydrate metabolism: 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. **Biological oxidation:** Electron transport chain (ETC) and its mechanism. Oxidativephosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC andoxidative phosphorylation/Uncouplers

Lipid 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. **Amino acid metabolism:** General reactions of amino acid metabolism:

Transamination, deamination & decarboxylation, urea cycle and its disorders, Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia), Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline. Catabolism of heme; hyperbilirubinemia and jaundice

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. **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 biochemicalfunctions.

Recommended Books (Latest Editions)

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry byRobert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D.Satyanarayan and U.Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry byDavid T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna. Practical Biochemistry byHarold Varley.

21PY1209P-BIOCHEMISTRY(Practical)

L-T-P-S:0-0-4 Credits:2 ContactHours:4

Mapping of Course Outcomes with PO/PSO:

CO NO	Course Outcome (CO)	PO/PSO	BloomsTaxonomyLevel(BTL)
CO1	Qualitative and quantitative analysis of carbohydrates, proteins and cholesterol.	PO3	3
CO2	Determination of blood cholesterol, and measurement of pH.	PO3	3
CO3	Preparation of buffer solution	PO3	3
CO4	Enzymatic hydrolysis of biomolecules and salivary enzyme activity.	PO3	3

Syllabus:

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose
2. and starch)
3. Identification tests for Proteins (albumin and Casein)
4. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret
5. method)
6. Qualitative analysis of urine for abnormal constituents
7. Determination of blood creatinine
8. Determination of blood sugar
9. Determination of serum total cholesterol
10. Preparation of buffer solution and measurement of pH
11. Study of enzymatic hydrolysis ofstarch
12. Determination of Salivary amylase activity
13. Study the effect of Temperature on Salivary amylaseactivity.
14. Study the effect of substrate concentration on salivary amylase activity.

21PY1210T - PATHOPHYSIOLOGY (THEORY)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO

CO NO	Course Outcome (CO)	PO/PSO	BloomsTaxonomyLevel(BTL)
CO1	Understand the conditions leading to a disease.	1,4	2
CO2	Understand the mechanism of inflammation	1,4	2
CO3	Understand the etiology and pathogenesis of the selected disease states	,4	2
CO4	Understanding the principles of selected diseases	1,4	2

Study of basic principles of cell injury, cell adaptation and the basic mechanism involved in the process of inflammation and repair. Pathophysiology related to disorders and diseases of cardiovascular, respiratory, renal, endocrine, nervous, GIT and skeletal systems. Pathophysiology involved in cancer, infectious and sexually transmitted diseases.

Syllabus

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 ofinflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis.

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 chronicrenal failure.

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 sexhormones. **Nervous system:** Epilepsy,

Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.

Gastrointestinal system: Peptic Ulcer, 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. **Infectious diseases:** Meningitis, Typhoid,Leprosy, Tuberculosis Urinary tract infections. **Sexually transmitted diseases:** AIDS, Syphilis,Gonorrhea.

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asiaedition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12thedition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Bestand Taylor's Physiological basis of medical practice; 12th ed; united states;
5. Williamand Wilkins, Baltimore;1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine;21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: APathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB SaundersCompany; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; ChurchillLivingstone publication; 2003.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

21PY1211T - COMPUTER APPLICATIONS IN PHARMACY (Theory)

L-T-P-S: 3-0-0 **Credits: 3** **Contact Hours:3**

Mapping of Course Outcomes with PO/PSO:

CO#	CourseOutcome	PO	BTL
CO1	Apply the knowledge of Numbering system and its calculations Understand the concepts of Information System and software	4	3
CO2	Apply the knowledge using HTML, XML, CSS, MS access languages. Understand the concepts of web technologies.	5	3
CO3	Understand the various types of application of computers in pharmacy	5	2

CO4	Applying knowledge on Data analysis in preclinical development Understand the concept of Bioinformatics.	5	3

Study of number system, concept of Information Systems, software and web technologies. Application of computers in Pharmacy and preclinical development. Bioinformatics.

Syllabus

Number system: Binary number system, Decimal number system, Octal number system,Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binaryetc, binary addition, binary subtraction – One's complement, Two's complement method,binary multiplication, binary division. **Concept of Information Systems and Software:I**nformation gathering, requirement and feasibility analysis, data flow diagrams, processspecifications, input/output design, process life cycle, planning and managing the project **Web technologies**: Introduction to HTML, XML, CSS and Programming languages,introduction to web servers and Server Products. Introduction to databases, MYSQL, MSACCESS, Pharmacy Drug database

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 andautomated dispensing of drugs, mobile technology and adherence monitoring. DiagnosticSystem, Lab-diagnostic System, Patient Monitoring System, Pharma Information System **Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept ofBioinformatics, Impact of Bioinformatics in Vaccine Discovery. **Computers as data analysis inPreclinicaldevelopment**: Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South WashingtonSquare, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience,A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors,4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)Microsoft office Access - 2003, Application Development Using VBA, SQLServer, DAP and Infopath– Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi -110002

21PY1211T - COMPUTER APPLICATIONS IN PHARMACY

L-T-P-S: 0-0-2 **Credits: 1** **Contact Hours:2**

CO#	CourseOutcome	PO	BTL
CO1	Apply knowledge on creating a HTML web page to show personal information. Understand to Design a questionnaire using a word processing package to gather information about a particular disease. Know to retrieve the information of a drug and its adverse effects using onlinetools	5	3
CO2	Apply knowledge on creating mailing labels Using Label Wizard, generating label in MSWORD, create a database in MS Access to store the patient information with the required fields Using access, design a form in MS Access to view, add, delete and modify the patient recording the database	5	3
CO3	Apply knowledge for Drug information storage and retrieval using	5	3

	MSAccess. Understand to generating report and printing the report from the patient database 8 Creating invoice table using – MS Access.		
CO4	Apply knowledge Creating and working with queries in MS Access, Exporting Tables, Queries, Forms and Reports to web page, Exporting Tables, Queries, Forms and Reports to XML pages	5	3

Syllabus:

1 Design a questionnaire using a word processing package to gather information about a particular disease.
2 Create a HTML web page to show personal information.
3 Retrieve the information of a drug and its adverse effects using onlinetools
4 Creating mailing labels Using Label Wizard , generating label in MSWORD
5 Create a database in MS Access to store the patient information with the required fields Using access
6 Design a form in MS Access to view, add, delete and modify the patient recording the database
7 Generating report and printing the report from patient database
8 Creating invoice table using – MS Access
9 Drug information storage and retrieval using MSAccess
10 Creating and working with queries in MS Access
11 Exporting Tables, Queries, Forms and Reports to web page
12 Exporting Tables, Queries, Forms and Reports to XML pages

21PY1212T - ENVIRONMENTAL SCIENCES (Theory)

L-T-P-S: 3-0-0 **Credits: 3** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the importance of Environmental education and conservation of natural resources.	1,4	2
CO2	Understand the importance of ecosystems and biodiversity.	1,4	2
CO3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process.	1,4	3

Study of multidisciplinary nature, renewable and nonrenewable sources, natural sources and associated problems, understand the concept, structure and function of different ecosystems and study of environmental pollution

Syllabus

The Multidisciplinary nature of environmental studies Natural Resources. Renewable andnon-renewable resources:

Natural resources and associated problems: a) Forest resources; b) Water resources; c) Mineralresources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual inconservation of natural resources.

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)

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Text Book:

1. Anubha Kaushik, C.P.Kaushik, "Environmental Studies" , New Age International, (2007).
2. Benny Joseph, "Environmental Studies", Tata McGraw-Hill companies, New Delhi

20UC1202: DESIGN THINKING AND INNOVATION – 2

L-T-P-S: 1-0-0-4 **Credits: 2** **Contact Hours:5**

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the problem statement, requirements and formulating approaches to solve real world problems.	PO1, PO2	2
CO2	Implementing Design Thinking Framework.	PO3	5
CO3	Develop innovative thinking ability through design thinking and also develop metrics for successful implementation of Design Thinking.	PO4, PO5, PO11	4
CO4	Understand the copyright, IPR, Trademark, Patent and license agreement policies for protecting own R&D innovations and enhancing brand image.	PO3, PO9	2

Design Thinking for Problem Solving Mindset : Understanding Problem Statements, Recapping Design Principles, Design Thinking Toolsets, Formulating approaches to Solutions, Applications of Design Thinking: Case Study

Designing Services : Functional requirements, User requirements, Designing for sustainability and resilience, Case study

Designing Thinking for Space and Environment : Functional requirements, user requirements,Implementing Design Thinking Framework,Case study

Design Thinking and Innovation Management Culture : How design thinking leads to innovative thinking,Business model thinking,How design Thinking can lead to next generation customer experience,Metrics for successful implementation of Design Thinking

Intellectual property and protection of ideas : Concepts of copyright, Intellectual Property,Trademark, Service mark Patent and typical business benefits,Applying for patent,Product license agreement,Open-source license,Need for protecting own R&D innovations,Enhancing brand image with IP

REFERENCE BOOKS:

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems

21PY2113T - PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

CO No	Course Outcome (CO)	PO/PSO	BloomsTaxonomy Level (BTL)
CO1	Understand Aromatic nature and type of chemical reactions of organic compound	PO 1	2
CO2	Understand account for reactivity of Polycyclic Aromatic compounds and different Strain theories	PO 1	2
CO3	Understand the preparation and properties of aromatic compounds	PO 1	2
CO4	Application of SAR on medical uses of selected drugs	PO 4	3

Benzene and its derivatives, Phenols, Aromatic Amines, Aromatic Acids, Fats and Oils, Polynuclear hydrocarbons and Cyclo alkanes.

Syllabus

Benzene and its derivatives: Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule, Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction, Structure and uses of DDT, Saccharin, BHC and Chloramine

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.

Fats and Oils: Fatty acids – reactions. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

Polynuclear hydrocarbons: Synthesis, reactions. Structure and medicinal uses of Naphthalene, Phenanthrene,Anthracene, Diphenylmethane, Triphenylmethane and their derivatives. **Cyclo alkanes*:** 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.

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

21PY2113P - PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	CourseOutcome	PO/PSO	BTL
CO1	Application of laboratory techniques	2	3
CO2	Determination of oil values	4	3
CO3	Preparation of various Organic compound	4	3
CO4	Synthesis of various otganic compunds	4	5

Syllabus:

1 **Experiments involving laboratory techniques:** Recrystallization & Steam distillation

2 **Determination of following oil values (including standardization of reagents)**
Acid value, Saponification value & Iodine value

3 **Preparation of compounds:**

a. Benzanilide/Phenyl benzoate/Acetanilide from Aniline/Phenol/Aniline by acylation reaction.
b. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
c. Acetanilide by halogenation (Bromination) reaction.
d. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
e. Benzoic acid from Benzyl chloride by oxidationreaction.
f. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
g. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
h. Benzil from Benzoin by oxidation reaction.
i. Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
j. Cinnammic acid from Benzaldehyde by Perkin reaction
k. *P*-Iodo benzoic acid from *P*-amino benzoic acid

21PY2114T -PHYSICALPHARMACEUTICS-I(Theory)

L-T-P-S:3-1-0-0 **Credits:4** **ContactHours:4**

Mapping of Course Outcomes with PO/PSO:

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Understand the Solubility of drugs and mechanisms of solute solvent interactions	PO1	2
CO2	Understand the Principles involved in States of Matter and properties of matter and Physicochemical properties of drug molecules	PO1	2
CO3	Understand the Concepts involved in Surface and interfacial phenomenon.	PO1	2
CO4	Application of Complexation and protein binding and determination of PH in biological systems	PO1	3

Study the physical and chemical properties of drug molecules like solubility, states of matter, surface, interfacial phenomenon, complexation, protein binding, pH, buffers and isotonicity used for designing the dosage forms.

Syllabus

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencingsolubility 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

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

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.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. 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.

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. MarcelDekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

21PY2114P - PHYSICAL PHARMACEUTICS – I (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	COURSE OUTCOME	PO/PSO	BTL
CO 1	Application of the principles of physical chemistry in development of colloidal systems and determining the stability of colloidal drug delivery systems	PO3	3
CO 2	Understand the different types of liquids based on the viscosity and viscosity determination techniques and their applications in pharmacy.	PO3	2
CO 3	Design a stable suspension / emulsion by using principles of dispersed systems	PO3	6
CO 4	Application of surface properties of solids, importance of particle size and particle size determination techniques in determining the particle size of various systems	PO3	3
CO 5	Application of various chemical reactions for determining stability of drugs and assessment of shelf life of the dosage forms.	PO3	3

Syllabus:

1 Determination the solubility of drug at room temperature
2 Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3 Determination of Partition co- efficient of benzoic acid in benzene and water
4 Determination of Partition co- efficient of Iodine in CCl_4 and water
5 Determination of % composition of NaCl in a solution using phenol-water system by CST method
6 Determination of surface tension of given liquids by drop count and drop weight method
7 Determination of HLB number of a surfactant by saponification method
8 Determination of Freundlich and Langmuir constants using activated char coal
9 Determination of critical micellar concentration of surfactants
10 Determination of stability constant and donor acceptor ratio ofPABA-Caffeine complex by solubility method
11 Determination of stability constant and donor acceptor ratio ofCupric-Glycine complex by pH titration method

21PY2115T - PHARMACEUTICAL MICROBIOLOGY (Theory)

L-T-P-S: 3-1-0-0 Credits: 4 Contact Hours:4

Mapping of Course Outcomes with PO/PSO:

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand methods of identification, cultivation and preservation of various microorganisms	PO1,PO4	2
CO2	Understand the importance and implementation of sterilization in pharmaceutical processing and industry	PO1, PO4	2
CO3	Understand sterility testing of pharmaceutical products.	PO1, PO4	2
CO4	Understand microbiological standardization of Pharmaceuticals.	PO1,PO4	2

Introduction to microbiology, Study of bacteria, sterilization techniques. Study of Fungi and Viruses. Disinfectants, antiseptics, Sterility testing, Microbiological assays, Standardization of antibiotics, vitamins and amino acids, Application of cell cultures in pharmaceutical industry and research.

Syllabus

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.

Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications ofphysical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipment employed in large scale sterilization. Sterility indicators.

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 othersterile products) according to IP, BP and USP.Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic. Types of spoilage, assessment of microbialcontamination 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 culturesin pharmaceutical industry and research.

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, OxfordLondon.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

21PY2115P – PHARMACEUTICAL MICROBIOLOGY (Practical)

L-T-P-S: 0-0-4-0 **Credits: 2** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Study of different equipments used in experimental microbiology, to perform the preparation of culture media and sterilization of glassware.	PO2	3
CO2	Applying the knowledge of sterilization techniques and isolation of Pure Cultures	PO2	3
CO3	Apply the staining techniques of bacteria, demonstration of bacterial motility by hanging drop technique.	PO2	3
CO4	Perform the microbiological assays of antibiotics, sterility testing of pharmaceuticals, biochemical tests of microorganisms.	PO2	3

Syllabus:

1 Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.

2 Sterilization of glassware, preparation and sterilization of media.

3 Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.

4 Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).

5 Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.

6 Microbiological assay of antibiotics by cup plate method and other methods.

7 Motility determination by Hanging drop method.

8 Sterility testing of pharmaceuticals.

9 Bacteriological analysis of water.

10 Biochemical test

21PY2116T –PHARMACEUTICALENGINEERING(Theory)

L-T-P-S:3-1-0-0 Credits:4 ContactHours:4

Mapping of Course Outcomes with PO/PSO

CO. No	Course Outcome (CO)	PO/PSO	BTL
CO1	Understand the concept of flow of fluids and various principles and equipment involved in size separation and size reduction techniques	2	2
CO2	Understand the concept of Heat transfer and principles and equipment involved in evaporation and distillation	2	2
CO3	Apply the concepts of drying and mixing in operation of pharmaceutical manufacturing dosage forms	2	3
CO4	Understand various materials involved in pharmaceutical manufacturing process, principles and equipment's involved in filtration and centrifugation	2	2

Flow of fluids, size reduction, size separation, heat transfer, Evaporation, Distillation, Drying,Distillation, drying, mixing, filtration, centrifugation, material plant construction.

Syllabus

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. **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, horizontaltube 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.

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,
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 Seidtz 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. **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 non metals, basic of material handling systems.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
   Theory and practice of industrial pharmacy by Lachmann., Latest edition
6. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
7. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

21PY2116P - PHARMACEUTICAL ENGINEERING (Practical)

L-T-P-S: 0-0-4-0 Credits: 2 Contact Hours:4

Mapping of Course Outcomes with PO/PSO:

CO No.	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	To know various unit operations used in Pharmaceutical industries.	2	1
CO2	To understand the material handling techniques.	2	2
CO3	Understand various processes involved in pharmaceutical manufacturing process.	2	2
CO4	Apply knowledge on operation of pharmaceutical manufacturing equipment	2	3

Syllabus:

1 Determination of radiation constant of brass, iron, unpainted and painted glass.
2 Steam distillation – To calculate the efficiency of steam distillation.
3 To determine the overall heat transfer coefficient by heat exchanger.
4 Construction of drying curves (for calcium carbonate and starch).
5 Determination of moisture content and loss on drying.
6 Determination of humidity of air – i) from wet and dry bulb temperatures –use of Dew point method.
7 Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
8 Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of varioussize frequency curves including, arithmetic and logarithmic probability plots.

9 Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
10 Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
11 Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
12 To study the effect of time on the Rate of Crystallization.
13 To calculate the uniformity Index for given sample by using Double Cone Blender.

(2009).

21UC1202-ENGLISH PROFICIENCY

L-T-P-S: 0-0-4-0 **Credits: 2** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Explain the gross morphology, structure and functions of various organs of the human body.	1,4	2
CO2	Understand the various homeostatic mechanisms and their imbalances.	1,4	2
CO3	Identify the various tissues and organs of different systems of human body.	1,4	2
CO4	Understand the organ functions	1,4	2

Study on basic English sounds and different communications like verbal, non-verbal and interpersonalcollaborations.

Syllabus

Basic English Sounds: Distinctive sounds of English; Assimilation, Contraction, Elision, Twinning; Stress, Syllables, Word- stress; Tone and Intonation, Rising, Falling, Rise-fall and Fall-rise. Pronunciation and Enunciation. Sound, Word, Sentence Drills

Oral Communication: Roll of oral communication in pharmacy practice, Significance of oral communication and barriers of communication, Lenoir process of communication

Types of communication: diagonal communication, horizontal communication, vertical communication (up-downward communication, downward-up communication), electronic communication, mass communication and media communication

Non-Verbal Communication: Non-verbal vs verbal communication, Elements of non-verbal communication, Distracting non-verbal communication, Detecting non-verbal cues in others, Dealing with sensitive issues, Overcoming non-verbal distracting factors.

Communication Skills and Inter Professional Collaboration: Case studies, Pharmacist working in collaboration with physicians (Knapps model), Confrontational relationships and procedural obstacles (Duck's phase model), Barriers and facilitators to collaborative partnership, Four key characteristics of effective collaboration (sharing, partnering, interdependency and power)

Reference Books:

1. Dictionary of Technical Terms
2. Dr. Meenakshi Raman and Dr. Sangeetha Sarma: *Technical Communication*. Oxford University Press:Delhi.2016.
3. The Ultimate Verbal and Vocabulary Builder. Texas: Lighthouse Review.2000.
4. Rajeev Vasisth: *Interactive Vocabulary Drills*. New Delhi: Arihant Publications Limited. 2011.

5. Language Laboratory Teacher Manual, KLEFU

21PY2217T-PHARMACEUTICALORGANICCHEMISTRY –III(Theory)

L-T-P-S:3-1-0 **Credits:4** **ContactHours:4**

Mapping of CourseOutcomes with PO/PSO:

CO#	CourseOutcome	PO/PSO	BTL
CO No	CourseOutcome(CO)	PO/PSO	BloomsTaxonomyLevel(BTL)
CO1	Describes stereoisomerism and racemic modification of compound	PO1	2
CO2	Account for sterereo specific reactions and its nomenclatutre of given organic compounds f	PO1	2
CO3	Detail study of Heterocyclics, its nomenclature, synthesis and its reactions	PO4	2
CO4	Description of preparative methods, medicinal uses of heterocyclicdrugs and Study of Named reactions.	PO4	2

Syllabus

Stereo isomerism: Optical isomerism – Optical activity, enantiomerism, diastereo-isomerism, mesocompounds Elements of symmetry, chiral and achiral molecules, DL system of nomenclature of opticalisomers, 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. Geometrical isomerism: Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Antisystems) Methods of determination of configuration of geometrical isomers. Conformationalisomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions.

Heterocyclic compounds: Nomenclature and classification, Synthesis, reactions and medicinal uses offollowing compounds/derivatives Pyrrole, Furan, and Thiophene. Relative aromaticity and reactivity ofPyrrole, Furan and Thiophene

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 theirderivatives. **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.

Recommended Books (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry by Morrison and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist.

21PY2218T - MEDICINAL CHEMISTRY – I (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO No.	CourseOutcome(CO)	PO/PSO	Blooms TaxonomyLevel(BTL)
CO1	Understand the correlation of pharmacology of a disease with physico-chemical properties of drugs	PO1	2
CO2	Understand the chemistry, metabolic pathways, structure activity relationship and therapeutic value of adrenergic drugs	PO1,PO4	2
CO3	Understand the chemistry, metabolic pathways, structure activity relationship and therapeutic value of cholinergicdrugs	PO1,PO4	2
CO4	Understand the chemistry, metabolic pathways, structure Activity relationship and therapeutic value o fCNS drugs	PO1,PO4	2

Syllabus

Introduction to Medicinal Chemistry: History and development of medicinal chemistry Physicochemical properties in relation to biological action, Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. **Drug metabolism:** Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.**Drugs acting on Autonomic NervousSystem: Adrenergic Neurotransmitters:** Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. **Sympathomimetic agents: SAR of Sympathomimetic agents:** Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxy-amphetamine, Pseudoephedrine, Propylhexedrine. Agents withmixed 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.**Cholinergic neurotransmitters:** Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. **Parasympathomimetic agents: SAR of Parasympathomimetic agents Direct acting agents:** Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine. **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):** Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium, Tacrine, Ambenonium, Isofluorphate, Echothiophate iodide, Parathione, Malathion. **Cholinesterase reactivator:** Pralidoxime chloride. **Cholinergic Blocking agents: SAR of cholinolytic agents Solanaceous alkaloids and analogues:** Atropine, Hyoscyamine, Scopolamine, Homatropine, Ipratropium bromide*. **Synthetic cholinergic blocking agents:** Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

Drugs acting on Central Nervous System: Sedatives & Hypnotics: Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem **Barbiturtes:** SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital **Miscelleneous:** Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde. **Antipsychotics: Phenothiazeines:** SAR of

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

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

21PY3123T:Industrial Pharmacy-I(Theory)

L-T-P/S:3-1-0 **Credits:4** **ContactHours:4**

Mapping of CourseOutcomes with PO/PSO:

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand about Physicochemical properties of drug that influences the performance of drug and dosage from.	PO2/PSO2	2
CO2	Understand the formulation, manufacturing, evaluation of tablets, liquid orals, capsules and pelletization.	PO2	2
CO3	Understand different considerations related to parenterals and ophthalmic products	PO2	2
CO4	Apply the formulation, preparation and evaluation of cosmetics and aerosols. A note on packaging materials for pharmaceutical products	PO2	3

Preformulation Studies, BCS classification of drugs, Tablets, Tablet coating, Liquid orals, Hard gelatin capsules, Soft gelatin capsules, Pellets, Parenteral Products, Ophthalmic Preparations, Cosmetics, Pharmaceutical Aerosols, Packaging Materials Science.

Syllabus

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. ***Physical properties:*** Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism. ***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.

Tablets: Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. 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 Capsules: ***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. ***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, equipment for manufacture of pellets

Parenteral Products: Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity, Production procedure, production facilities and controls, aseptic processing, Formulation of injections, sterile powders, large volume parenterals and lyophilized products. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. **Ophthalmic Preparations:** Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens. **Pharmaceutical Aerosols:** Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. **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.

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
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,2005

Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel

Dekker Series,Vol 10

21PY3123P-IndustrialPharmacy-I(Practical)

L-T-P-S:0-0-4-0 **Credits:2** **ContactHours:4**

Mapping of Course Outcomes with PO/PSO:

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Applying the Preformulation studies on paracetamol/aspirin/or any other drug	PO2/PSO2	3
CO2	Applying the preparation and evaluation of capsules and coated tablets.	PO2/PSo2	3
CO3	Analysing the preparation and evaluation of injections	PO3	4
CO4	Analysing the evaluation of creams	PO3	4

Syllabus

1. Preformulation studies on paracetamol/asparin/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Qulaity control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

21PY3124T - PHARMACOLOGY-II (Theory)

Credits: 4 **Contact Hours:4**

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understanding Pharmacology of cardio vascular system drugs: congestive heart failure drugs, Anti-hypertensive drugs, Anti-anginal drugs, Anti-arrhythmic drugs, Anti-hyperlipidemic drugs.	**PO1**	2
CO2	Understanding the pharmacology of shock, Hematinics, coagulants and anticoagulants, Fibrinolytics and anti-platelet drugs, diuretics and autocoids	**PO1**	2

CO3	Understand the Pharmacology of drugs acting on endocrine system. Anterior Pituitary hormones, Thyroid hormones, Insulin, Oral Hypoglycemic agents and glucagon, ACTH and corticosteroids.	**PO1**	2
CO4	Applying the Principles of Bioassays&understanding estrogens, progesterone and oral contraceptives. Drugs acting on the uterus	**PO1&PO4**	3

Pharmacology of drugs acting on cardiovascular system, urinary system, endocrine system, Autocoidsand related drugs,

Syllabus

Pharmacology of drugs acting on cardiovascular system: Introduction to hemodynamic and electrophysiology ofheart. Drugs used in congestive heart failure Anti-hypertensive drugs. Anti-anginaldrugs. Anti-arrhythmic drugs. Anti-hyperlipidemic drugs.

Pharmacology of drugs acting on cardiovascular system: Drug used in the therapy of shock. Hematinics, coagulants and anticoagulants. Fibrinolytics and anti-platelet drugs. Plasma volume expanders. **Pharmacology of drugs acting on urinary system:** Diuretics, Anti-diuretics. **Autocoids and related drugs:** Introduction to autacoids and classification, Histamine, 5-HT and their antagonists. Prostaglandins, Thromboxanes and Leukotrienes. Angiotensin, Bradykinin and Substance P. Non- steroidal anti-inflammatoryagents, Anti-gout drugs, Antirheumatic drugs

Pharmacology of drugs acting on endocrine system: Basic concepts in endocrine pharmacology., Anterior Pituitary hormones- analogues and their inhibitors. Thyroid hormones- analogues and their inhibitors. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. Insulin, Oral Hypoglycemic agents and glucagon. ACTH and corticosteroids.

Pharmacology of drugs acting on endocrine system: Androgens and Anabolic steroids. Estrogens, progesterone and oral contraceptives. Drugs acting on the uterus. **Bioassay:** Principles and applications of bioassay. b. Types of bioassay Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil LivingstoneElsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W.,Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, NewDelhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan

21PY3124P-PHARMACOLOGY-II(Practical)

L-T-P-S:0-0-4-0 Credits:2 ContactHours:4

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Analyzing the pharmacological activity of drugs on Cardiac and Renal system	PO2	4
CO2	Analysing dose responses on isolated tissues (Insilico)	PO2	4
CO3	Examining the potency of drugs by Bioassays	PO3	4
CO4	Analysing the effect of drugs on analgesic and inflammation	PO3	4

Syllabus

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 frogrectus abdominis muscle and ratileum respectively.
7. Bioassay of histamine using guinea pig ileum bymatching method.
8. Bioassay of oxytocin using rat uterine horn by interpolationmethod.
9. Bioassay of serotonin using rat fundus strip bythree point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four pointbioassay.
11. Determination of PA2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12. Determination of PD2 value using guinea pigileum.
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

21PY3125T-PHARMACOGNOSYANDPHYTOCHEMISTRYII(Theory)

L-T-P/S:3-1-0 Credits:4 ContactHours:4

MappingofCourseOutcomeswithPO/PSO:

CO No:	CO	PO	BTL
CO1	Understand the importance of the basic metabolic pathways occurring in higher plants	1	2
CO2	Understand the importance of biological sources of various crude drugs	1	2
CO3	Understand the extraction procedures of crude drugs	2	2
CO4	Production of the phytoconstituents and identification of it.	2	3

Metabolic pathways in higher plants and their determination, Alkaloids, Phenylpropanoids and Flavonoids, Steroids, Cardiac Glycosides & Triterpenoids, Volatile oils, Tannins, Resins, Glycosides, Iridoids, Other terpenoids & Naphthaquinones, Basics of Phytochemistry

Syllabus

Metabolic pathways in higher plants and their determination: Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites: **Alkaloids:** Vinca, Rauwolfia, Belladonna,Opium, **Phenylpropanoids and Flavonoids:** Lignans, Tea, Ruta **Steroids, Cardiac Glycosides & Triterpenoids**: Liquorice, Dioscorea, Digitalis **Volatile oils**: Mentha, Clove, Cinnamon, Fennel, Coriander, **Tannins:** Catechu, Pterocarpus **Resins:** Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony **Glycosides:** Senna, Aloes, Bitter Almond **Iridoids, Other terpenoids & Naphthaquinones:** Gentian, Artemisia, taxus, carotenoidsIsolation, Identification and Analysis of Phytoconstituents: Terpenoids: Menthol, Citral, Artemisin, Glycosides: Glycyrhetinic acid & Rutin Alkaloids: Atropine, Quinine, Reserpine, Caffeine, Resins: Podophyllotoxin, Curcumin.Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine **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.

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers& Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan,New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

21PY3125P-PHARMACOGNOSYANDPHYTOCHEMISTRYII(Practical)

L-T-P/S:0-0-4 Credits:2 ContactHours:4

Mapping of CourseOutcomes with PO/PSO:

CO No.	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO-1	Identification of phytoconstituents in the crude drug by chemical tests	1	3
CO-2	Application of Pharmacognostical study of crude drugs	**1**	**3**
CO-3	Isolation of phytoconstituents from the crude drugs.	**2**	**3**
CO-4	Detection of Phytoconstituents by chromatographic techniques	**2**	**4**

Syllabus

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of activeprinciples

a. Caffeine - from tea dust.
b. Diosgenin from Dioscorea
c. Atropine from Belladonna
d. Sennosides from Senna

3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh
7. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
8. Exercise involving isolation & detection of active principles

21PY3126T-PHARMACEUTICALJURISPRUDENCE(Theory)

L-T-P-S:3-1-0-0 **Credits:4** **ContactHours:4**

Mapping of Course Outcomes with PO/PSO:

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understanding the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.	1	2
CO2	Understanding Various Indian pharmaceutical Acts and Laws	1	2
CO3	Understanding the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	8	2
CO4	Understanding the code of ethics during the pharmaceutical practice	8	2

Detailed study of Objectives, definitions, rules of drug and cosmetics act (1940), Pharmacy act (1948), medicinal and toilet preparation act(1955),narcotic drugs and psychotropic act (1985), Drugs and Magic Remedies Act, Prevention of Cruelty to animals Act-1960, National Pharmaceutical Pricing Authority, Pharmaceutical Legislations, Medical Termination of Pregnancy Act, Right to Information Act and introduction to code of ethics, intellectual property act.

Syllabus

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

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 **Pharmacy Act – 1948**: 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. **Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties. **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties. **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, 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. **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)- 2113. 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). **Pharmaceutical Legislations –** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee. **Code of Pharmaceutical ethics** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath. Medical Termination of Pregnancy Act. **Right to Information Act. Introduction to Intellectual Property Rights (IPR)**

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21PY3227T - MEDICINAL CHEMISTRY – III (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/ PSO	BTL
CO1	Understand the importance of drug design and different techniques ofdrug design.	1,4	2
CO2	Understand the chemistry of drugs with respect to their biologicalactivity.	1,4	2
CO3	Know the metabolism, adverse effects & therapeutic value of drugs.	1,4	2
CO4	Know the importance of SAR of drugs.	1,4	2

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs, Structure activity relationship of selective class of drugs and synthesis of some important drugs. Antibiotics, β-Lactam antibiotics, Aminoglycosides,

Tetracyclines.
Macrolide, Miscellaneous, Prodrugs, Antimalarials. Anti-tubercular Agents: Synthetic anti tubercular agents. Urinary tract anti-infective agents: Antiviral agents. Antifungal agents, Anti-protozoal Agents, Anthelmintics, Sulphonamides and Sulfones, Folate reductase inhibitors, Introduction to Drug Design,Combinatorial Chemistry.

Syllabus

Antibiotics: Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. **β-Lactam antibiotics:** Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams **Aminoglycosides:** Streptomycin, Neomycin, Kanamycin, **Tetracyclines:** Tetracycline, Oxytetracycline, Chlortetracycline,Minocycline, Doxycycline

Antibiotics: Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. **Macrolide:** Erythromycin Clarithromycin, Azithromycin. **Miscellaneous:** Chloramphenicol*, Clindamycin. **Prodrugs:** Basic concepts and application of prodrugs design. **Antimalarials:** Etiology of malaria. **Quinolines:** SAR, Quinine, Primaquine, Chloroquine*,Amodiaquine,Paquine*, Quinacrine, Mefloquine. **Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil. **Miscellaneous:** Pyrimethamine, Artesunete, Artemether, Atovoquone**Anti-tubercular Agents: Synthetic anti tubercular agents:** Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* **Antitubercular antibiotics:** Rifampicin,utin, Cycloserine Streptomycine, Capreomycin sulphate. Urinary tract anti-infective agents: **Quinolones:** SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin,SparfloxaciGatifloxacinMoxifloxacin,**Miscellaneous:**Furazolidine,Nitrofurantoin*, Methanamine. Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.
Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin. **Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, 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, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine. **Folate reductase inhibitors:** Trimethoprim*, Cotrimoxazole. **Sulfones:** Dapsone*. Introduction to Drug Design: Various approachesused in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hanschanalysis. Pharmacophore modeling and docking techniques. **Combinatorial Chemistry:** Concept and applications chemistry: solid phase and solution phase synthesis.

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.

8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

21PY3227P-MEDICINALCHEMISTRY-III(Practical)

L-T-P/S:0-0-4 Credits:4 ContactHours:4

MappingofCourseOutcomeswithPO/PSO:

CO#	CourseOutcome	PO /PSO	BTL
CO1	Perform synthesisof drugs and intermediates	4	3
CO2	Performing Assay of drugs	4	3
CO3	Preperation of medicinally important compounds	4	3
CO4	Analyzing the structures using Chem draw	4	4

Syllabus

I **Preparation of drugs and intermediates:** Sulphanilamide, 7-Hydroxy, 4-methyl coumarin, Chlorobutanol, Triphenyl imidazole, Tolbutamide & Hexamine

II **Assay of drugs: Isonicotinic acid hydrazide, Chloroquine, Metronidazole, Dapsone, Chlorpheniramine maleate & Benzyl penicillin**

III Preparation of medicinally important compounds or intermediates byMicrowave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

VI Preparation of medicinally important compounds or intermediates byMicrowave irradiation technique

VII Drawing structures and reactions using chem draw®

21PY3228T - PHARMACOLOGY-III (Theory)

L-T-P-S: 3-1-0-0 Credits: 4 Contact Hours:4

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/ PSO	BTL
CO1	understand the mechanism of drug action and its relevance in thetreatment of different infectious diseases	1,4	2
CO2	comprehend the principles of toxicology and treatment of various poisoning agents	1,4	2
CO3	appreciate correlation of pharmacology with related medical sciences.	1,4	2
CO4	To be able to ascertain the pharmacodynamics of medicinal agents	1,4	2

Pharmacology of drugs acting on Respiratory system, Chemotherapy, Immunopharmacology,Principles of toxicology, General principles of treatment of poisoning, Chrono-pharmacology.

Syllabus

Pharmacology of drugs acting on Respiratory system: Anti -asthmatic drugs, Drugs used in the management of COPD, Expectorants and antitussives, Nasal decongestants &

Respiratory stimulants. Pharmacology of drugs acting on the Gastrointestinal Tract: Antiulcer agents. Drugs for constipation and diarrhoea. Appetite stimulants and suppressants. Digestants and carminatives. Emetics and anti- emetics.
Chemotherapy: General principles of chemotherapy. Sulfonamides and cotrimoxazole. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides, Antitubercular agents, Antileprotic agents, Antifungal agents, Antimalarial drugs& Antiamoebic agents.
Chemotherapy: Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy. **Immunopharmacology**: Immunostimulants, Immunosuppressant, Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars
Principles of toxicology: Definition and basic knowledge of acute, subacute and chronictoxicity.Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity **General principles of treatment of poisoning**, Clinical symptoms and management of barbiturates,morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning. **Chrono-pharmacology**: Definition of rhythm and cycles. Biological clock and their significance leading tochronotherapy.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil LivingstoneElsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W.,Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, NewDelhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher ModernPharmacology with clinical Applications, by Charles R.Craig& Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

21PY3228P-PHARMACOLOGY-III(Practical)

L-T-P-S:0-0-4-0 Credits:2 ContactHours:4

MappingofCourseOutcomeswithPO/PSO:

CO#	CourseOutcome	PO/PSO	BTL
CO1	Demonstration of various insilico experiments	1	3
CO2	Understanding various pharmacokinetic calculations	4	2
CO3	Analysing Pharmacological effects	4	4
CO4	Application of biostatistics in experimental pharmaclogy	4	3

Syllabus

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay

3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat modelandNSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi-auto analyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a givendata
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology (student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, WilcoxonSigned Rank test)

Note: *Experiments are demonstrated by simulated experiments/videos*

21PY3229T-HERBALDRUGTECHNOLOGY(Theory)

L-T-P-S:3-1-0-0 **Credits:4** **ContactHours:4**

Mapping of CourseOutcomes with PO/PSO:

CO#	Course Outcome	PO	BTL
CO1	Apply the knowledge on formulation of Ayurvedic dosage form understand raw material as source of herbal drugs from cultivation to herbal drug product.	4	3
CO2	Understand the concept of Nutraceuticals and their role in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastrointestinal diseases	4	2
CO3	Apply the knowledge on formulation of Herbal Cosmetics using Herbal excipients	4	3
CO4	Understand the WHO and ICH guidelines for evaluation of herbal drugs. Understand Regulatory Issues -Regulations in India and Schedule T	4	2

Syllabus

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. **Biodynamic Agriculture:** Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. **Indian Systems of Medicine:** Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy, Preparation and standardization of Ayurvedic formulations viz Aristasand Asawas, Ghutika,Churna, Lehya and Bhasma.

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 Gastrointestinal 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.

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. **Herbal excipients:** Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. **Herbal formulations:** Conventional herbal formulations like syrups,mixtures and tablets and Novel dosage forms like phytosomes

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. **Patenting and Regulatory requirements of natural products:** Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy, Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. **Regulatory Issues** - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Zof Drugs & Cosmetics Act for ASU drugs. **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. S**chedule T – Good Manufacturing Practice of Indian systems ofmedicine:** 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.

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease &Evans.
2. Textbook of Pharmacognosy byTyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine &Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. BusinessHorizons Publishers, New Delhi, India, 2002.

21PY3229P - HERBAL DRUG TECHNOLOGY (Practical)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

CO#	CourseOutcome	PO/PSO	BTL
CO1	Test for preliminary phytochemical screening___	1	4
CO2	Determination of phytochemical constituents	4	3
CO3	Evaluation of natural origins	4	5
CO4	Application of herbal products in cosmetics	4	4

Syllabus

1. To perform preliminary phytochemical screening of crudedrugs.
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations likecreams, lotions and shampoos and their evaluation.

5. Incorporation of prepared and standardized extract in formulations like syrups,mixtures and tablets and their evaluation as per Pharmacopoeialrequirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids
10. To perform preliminary phytochemical screening of crudedrugs.
11. Determination of the alcohol content of Asava and Arista
12. Evaluation of excipients of natural origin
13. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.

21PY3230T-BIOPHARMACEUTICSAND PHARMACOKINETICS(Theory)

L-T-P-S:3-1-0-0 Credits:4 ContactHours:4

Mapping of CourseOutcomes with PO/PSO:

CO#	Course Outcome	PO	BTL
CO1	Understand the basic concepts in bio pharmaceutics and pharmacokinetics and their significance.	1	2
CO2	To understand the concepts of bioavailability and bioequivalence of drug products and their significance.	1	2
CO3	Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.	1	2
CO4	Understand various pharmacokinetic parameters, their significance & applications.	1	2

Introduction to Biopharmaceutics, Absorption, Distribution, protein binding, Elimination, Bioavailability and Bioequivalence, Pharmacokinetics, Multicompartment models, Nonlinear Pharmacokinetics.

Syllabus

Introduction to Biopharmaceutics.

Absorption: Mechanisms of drug absorption through GIT, factors influencing drug absorptionthough 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.

Elimination: Drug metabolism and basic understanding of metabolic pathways, renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, non-renal routesof 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* correlation, bioequivalence studies protocol, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

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 - K_E, $t_{1/2}$, V_d, AUC, K_a, Cl_T and CL_R: definitions, methods of eliminations, understanding of their significance and application.

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.

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Clinical Pharmacokinetics: Dose adjustment in renal impaired patients

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar . Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowlandand
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

21PY3231T - PHARMACEUTICAL BIOTECHNOLOGY (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understanding the importance of Immobilized enzymes in Pharmaceutical Industries	1,4	1,2
CO2	Applications of genetic engineering in relation to production of pharmaceuticals	1,4	3
CO3	Understanding Importance of Monoclonal antibodies in Industries	1,4	2
CO4	Appreciate the use of microorganisms in fermentation technology	1,4	2

Introduction to Biotechnology, Protein Engineering, cloning vectors, Recombinant DNA technology, Types of immunity, General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity, Immuno blottingtechniques, Mutation, Fermentation methods, Blood Products.

Syllabus

Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. Enzyme Biotechnology- Methods of enzyme immobilization and applications. Biosensors- Working and applications of biosensors in Pharmaceutical Industries. Brief introduction to Protein Engineering. Useof microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering.

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: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. Brief introduction to PCR

Types of immunity- humoral immunity, cellular immunity, Structure of Immunoglobulins, Structure and Function of MHC, Hypersensitivity reactions, Immune stimulation and Immune suppressions. General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. Storage conditions and stability of official vaccines. Hybridoma technology- Production, Purification and Applications. Blood products and Plasma Substitutes. Immuno blotting techniques- ELISA, Western blotting, Southern blotting. Genetic organization of Eukaryotes and Prokaryotes. Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. Introduction to Microbial biotransformation and applications. Mutation: Types of mutation/mutants. Fermentation methods and general requirements, study of media, equipment, sterilization methods, aeration process, stirring. Large scale production fermenter design and its variouscontrols. Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and

Applications ofRecombinantDNA: ASM Press Washington D.C.
2. RA Goldshy et. al., : Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Adityabooks Ltd., New Delhi

21PY3232T - QUALITY ASSURANCE (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO No.	Course Outcome(CO)	PO/PSO	BTL
CO1	Understand the importance of quality assurance in Production of quality pharmaceutical production industry	PO1/PSO1	2
CO2	Understand the importance of good manufacturing Practices in a pharmaceutical industry	PO1/PSO1	2
CO3	Understand the importance of good laboratory practices in a pharmaceutical industry	PO1/PSO1	2
CO4	Applying the concepts of documentation and validation	PO1/PSO1	3

Quality Assurance and Quality Management concepts: Total Quality Management (TQM), ICH Guidelines, Quality by design (QbD), ISO 9000 & ISO14000, NABL accreditation. Organization and personnel, Equipment and raw materials. Quality Control, Good Laboratory Practices, Complaints. Document maintenance in pharmaceutical industry, Calibration and Validation: Warehousing.

Syllabus

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

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. **Equipment and raw materials:** Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

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 **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. **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

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guidelines and Related materials Vol I WHOPublications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Qualityspecification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

21PY4133T - INSTRUMENTAL METHODS OF ANALYSIS (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

CO#	Course Outcome	PO/ PSO	BTL
CO1	Know about various instruments and standard operating procedures	1,4	2
CO2	Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis	1,4	2
CO3	Understand the chromatographic separation and analysis of drugs.	1,4	2
CO4	Understand the principle and application of advanced analytical instruments.	1,4	2

Analytical techniques, Spectroscopic and Chromatographic techniques. UV-Visible spectroscopy, Fluorimetry, IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy, Nepheloturbidometry. Chromatographic techniques, Adsorption and partition column chromatography, Thin layer chromatography, Paper chromatography, Gas chromatography, High performance liquid chromatography, Ion exchange chromatography, Gel chromatography, Affinity chromatography and Electrophoresis techniques.

Syllabus

UV Visible spectroscopy: 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. Fluorimetry: Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

IR 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. **Flame Photometry**-Principle, interferences, instrumentation and applications. **Atomic absorption spectroscopy**-Principle, interferences, instrumentation and applications. **Nepheloturbidometry**-Principle, instrumentation and applications

Introduction to chromatography: Adsorption and partition column chromatography- Methodology, advantages, disadvantages and applications. **Thin layer chromatography-** Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications. **Electrophoresis**– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications.

Gas chromatography- Introduction, theory, instrumentation, derivatization,temperatureprogramming, advantages, disadvantages and applications. High performance liquid

chromatography: Introduction, theory, instrumentation, advantages and applications. Ion exchangechromatography- Introduction, classification, ion exchange resins, properties, mechanism of ionexchange process, factors affecting ion exchange, methodology and applications. Gel chromatography-Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.KSharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry byA.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

21PY4133P - INSTRUMENTAL METHODS OF ANALYSIS (Practical)

L-T-P-S: 0-0-4-0 **Credits: 4** **Contact Hours:4**

CO#	Course Outcome	PO/ PSO	BTL
CO1	Know about various instruments and standard operating procedures	1,4	2
CO2	Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis	1,4	2
CO3	Understand the chromatographic separation and analysis of drugs.	1,4	2
CO4	Understand the principle and application of advanced analytical instruments.	1,4	2

Syllabus

1 Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2 Estimation of dextrose by colorimetry
3 Estimation of sulfanilamide by colorimetry
4 Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5 Assay of paracetamol by UV- Spectrophotometry
6 Estimation of quinine sulfate by fluorimetry
7 Study of quenching of fluorescence
8 Determination of sodium by flame photometry
9 Determination of potassium by flame photometry
10 Determination of chlorides and sulphates by nephelo turbidometry

11 Separation of amino acids by paper chromatography
12 Separation of sugars by thin layerchromatography
13 Separation of plant pigments by column chromatography
14 Demonstration experiment on HPLC
15 Demonstration experiment on Gas Chromatography

21PY4134T - INDUSTRIAL PHARMACY-II (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

MappingofCourseOutcomeswithPO/PSO:

CO#	CourseOutcome	PO/PSO	BTL
CO1	Understand the process of pilot plant and scale up of pharmaceutical dosage forms	1,4	2
CO2	Understand the process of technology transfer from lab scale to commercial batch	1,4	2
CO3	Understand different Laws and Acts that regulate pharmaceutical industry	1,4	2
CO4	Application of the approval process and regulatory requirements for drug products	1,4	3

The process of pilot plant scale up of techniques of pharmaceutical dosage forms and the process of technology transfer from lab scale to commercial batch. Regulation of pharmaceutical industry, approval process, regulatory requirements for drug products, quality management and certifications pharmaceutical products.

Syllabus

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. **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 equipment, 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.

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals. **Regulatory requirements for drug approval:** 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.

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. **Indian Regulatory Requirements:** 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.

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available athttp,//en.wikipedia.org/wiki/Regulatory_ Affairs.
2. International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for PrescriptionDrugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought bylearning plus, inc. available at http.//www.cgmp.com/ra.htm.

21PY4135T - PHARMACY PRACTICE (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand various drug distribution methods in a hospital	1,4	2
CO2	Appreciate the pharmacy stores management and inventory control	1,4	2
CO3	Examining patient drug therapy	1,4	4
CO4	Application of communication skills in patient counselling	1,4	3

Hospital and it's organization, Adverse drug reaction, Community Pharmacy, Drug distribution system in a hospital, Hospital formulary, Therapeutic drug monitoring, Medication adherence: Causes of medication non-adherence, pharmacist role in the Patient medication history interview, Pharmacy and therapeutic committee, Drug information services, Patient counseling, Prescribed medication order andcommunication skills, Budget preparation and implementation, Over the counter (OTC) sales, Investigational use of drugs, Interpretation of Clinical Laboratory Tests.

Syllabus

Hospital and it's organization: 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. Hospital pharmacy and its organization:Definition, functions of hospital pharmacy, Organization structure, Location, Layout

and staff requirements, and Responsibilities and functions of hospital pharmacists. Adverse drug reaction: 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. Community Pharmacy: 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 drugstore. **Drug distribution system in a hospital:** 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. Hospital formulary: Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary. Therapeutic drug monitoring: Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring. Medication adherence: Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence. Patient medication history interview: Need for the patient medication history interview, medication interview forms. Community pharmacy management: Financial, materials, staff, and infrastructure requirements.

Pharmacy and therapeutic committee: 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 information services: Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information. Patient counseling: Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist. Education and training program in the hospital: 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 and communication skills: Prescribed medication order-interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

Budget preparation and implementation: Budget preparation and implementation: Clinical Pharmacy: 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. Over the counter (OTC) sales: Introduction and sale of over the counter, and Rational use of common over the counter medications. Drug store management and inventory control. Organisation 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. Investigational use of drugs: Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. Interpretation of Clinical Laboratory Tests: Blood chemistry, hematology, and urinalysis.

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4th ed. Ahmadabad: B.S. ShahPrakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of Clinical Pharmacy Practice-essential concepts and skills,* 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health SystemPharmacists Inc; 2009.
6. Parmar N.S. *Health Education and Community Pharmacy*, 18th ed. India: CBS Publishers &Distributers; 2008.

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacy practice. ISSN: 0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)Pharmacy times (Monthly magazine

20PY4136T -NOVELDRUGDELIVERY SYSTEMS(Theory)

L-T-P-S:3-1-0-0 Credits:4 ContactHours:4

CO. No	Course Outcome (CO)	PO	Blooms Taxonomy Level (BTL)
CO1	Understand the Various approaches of controlled drug delivery system and Microspheres.	PO 1,4	2
CO2	Understand the various approaches for development of Mucosal drug delivery systems, implantable, buccal drug delivery sytem	PO 1,4	2
CO3	Understand the approaches and Evaluation of Transdermal, Gastro retentive and Naso pulmonary drug delivery system.	PO 1,4	2
CO4	Apply the concept and approaches ocular and targeting methods such as liposomes, niosomes, and nanoparticles.	PO 1,4	3

Various approaches for development of novel drug delivery systems like controlled drug delivery system, microencapsulation, mucosal drug delivery system, implantable drug delivery system, transdermal drug delivery system, nasopulmonary drug delivery system, gastroretentive drug delivery systems, targeted drug delivery, ocular drug delivery systems, intrauterine drug delivery systems.

Syllabus

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations **Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

Microencapsulation: Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications. **Mucosal Drug Deliverysystem:** Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems. **Implantable Drug Delivery Systems:** Introduction, advantages and disadvantages, concept of implants and osmotic pump.

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches. **Gastroretentive drug delivery systems:** Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications. **Nasopulmonary drug delivery system:** Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers.

Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications. **Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts. **Intrauterine Drug Delivery Systems:** Introduction, advantages anddisadvantages, development of intra uterine devices (IUDs) and applications.

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc.,New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication,John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, NewDelhi, First edition 2002.

Journals

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

21UC0010-UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS
L-T-P-S: 2-0-0-0 Credits: 2

Mapping of Course Outcomes with Program Outcomes

CO	Course Outcome (CO)	PO/PSO	BTL
CO1	Realize the basic aspiration and understanding harmony in the human being. Understand the process of Self-exploration and able to differentiate between right and wrong. Realize the harmony in the self, and body.	PO8	1
CO2	Realize the purpose of family and understand about relationship and attain harmony in society	PO8	1
CO3	Realize ways to attain harmony in nature. Realize the root cause of the techno-genic maladies and able to identify the solution and understand harmony in the human being.	PO8	2
CO4	Realize the definitiveness of human conduct. Analyze the profession and his role in this existence.	PO8	2

Syllabus :

CO1 - Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - The Basic Human Aspirations, Right Understanding, Relationship and Physical Facilities, Happiness and Prosperity – Current Scenario, Method to fulfill the Basic Human Aspirations.

CO 1 - Harmony in the Human Being: Understanding the Human Being as Co-existence of Self ('I') and Body, Discriminating between the Needs of the Self and the Body, The Body as an Instrument of 'I', Understand Harmony in the Self ('I'), Harmony of the Self ('I') with the Body, Program to Ensure Sanyam and Svasthya.

CO 2 - Harmony in the Family and Society: Harmony in the Family - the Basic Unit of Human Interaction, Values in Human-to-Human Relationships, 'Trust' – the Foundational Value in Relationships, 'Respect' – as the Right Evaluation, Understand Harmony in the Society, Vision for the Universal Human Order.

CO 3 - Harmony in the Nature (Existence): Understand Harmony in the Nature, Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing 'Existence is Co-existence' at All Levels, The Holistic Perception of Harmony in Existence.

CO 4 - Implications of the Right Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models - Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text Book:

1. A Foundation Course in Human Values and Professional Ethics - R R Gaur, R Sangal and G PBagaria, First Edition, Excel Books.

21PY4137-PS-Practice School
L-T-P-S: 0-0-12-0 Credits: 6

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Educational initiatives seeking to introduce industry perspective in education	PO1	1
CO2	To acquire learning by applying the knowledge and the skills they possess	PO2,PO3	2
CO3	Simulation of the Industry environment into the process of education	PO4	2
CO4	Industrial training through experimental and cooperative learning	PO4	5
CO5	Promotes Partnership and intellectual exchange between academia and industry	PO6	2

21PY4238T–BIOSTATISTICSANDRESEARCHMETHODOLOGY(Theory)

L-T-P-S:3-1-0-0 Credits:4 ContactHours:4

Mapping of Course Outcomes with PO/PSO:

CO#	CourseOutcome	PO/PSO	BTL
CO1	Understand high consciousness/realization of current issues related to health and Pharmaceutical problems with in the country and worldwide.	1,4	2
CO2	Priortize healthcare development.	1,4	5
CO3	Evaluatealternativewaysofsolvingproblemsrelatedtohealthan d pharmaceutical issues	1,4	5
CO4	Designabetterhealthcareservicesystem	1,4	6

Importance of biostatistics in drug design and understand and apply the statistic of measures of centraltendency, measures of dispersion, correlation, regression, probability, parametric and non

parametric tests in pharmaceutical research. Study the importance of research, its designing like factorial design, response surface methodology and statistical analysis software.

Syllabus

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

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

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 ofa study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, variousphases.

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. Design and Analysis of experiments: **Factorial Design:** Definition, 2^2, 2^3design. Advantage of factorial design **Response Surface methodology**: Central composite design, Historical design, Optimization Techniques

Recommended Books (Latest edition):

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel DekkerInc. NewYork.
2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

21PY4240ET - PHARMA MARKETING MANAGEMENT (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	to provide an understanding of sales and marketing of pharmaceutical products.	1,4	2
CO2	Know about various policies for drug inventory management	1,4	2
CO3	Know about retail and wholesale marketing	1,4	2
CO4	Understand business potential and development in product sales and manufacturing	1,4	2

Marketing, Analyzing the Market, Product decision, Promotion, Pharmaceutical marketing, channels, Professional sales representative, Pricing, Emerging concepts in marketing

Syllabus

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.

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. 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.

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 andfuture prospects of the PSR.

Pricing: Meaning, importance, objectives, and 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.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill,New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global

Perspective,IndianContext,Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

21PY4241ET - PHARMACEUTICAL REGULATORY SCIENCE (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Know about legal aspects and quality policies for drug manufacturing	1,1	2
CO2	Know about the process of drug discovery and development	1,1	2
CO3	Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	1,1	2
CO4	Know the regulatory approval process and their registration in Indian and international markets	1,1	2

New Drug Discovery and development, Regulatory Approval Process, Regulatory authorities and agencies, Registration of Indian drug product in overseas market, Clinical trials, Regulatory Concepts

Syllabus

New Drug Discovery and development

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

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)

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.

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

Regulatory Concepts

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register,

Code of Federal Regulatory, Purple book

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, 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 / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited byDouglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, MarcelDekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovskyand Rodney K. Adams Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P.Ognibene
8. Drugs: From Discovery to Approval, Second Edition By Rick Ng

21PY4242ET - PHARMACOVIGILANCE (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO No.	CO	PO	BTL
CO-1	Know about the history, basic terminologies & development of Pharmacovigilance & highlight the importance of monitoring in drug safety.	1	1
CO-2	Applications of the principles of Medra coding & establishing Pharmacovigilance programme in India & providing criteria for classification of drugs diseases & providing resources.	3	3
CO-3	Analyse identified problems and communicate effectively with the regulatory bodies& other stake holders pertaining to the vaccine Pharmacovigilance.	4	4
CO-4	Application of ICH Guidelines and clear instructions to follow the practice of Pharamcovigilance in GMP environment.	7	3

Introduction to Pharmacovigilance, adverse drug reactions, Basic terminologies used in pharmacovigilance, Drug and disease classification, Basic drug information resources, Safety data generation, Guidelines for Pharmacovigilance.

Syllabus

Introduction to Pharmacovigilance: 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, 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: Terminologies of adverse medication related events, Regulatory terminologies.

Drug and disease classification: Anatomical, therapeutic and chemical classification of drugs. International classification of diseases, Daily defined doses, International Non-proprietary Names for drugs, Drug dictionaries and coding inpharmacovigilance, WHO adverse reaction terminologies MedDRA and Standardised Med DR Aqueries, WHO drug dictionary, Eudravigilance medicinal product dictionary, Information resources in pharmacovigilance, Basic drug information resources Specialised resources for ADRs, Establishing pharmacovigilance programme, Establishing in a hospital, Establishment & operation of drug safety department in industry, Contract Research Organisations (CROs), Establishing a national programme.

Vaccine safety surveillance, Vaccine Pharmacovigilance, Vaccination failure, Adverse events following immunization, Pharmacovigilance methods, 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, Effective communication in Pharmacovigilance, Communication in Drug Safety Crisis management, Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media.

Safety data generation, Pre clinical phase, Clinical phase, Post approval phase (PMS), ICH Guidelines for Pharmacovigilance, 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, Pharmacogenomics of adverse drug reactions, Genetics related ADR with example focusing PK parameters. Drug safety evaluation in special population, Paediatrics, Pregnancy and lactation, Geriatrics, CIOMS, CIOMS Working Groups, CIOMS Form, CDSCO (India) and Pharmacovigilance, D&C Act and Schedule Y, Differences in Indian and global pharmacovigilance requirements.

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
3. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
4. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
5. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones& Bartlett Publishers.
6. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,WileyPublishers.
7. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, KarinNyfortHansen,Milap C. Nahata
8. National Formulary of India

9. Text Book of Medicine by Yashpal Munjal
10. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297

13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
11. http://www.ipc.gov.in/PvPI/pv_home.html

21PY4243ET - QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	know WHO guidelines for quality control of herbal drugs	1,4	2
CO2	know Quality assurance in herbal drug industry	1,4	2
CO3	know the regulatory approval process and their registration inIndian and international markets	1,4	2
CO4	appreciate EU and ICH guidelines for quality control of herbal drugs	1,4	2

Basic tests for quality control of herbal drugs, Evaluation of commercial crude drugs, Quality assurance in herbal drug industry, WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines, EU and ICH guidelines for quality control of herbal drugs, Stability testing of herbal medicines, Preparation of documents for new drug application and export registration, Regulatory requirements for herbal medicines, Role of chemical and biological markers in standardization of herbalproducts.

Syllabus

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms WHOguidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use. **Quality assurance in herbal drug industry** of cGMP, GAP, GMP and GLP in traditional system ofmedicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal MedicinesWHO Guidelines on GACP for Medicinal Plants.

EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines. 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.

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.

Recommended Books: (Latest Editions

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. BusinessHorizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
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 Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rdedn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

21PY4244ET -COMPUTERAIDEDDRUGDESIGN(Theory)

L-T-P/S:3-1-0 Credits:4 ContactHours:4

MappingofCourseOutcomeswithPO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Design and discovery of lead molecules	1,4	6
CO2	Application of of drug design in drug discovery process	1,4	3
CO3	Application of the concept of QSAR and docking	1,4	3

CO4	Understand various strategies to develop new druglikemolecules.	1,4	2

Introduction to Drug Discovery and Development, Analog Based Drug Design, Quantitative Structure Activity Relationship, Molecular Modeling and virtual screening techniques: Virtual Screening techniques, Molecular docking, Informatics & Methods in drug design, Molecular Modeling.

Syllabus

Introduction to Drug Discovery and Development: Stages of drug discovery and development. Leaddiscovery 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 casestudies

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, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

Molecular Modeling and virtual screening techniques: 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. **Informatics & Methods in drug design:** Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases. **Molecular Modeling:** Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.

Recommended Books (Latest Editions)

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

21PY4245ET - CELL AND MOLECULAR BIOLOGY (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Summarize cell and molecular biology history.	1,4	2
CO2	Summarize cellular functioning and composition.	1,4	2
CO3	Describe the chemical foundations of cell biology.	1,4	2
CO4	Summarize the DNA properties of cell biology.	1,4	2

Cell and Molecular Biology, DNA and the Flow of Molecular Information, Transcription and Translation, Proteins, Cellular Activities and Checkpoints, Science of Genetics

Syllabus

Cell and Molecular Biology: Definitions theory and basics and Applications. Cell and Molecular Biology: History and Summation. Properties of cells and cell membrane. Prokaryotic versus Eukaryotic. Cellular Reproduction. Chemical Foundations – an Introduction and Reactions (Types).

DNA and the Flow of Molecular Information. DNA Functioning, DNA and RNA, Types of RNA, Transcription and Translation.

Proteins: Defined and Amino Acids, Protein Structure, Regularities in Protein Pathways, Cellular Processes, Positive Control and significance of Protein Synthesis. Science of Genetics: Transgenics and Genomic Analysis, Cell Cycle analysis, Mitosis and Meiosis, Cellular Activities and Checkpoints. Cell Signals: Introduction, Receptors for Cell Signals, Signaling Pathways: Overview, Misregulation of Signaling Pathways, Protein-Kinases: Functioning.

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, OxfordLondon.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
6. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
7. Peppler: Microbial Technology.
8. Edward: Fundamentals of Microbiology.
9. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
10. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
11. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications ofRecombinantDNA: ASM Press Washington D.C.
12. RA Goldshy et. al., : Kuby Immunology.

21PY4246ET - COSMETIC SCIENCE (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Principles of formulation and building blocks of skin care products	1,4	2
CO2	Principles of formulation and building blocks of Hair care products	1,4	2
CO3	Role of herbs in cosmetics	1,4	2
CO4	Principles of Cosmetic Evaluation	1,4	2

Concept of cosmetics, principles, evaluation, classification, excipients used. Study of Principles of formulation of skincare products like different creams, antiperspirants, deodorants, hair care products, oral care products, sun protectors, analytical cosmetics.

Syllabus

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, rheology modifiers, 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**.**
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 cosmecuticals. **Antiperspants & 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- phylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

Sun protection, Classification of Sunscreens and SPF. Role of herbs in cosmetics: Skin Care: Aloe andturmeric Hair care: Henna and amla. Oral care: Neem and clove. **Analytical cosmetics:** BIS specification and analytical methods for shampoo, skin- cream and toothpaste**.**

Principles of Cosmetic Evaluation:Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties. Soaps, and syndet bars. Evolution and skin benefits. Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic under-standing of the terms Comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.Antiperspirants and Deodorants- Actives and mechanism of action.

References

1. Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
1. Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, VandanaPublications Pvt. Ltd., Delhi.
2. Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers

21PY4247ET – EXPERIMENTAL PHARMACOLOGY (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Appreciate the applications of various commonly used laboratory animals	2,4	2
CO2	Appreciate and demonstrate the various screening methods used in preclinical research	2,4	2
CO3	Appreciate and demonstrate the importance of biostatistics and research methodology	2,4	2
CO4	Design and execute a research hypothesis independently	2,4	2

Syllabus

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 collectionand euthanasia.

Preclinical screening models: Introduction: Dose selection, calculation and conversions, preparationof drug solution /suspensions, grouping of animals and importance of sham negative and positivecontrol groups. Rationale for selection of animal species and sex for the study. **Study of screeninganimal models for** Diuretics, nootropics, anti-Parkinson's, antiasthmatics, **Preclinical screeningmodels:** for CNS activity- analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedativeandhypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease **Preclinical screening models:** for ANS activity, sympathomimetics, sympatholytics,parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, localanaethetics. **Preclinical screening models:** for CVS activity- antihypertensives, diuretics,antiarrhythmic, antidyslepidemic, anti-aggregatory, coagulants, and anticoagulants. Preclinicalscreening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics. **Research methodology and Bio-statistics:** Selection of research topic, review of literature, researchhypothesis and study design, Pre-clinical data analysis and interpretation using Students 't' test, andOne-way ANOVA. Graphical representation of data

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-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

21PY4248ET-ADVANCEDINSTRUMENTATIONTECHNIQUES(Theory)

L-T-P-S:3-1-0-0 Credits:4 ContactHours:4

Mapping of Course Outcomes with PO/PSO:

CO#	CourseOutcome	PO/PSO	BTL
CO1	Understand the advanced instruments used and its applications in drug analysis	1,4	2
CO2	understand the chromatographic separation and analysis ofdrugs.	1,4	2
CO3	Understand the calibration of various analytical instruments	1,4	2
CO4	Application of analysisofdrugs usingvariousanalyticalinstruments.	1,4	3

Principles, theory, instrumentation, factors influencing their efficiency and applications on advanced instrumental analytical techniques like Nuclear Magnetic Resonance spectroscopy, Mass Spectrometry, Thermal Methods of Analysis, X-Ray Diffraction Methods, Radio immune assay, Extraction and Hyphenated techniques. It gives extensive study on Calibrationand validation of analytical Instruments as per ICH and USFDA guidelines.

Syllabus

Nuclear Magnetic Resonance spectroscopy: Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications. **Mass Spectrometry**- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications.

Thermal Methods of Analysis: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC). X-**Ray Diffraction Methods:** Origin of X-rays, basic aspects of crystals, X- ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications. **Calibration and validation-**as per ICH and USFDA guidelines Calibration of following Instruments. Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC.

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay. **Extraction techniques**: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction. **Hyphenated techniques**-LC- MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.KSharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry byA.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

21PY4249ET – DIETARY SUPPLEMENTS AND NUTRACEUTICALS (Theory)

L-T-P-S: 3-1-0-0 **Credits: 4** **Contact Hours:4**

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the need of supplements by the different group of people to maintain healthy life.	2	2
CO2	Understand the outcome of deficiencies in dietary supplements.	2	2
CO3	Appreciate the components in dietary supplements and the application.	2	2
CO4	Appreciate the regulatory and commercial aspects of dietary supplements including health claims.	2	2

Definitions of Functional foods, Nutraceuticals and Dietary supplements, Phytochemicals asnutraceuticals, Introduction to free radicals, Synthetic antioxidants

Syllabus

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. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community. 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

Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following: Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin; Sulfides: Diallyl sulfides, Allyl trisulfide; Polyphenolics: Reservetrol; Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones; Prebiotics / Probiotics.: Fructo oligosaccharides, Lactobacillum; Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans; Tocopherols; Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, teaand the like.

Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in

cells,damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids. Dietary fibres andcomplex carbohydrates as functional food ingredients..

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. Antioxidants: Endogenous antioxidants

– enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin. Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole. Functional foods for chronic disease prevention. Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

References:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal:BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A.,(1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery PublishingGroup, NY (1997).
6. G. Gibson and C.williams Editors *2000 Functional foods* Woodhead Publ.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.

1. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
2. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
3. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea andFebiger

21PY4250PW – PROJECT WORK

L-T-P-S: 0-0-12 **Credits: 6** **Contact Hours: 12**

CO#	Course Outcome	PO/PSO	BTL
CO1	Application of Pharmacy in clinical settings	7	3
CO2	Application of modern tools usage	3	3
CO3	Application of pharmacy knowledge in communication skills and ethics	6,8	3
CO4	Application of Pharmacy knowledge in research development	4	3