HAND BOOK: 2018-19

K L COLLEGE OF PHARMACY

2018-19

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)

S.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)

S.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**	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	PEO5
PO1	√	√			
PO2		√	√		
PO3		√		√	
PO4			√	√	
PO5	√				√
PO6	√				√
PO7		√			√
PO8					
PSO1		√	√		
PSO2			√	√	

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:

S.No.	M1	M2	M3	M4
G1	✓			✓
G2	✓	✓	✓	
G3	✓			
G4			✓	✓
G5			✓	✓
G6	✓			✓
G7	✓			✓

MAPPING OF PEOs WITH GOALS:

PEO	G1	G2	G3	G4	G5	G6	G7
1	✓	✓	✓	✓	✓	✓	✓
2	✓	✓				✓	✓
3			✓	✓	✓	✓	✓
4			✓	✓	✓	✓	✓

CO's - PO's Mapping										
Name of the Program: B.Pharm. - I Year - I Sem.										
S.No	**Course Title with Code**	**Course Outcomes (COs)**	**PROGRAM OUTCOMES(POs)**							
			PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
1	**HUMAN ANATOMY AND PHYSIOLOGY-I 18PH1101**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5	3	3						
2	**PHARMACEUTICAL ANALYSIS 18PH1102**	CO1	2	2						
		CO2	2	2						
		CO3	2	2						
		CO4	2	2						
		CO5	3	3						
3	**GENERAL PHARMACY 18PH1103**	CO1	2						2	
		CO2	2						2	
		CO3	2						2	
		CO4	2						2	
		CO5	3	3						
4	**PHARMACEUTICAL INORGANIC CHEMISTRY 18PH1104**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5	3	3						
5	**REMEDIAL BIOLOGY 18PH1106RB**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
		CO5	3	3						
6	**REMEDIAL MATHEMATICS 18PH1106RM**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
7	**BASIC ENGLISH 18UC1101**	CO1						3	3	
		CO2						3	3	
		CO3						3	3	
		CO4						3	3	
Name of the Program: B.Pharm. - I Year - II Sem.										
1	**HUMAN ANATOMY AND PHYSIOLOGY-II 18PH1207**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5	3	3						
2	**PHARMACEUTICAL ORGANIC CHEMISTRY –I 18PH1208**	CO1		2						
		CO2		2						
		CO3		2						
		CO4		2						
		CO5		3						
3	**BIOCHEMISTRY 18PH1209**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				

		CO4	2			2				
		CO5	3	3						
4	**PATHOPHYSIOLOGY 18PH1210**	CO1	2						2	
		CO2	2						2	
		CO3	2						2	
		CO4	2						2	
5	**COMPUTER APPLICATIONS IN PHARMACY 18PH1211**	CO1			3					
		CO2			3					
		CO3			3					
		CO4			3					
		CO5						4		
6	**ECOLOGY & ENVIRONMENT 18UC0009**	CO1				2			2	
		CO2				2			2	
		CO3				2			2	
		CO4							2	2
7	**ENGLISH PROFICIENCY 18UC1202**	CO1								3
		CO2								3
		CO3	3			3				
		CO4	4				4			
Name of the Program: B.Pharm. - II Year - I Sem.										
1	**PHARMACEUTICAL ORGANIC CHEMISTRY –II 18PH2113**	CO1		2						
		CO2		2						
		CO3		2						
		CO4		2						
		CO5		3						
2	**PHYSICAL PHARMACEUTICS-I 18PH2114**	CO1	2	2						
		CO2	2	2						
		CO3	2	2						
		CO4	2	2						
		CO5	3	3						
3	**PHARMACEUTICAL MICROBIOLOGY 18PH2115**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
		CO5		3		3				
4	**PHARMACEUTICAL ENGINEERING 18PH2116**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5	3	3						
5	**PROFESSIONAL COMMUNICATION SKILLS 18UC2103**	CO1								3
		CO2								4
		CO3	3							
		CO4	3				3			
Name of the Program: B.Pharm. - II Year - II Sem.										
1	**PHARMACEUTICAL ORGANIC CHEMISTRY –III 18PH2217**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
2	**MEDICINAL CHEMISTRY – I 18PH2218**	CO1	2							
		CO2	2							
		CO3	2			2				
		CO4	2			2				

		CO5				3				
3	**PHYSICAL PHARMACEUTICS-II 18PH2219**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5		3		3				
4	**PHARMACOLOGY-I 18PH2220**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5				3				
5	**PHARMACOGNOSY AND PHYTOCHEMISTRY I 18PH2221**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
		CO5	3	3						
6	**APTITUDE BUILDER -I 18UC2204**	CO1					3	3		
		CO2							3	
		CO3	3				3			
		CO4	3				3			
Name of the Program: B.Pharm. - III Year - I Sem.										
1	**MEDICINAL CHEMISTRY – II 18PH3122**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
2	**INDUSTRIAL PHARMACY I 18PH3123**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
		CO5		3						
3	**PHARMACOLOGY-II 18PH3124**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5		3		3				
4	**PHARMACOGNOSY AND PHYTOCHEMISTRY II 18PH3125**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
		CO5		3						
5	**PHARMACEUTICAL JURISPRUDENCE 18PH3126**	CO1	2							2
		CO2	2							2
		CO3	2							2
		CO4	2							2
6	**APTITUDE BUILDER-II 18UC3105**	CO1								3
		CO2								3
		CO3	3				3			
		CO4	4							
Name of the Program: B.Pharm. - III Year - II Sem.										
1	**MEDICINAL CHEMISTRY – III 18PH3227**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				

		CO5		3						
2	**PHARMACOLOGY-III 18PH3228**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
		CO5		3		3				
3	**HERBAL DRUG TECHNOLOGY 18PH3229**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
		CO5		3						
4	**BIOPHARMACEUTICS AND PHARMACOKINETICS 18PH3230**	CO1		2						
		CO2		2						
		CO3		2						
		CO4		2						
5	**PHARMACEUTICAL BIOTECHNOLOGY 18PH3231**	CO1	2			2				
		CO2	2			2				
		CO3	2			2				
		CO4	2			2				
6	**PHARMACEUTICAL QUALITY ASSURANCE 18PH3232**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
7	**CAMPUS TO CORPORATE 18UC3205**	CO1					3	3		
		CO2							4	4
		CO3	3			3	3			
		CO4	3				3			
Name of the Program: B.Pharm. - IV Year - I Sem.										
1	**INSTRUMENTAL METHODS OF ANALYSIS 18PH4133**	CO1		2		2				
		CO2		2		2				
		CO3		2		2				
		CO4		2		2				
		CO5		3		3				
2	**INDUSTRIAL PHARMACY II 18PH4134**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
3	**PHARMACY PRACTICE 18PH4135**	CO1					2		2	
		CO2					2		2	
		CO3					2		2	
		CO4					2		2	
4	**NOVEL DRUG DELIVERY SYSTEMS 18PH4136**	CO1		2						
		CO2		2						
		CO3		2						
		CO4		2						
5	**UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS 18PH1207**	CO1								
		CO2								
		CO3								
		CO4								
Name of the Program: B.Pharm. - IV Year - II Sem.										
1	**BIOSTATISITCS AND RESEARCH METHODOLOGY**	CO1				2	2			
		CO2				2	2			
		CO3				2	2			

	18PH4238	CO4				2	2			
2	**SOCIAL AND PREVENTIVE PHARMACY 18PH4239**	CO1							2	2
		CO2							2	2
		CO3							2	2
		CO4							2	2
3	**PHARMA MARKETING MANAGEMENT 18PH4240ET**	CO1						2		
		CO2						2		
		CO3						2		
		CO4						2		
4	**PHARMACEUTICAL REGULATORY SCIENCE 18PH4241ET**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
5	**PHARMACOVIGILANCE 18PH4242ET**	CO1						2		
		CO2						2		
		CO3						2		
		CO4						2		
6	**QUALITY CONTROL AND STANDARDIZATION OF HERBALS 18PH4243ET**	CO1		2						
		CO2		2						
		CO3		2						
		CO4		2						
7	**COMPUTER AIDED DRUG DESIGN 18PH4244ET**	CO1			2					
		CO2			2					
		CO3			2					
		CO4			2					
8	**CELL AND MOLECULAR BIOLOGY 18PH4245ET**	CO1		2		2				
		CO2		2		2				
		CO3		2		2				
		CO4		2		2				
9	**COSMETIC SCIENCE 18PH4246ET**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
10	**EXPERIMENTAL PHARMACOLOGY 18PH4247ET**	CO1		2		2				
		CO2		2		2				
		CO3		2		2				
		CO4		2		2				
11	**ADVANCED INSTRUMENTATION TECHNIQUES 18PH4248 ET**	CO1		2		2				
		CO2		2		2				
		CO3		2		2				
		CO4		2		2				
12	**DIETARY SUPPLEMENTS AND NUTRACEUTICALS 18PH4249ET**	CO1	2							
		CO2	2							
		CO3	2							
		CO4	2							
13	**PROJECT WORK 18PH4250PW**									

B.PHRAM. COURSE STRUCTURE 2018-19

Table-I: Course of study for semester I

Course code	Name of the course	No. of Hours				Total Credits	CH
		L	T	P	S		
18PH1101	Human Anatomy and Physiology I	3	1	3	0	5.5	7
18PH1102	Pharmaceutical Analysis	3	1	3	0	5.5	7
18PH1103	General Pharmaceutics	3	1	3	0	5.5	7
18PH1104	Pharmaceutical Inorganic Chemistry	3	1	3	0	5.5	7
18UC1101	Basic English	0	0	4	0	2.0	4
18PH1106RB	#Remedial Biology	2	0	2	0	3.0	4
18PH1106RM	$Remedial Mathematics	2	1	0	0	3.0	3
18GN1101	Counseling I	0	0	1	0	0.5	1
18GN1107	Co curricular Activity I	0	0	0	2	0.5	2
	Total	14	5$/4#	17$/19#	2	28.0	38$/39#

#Applicable only for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course.

$Applicable only for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course.

Table-II: Course of study for semester II

Course code	Name of the course	No. of Hours				Total Credits	CH
		L	T	P	S		
18PH1207	Human Anatomy and Physiology II	3	1	3	0	5.5	7
18PH1208	Pharmaceutical Organic Chemistry I	3	1	4	0	6.0	8
18PH1209	Biochemistry	3	1	4	0	6.0	8
18PH1210	Pathophysiology	3	1	0	0	4.0	4
18PH1211	Computer Applications in Pharmacy	3	0	2	0	4.0	5
18UC0009	Ecology & Environment	3	0	0	0	3.0	3
18UC1202	English Proficiency	2	0	0	0	2.0	2
18GN1202	Counseling II	0	0	1	0	0.5	1
18GN1208	Co curricular Activity II	0	0	0	2	0.5	2
	Total	20	4	14	2	31.5	40

Table-III: Course of study for semester III

Course code	Name of the course	No. of Hours				Total Credits	CH
		L	T	P	S		
18PH2113	Pharmaceutical Organic Chemistry II	3	1	4	0	6	8
18PH2114	Physical Pharmaceutics I	3	1	4	0	6	8
18PH2115	Pharmaceutical Microbiology	3	1	4	0	6	8
18PH2116	Pharmaceutical Engineering	3	1	4	0	6	8
18UC2103	Professional Communication skill	0	0	4	0	2	4
18GN2103	Counseling III	0	0	1	0	0	1
18GN2109	Co curricular Activity III	0	0	0	2	0.5	2
	Total	12	4	21	2	26.5	39

Table-IV: Course of study for semester IV

Course code	Name of the course	No. of Hours				Total Credits	CH
		L	T	P	S		
18PH2217	Pharmaceutical Organic Chemistry III	3	1	0	0	4.0	4
18PH2218	Medicinal Chemistry I	3	1	3	0	5.5	7
18PH2219	Physical Pharmaceutics II	3	1	3	0	5.5	7
18PH2220	Pharmacology I	3	1	3	0	5.5	7
18PH2221	Pharmacognosy and Phytochemistry I	3	1	3	0	5.5	7
18UC2204	Aptitude builder I	0	0	4	0	2.0	4
18GN2204	Counseling IV	0	0	1	0	0.5	1
18GN2210	Co curricular Activity IV	0	0	0	2	0.5	2
	Total	15	5	17	2	29	39

Table-V: Course of study for semester V

Course code	Name of the course	No. of Hours				Total Credits	CH
		L	T	P	S		
18PH3122	Medicinal Chemistry II	3	1	0	0	4	4
18PH3123	Industrial Pharmacy I	3	1	4	0	6	8
18PH3124	Pharmacology II	3	1	4	0	6	8
18PH3125	Pharmacognosy and Phytochemistry II	3	1	4	0	6	8
18PH3126	Pharmaceutical Jurisprudence	3	1	0	0	4	4
18UC3105	Aptitude builder II	0	0	4	0	2	4
18GN3105	Counseling V	0	0	1	0	0.5	1
18GN3111	Co curricular Activity V	0	0	0	2	0.5	2
	Total	15	5	17	2	29.0	39

Table-VI: Course of study for semester VI

Course code	Name of the course	No. of Hours				Total Credits	CH
		L	T	P	S		
18PH3227	Medicinal Chemistry III	3	1	3	0	5.5	7
18PH3228	Pharmacology III	3	1	3	0	5.5	7
18PH3229	Herbal Drug Technology	3	1	3	0	5.5	7
18PH3230	Biopharmaceutics and Pharmacokinetics	3	1	0	0	4.0	4
18PH3231	Pharmaceutical Biotechnology	3	1	0	0	4.0	4
18PH3232	Quality Assurance	3	1	0	0	4.0	4
18UC3205	Campus to Corporate	0	0	4	0	2.0	4
18GN3206	Counseling VI	0	0	1	0	0.0	1
18GN3212	Co curricular Activity VI	0	0	0	2	0.5	2
	Total	18	6	14	2	31.0	40

Table-VII: Course of study for semester VII

Course code	Name of the course	No. of Hours				Total Credits	CH
		L	T	P	S		
18PH4133	Instrumental Methods of Analysis	3	1	4	0	6	8
18PH4134	Industrial Pharmacy II	3	1	0	0	4	4
18PH4135	Pharmacy Practice	3	1	0	0	4	4
18PH4136	Novel Drug Delivery System	3	1	0	0	4	4
18PH4137	Practice School*	0	0	12	0	6	12
18UC0010	Universal Human Values and Professional Ethics	1	0	2	0	2	3
	Total	13	4	18	0	26	35

*Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

Course code	Name of the course		No. of Hours				Total Credits	CH
			L	T	P	S		
18PH4238		Biostatistics and Research Methodology	3	1	0	0	4	4
18PH4239		Social and Preventive Pharmacy	3	1	0	0	4	4
18PH4240ET	Elective -I	Pharma Marketing Management	3	0	0	0	3	3
18PH4242ET		Pharmacovigilance						
18PH4243ET		Quality Control and Standardization of Herbals						
18PH4246ET		Cosmetic Science						
18PH4248ET		Advanced Instrumentation Techniques						
18PH4241ET	Elective-II	Pharmaceutical Regulatory Science	3	0	0	0	3	3
18PH4244ET		Computer Aided Drug Design						
18PH4245ET		Cell and Molecular Biology						
18PH4247ET		Experimental Pharmacology						
18PH4249ET		Dietary Supplements and Nutraceuticals						
18PH4250PW		Project Work	12	0	0	0	6	12
		Total	24	4	0	0	22	28

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	28.0
II	31.5
III	26.5
IV	29.0
V	28.5
VI	31.5
VII	26.0
VIII	22.0
Extracurricular/ Co-curricular activities	01*
Total credit points for the program	**224**

The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

B. PHARMACY PROGRAM SYLLABUS
SEMESTER I

Course Name: HUMAN ANATOMY AND PHYSIOLOGY-I
Course Code: 18PH1101
Semester: I / Year I **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Explain the gross morphology, structure and functions of various organs of the human body.	1,4	1,2
CO2	Describe the various homeostatic mechanisms and their imbalances.	1,4	1,2
CO3	Identify the various tissues and organs of different systems of human body.	1,4	1,2
CO4	Understand the organ functions	1,4	1,2
CO5	Perform the various experiments related to physiology and health.	1,2	2,3

Theory Syllabus

CO 1: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. **Cellular level of organization:** Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine. **Tissue level of organization:** Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

CO 2: 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:** Body fluids, composition and functions of blood, Hemopoiesis, formation of hemoglobin, anemia, Mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders blood.

CO 3: Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system. **Peripheral nervous system**: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.

CO4: Specialsenses: Structure and functions of eye, ear, nose and tongue and their disorders. **Cardiovascularsystem:** Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of 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.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brother's medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-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's medical 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

Practicals:

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

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.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-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 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's medical 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) byDr. C.C. Chatterrje ,Academic Publishers Kolkata

*****

Course Name: PHARMACEUTICAL ANALYSIS
Course Code: 18PH1102
Semester: I / Year I L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand the principles of volumetric and electro chemical analysis	1,2	1,2
CO2	carryout various volumetric and electrochemical titrations	1,2	1,2
CO3	develop analytical skills	1,2	1,2
CO4	Reporting analytical result and data integrity	1,2	1,2
CO5	Perform various analytical experiments	1,2	2,3

Theory syllabus

CO-I: Pharmaceutical analysis- Definition and scope of 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. Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.

CO-II: 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.

CO-III: 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

CO- IV: 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 indicator electrodes (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

Practicals

I **Limit Test of the following:** Chloride; Sulphate; Iron & Arsenic

II **Preparation and standardization of** Sodium hydroxide; Sulphuric acid; Sodium thiosulfate; Potassium permanganate; Ceric ammonium sulphate

III **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 Permanganometry; Sodium benzoate by non-aqueous titration; Sodium Chloride by precipitation titration.

IV **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

Recommended Books: (Latest Editions)

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

*****

Course Name: GENERAL PHARMACY
Course Code: 18PH1103
Semester: I / Year I L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Know the history of profession of pharmacy	1,7	1,2
CO2	Understand the basics of different dosage forms	1,7	1,2
CO3	Understand the pharmaceutical incompatibilities and pharmaceutical calculations	1,7	1,2
CO4	Understand the professional way of handling the prescription	1,7	1,2
CO5	Apply the knowledge to prepare various conventional dosage forms	2,1	2,3

Theory syllabus

CO – I: 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.

CO – II: 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. Snuff, Insufflations, Divided & bulk powders, Dentifrices, Douches. **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.

CO – III: Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. Solutions, Linctuses. 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. Parenterals: Introductions to parenterals and types

CO – IV: Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms. Aerosols: Introductions to aerosols and types. Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

Practical

1. Syrups: a) Syrup IP'66; b) Compound syrup of Ferrous Phosphate BPC'68
2. Elixirs: a) Piperazine citrate elixir b) Paracetamol pediatric elixir

3. Linctus: a) Terpin Hydrate Linctus IP'66 b) Iodine Throat Paint (Mandles Paint)
4. Solutions: a) Strong solution of ammonium acetate; b) Cresol with soap solution; c) Lugol's solution
5. Suspensions: a) Calamine lotion; b) Magnesium Hydroxide mixture; c) Aluminimum Hydroxide gel
6. Emulsions a) Turpentine Liniment; b) Liquid paraffin emulsion
7. Powders and Granules: a) ORS powder (WHO); b) Effervescent granules c)Dusting powderd)Divded powders
8. Suppositories: a) Glycero gelatin suppository: b) Coca butter suppository: c) Zinc Oxide suppository
9. Semisolids: a) Sulphur ointment; b) Non staining-iodine ointment with methyl salicylate; c) Carbopol gel
10. Gargles and Mouthwashes: a) Iodine gargle; b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, 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 of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
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 Health Sciences, 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.

*****

Course Name: PHARMACEUTICAL INORGANIC CHEMISTRY
Course Code: 18PH1104
Semester: I / Year I L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals	1,4	1,2
CO2	understand the medicinal and pharmaceutical importance of inorganic compounds	1,4	1,2
CO3	Know the preparation and analysis of inorganic medicinal compounds	1,4	1,2
CO4	Know their diagnostic applications	1,4	1,2
CO5	Apply the knowledge to prepare various inorganic pharmaceuticals	1,2	2,3

Theory syllabus

CO- I: 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

CO- II: 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.

CO- III: 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

CO- IV: 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: Zinc Sulphate, 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.

Practical

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 II

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

Recommended Books (Latest Editions)

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

*****

Course Name: BASIC ENGLISH
Course Code: 18UC1101
Semester: I / Year I L-T- P : 0-0-4 Credits : 2

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course outcome's	PO No	BTL
CO 1	Apply the practical knowledge of using action words in sentence construction.	10	3
CO 2	Apply and analyse the right kind of pronunciation with regards to speech sounds and able to get different types of pronunciations.	10	3
CO 3	Apply the concept of fundamental principle of counting to solve the problems on linear, circular permutations and also for the problems on selections. Apply the concept of probability, while doing the problems on Leap year & Non-Leap year problems, coins, dice, balls and cards.	1	3
CO 4	Analyze the given conditions and finding out all the possible arrangements in linear & circular order. Analyze the given numbers or letters to find out the hidden analogy and apply that analogy to find solutions. Finding the odd man out by observing the principle which makes the others similar.	5	4

PROGRAM OUTCOMES(POs):

PO Number	Particulars	Description
1.	**Pharmaceutical Sciences Knowledge**	An ability to apply knowledge of mathematics, science, fundamentals for the solution of complex manufacturing & marketing problems in pharmaceutical sciences
2.	**Problem Analysis**	An ability to identify, formulate, research literature, analyze complex problems in pharmaceutical sciences using first principles of sciences
3.	**Design/ development of solutions**	An ability to design solutions for complex problems and system component or processes that meet the specified needs considering public health & safety and cultural, societal & environment
4.	**Conduct investigations of complex problems**	An ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to obtain solutions to problems
5.	**Modern tool usage**	Ability to create, select and apply appropriate techniques, resources and modern activities, with an understanding of the limitations
6.	**The engineer and society**	Ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7.	**Environment and sustainability**	Ability to demonstrate the knowledge of engineering solutions, contemporary issues understanding their impacts on societal and environmental contexts, leading towards sustainable development
8.	**Ethics**	An ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice

PO Number	Particulars	Description
9.	**Individual and team work**	An ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
10.	**Communication**	Ability to communicate effectively oral, written reports and graphical forms on complex engineering activities
11.	**Project management and finance**	Ability to demonstrate knowledge and understanding of the engineering and management principles and apply those one's own work, as a member and leader in team, to manage projects and in multi-disciplinary environments
12.	**Lifelong learning**	An ability to recognize the need for and having the preparation and ability to engage independent and life-long learning in broadest context of technological change

Interactive Grammar: Action Words-Modifiers, Intensifiers, Connectives, Sentence Skills: Tense, Voice, Case, Gender, Reported Speech, Syntax, Types of Sentences, Syntactic Ordering, Introduction to the Sounds of English: 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.
Language Laboratory Interactive: Esca talk, JAM, Ranking, Shrinking Story, Desperate Decision, Listening for Specifics, Pronunciation Practice. **Quantitative Aptitude:** Permutations and Combinations, Probability. **Reasoning**: Number and Letter Analogy, Odd Man out, Analytical Reasoning-I

Reference Books

1. Kerry Patterson, Joseph Grenny, Ron McMillan:*Crucial Conversations: Tools for Talking When Stakes Are High.*Switzler: Paperback – Animated, September 9, 2011.
2. Douglas Stone, Bruce Patton, Sheila Heen, and Roger Fisher :*Difficult Conversations: How to Have Conversations that Matter the Most* .Paperback – November 2, 2010
3. R.K. Bansal, J.B. Harrison: *Spoken English*. Delhi: Orient Black Swan.2009.
4. 4. Language LaboratoryTeacher Manual, KLEFU

*****

Course Name: REMEDIAL BIOLOGY
Course Code: 18PH1106RB
Semester: I / Year I L-T- P : 3-0-2 Credits : 3

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Introduce biology to non biology students	1	1,2
CO2	know the classification and salient features of five kingdoms of life	1	1,2
CO3	understand the basic components of anatomy & physiology of plant	1	1,2
CO4	know understand the basic components of anatomy & physiology animal with special reference to human	1	1,2
CO5	Perform various biology experiments	1,2	2,3

Theory syllabus

CO-I: 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.

CO-II: 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.

CO-III: 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 medulla oblongata; **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

CO-IV: 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.

Practical

1. Introduction to experiments in biology: a) Study of Microscope; b) Section cutting techniques; c)Mounting and staining d) 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 computermodels
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Text Books

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

*****

Course Name: REMEDIAL MATHEMATICS
Course Code: 18PH1106RM
Semester: I / Year I L-T- P : 2-1-0 Credits : 3

Mapping of Course Outcomes (CO) to Student outcomes:

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

Theory syllabus

CO – I: 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 (ε-δ definition), $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$

CO-II: **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,Applicationof Matrices in solving Pharmacokinetic equations.

CO – III: **Calculus Differentiation** : Introductions, Derivative of a function, Derivative of a constant, Derivative of 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 form of a straight line **Integration:** Introduction, Definition, Standard formulae, Rules of integration , Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application.

CO – IV**: 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

B. PHARMACY PROGRAM SYLLABUS
SEMESTER II

Course Name: HUMAN ANATOMY AND PHYSIOLOGY-II
Course Code: 18PH1207
Semester: II / Year I **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Explain the gross morphology, structure and functions of various organs of the human body.	1,4	1,2
CO2	Describe the various homeostatic mechanisms and their imbalances.	1,4	1,2
CO3	Identify the various tissues and organs of different systems of human body.	1,4	1,2
CO4	Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.	1,4	1,2
CO5	Apply the knowledge to perform various physology experiments	1,2	2,3

Theory syllabus

CO- I: 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)

CO- II: 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.

CO- III: 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.

CO- IV: Endocrine system: Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders. 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

Practical

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

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
16. Permanent slides of vital organs and gonads.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.

2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-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's medical 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 PublishersKolkata

*****

Course Name: PHARMACEUTICAL ORGANIC CHEMISTRY –I
Course Code: 18PH1208
Semester: II / Year I L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	write the structure, name and the type of isomerism of the organic compound	2,PSO1	1,2
CO2	write the reaction, name the reaction and orientation of reactions	2,PSO1	1,2
CO3	account for reactivity/stability of compounds,	2,PSO1	1,2
CO4	identify/confirm the identification of organic compound	2,PSO1	1,2
CO5	Apply the knowledge to synthesize various organic compounds	2,PSO1	2,3

Theory syllabus

CO I: General principles: Classification of organic compounds, atomic structure, atomic orbitals, Molecular orbital theory, wave equation, Molecular orbitals, Hybrid orbitals, sp^3, sp^2, sp hybridization, Bonding and Antibonding orbitals, sigma & pi- bonds, bond lengths, bond angles & Bond dissociation energy. An overview of Polarity of bonds, Polarity of molecules, Covalent bond, hydrogen bonds, Intra- & Intermolecular forces, inductive effects, resonance, and hyper conjugation. Homolytic & heterolytic bond fission, acidity & basicity with different theories. Ease of formation & order of stabilities of electron deficient & electron rich species along with the reasons.

CO II: Different classes of compounds: The following classes of compounds should be taught in detail with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable]. Alkanes (SP^3 hybridization, Halogenation); Alkenes (Stabilities of alkenes, SP^2 hybridization in alkenes, Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti-Markownikoff's orientation.). Conjugated Dienes (Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement).

CO-III: Different classes of compounds: The following classes of compounds should be taught in detail with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable]. Alkyl halides (SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions. E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions.) Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Aliphatic hydroxyl compounds (Nucleophilic substitution and elimination reactions, Differentiation of primary, secondary and tertiary alcohols). Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol.

CO-IV: Different classes of compounds: The following classes of compounds should be taught in detail with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable]. Carbonyl compounds (Nucleophilic addition, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, reaction with Grignard reagents). Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde. Carboxylic acids (Acidity of carboxylic acids, effect of substituents on acidity, Esterification). All functional derivatives of carboxylic acids (Reactivity, Hydrolysis and Hoffmann's degradation). Active methylene compounds (Applications of Ethyl acetoacetate and ethyl malonate). 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.

Practical

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

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.

*****

Course Name: BIOCHEMISTRY
Course Code: 18PH1209
Semester: II / Year I L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the principles of chemistry in biology	1,4	1,2
CO2	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.	1,4	1,2
CO3	Understand the metabolism of nutrient molecules in physiological and pathological conditions.	1,4	1,2
CO4	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.	1,4	1,2
CO5	Apply the knowledge to estimate various biochemical parameters in physilogical systems	1,2	2,3

Theory syllabus

CO- I: 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

CO- II: 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. Oxidative phosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers

CO- III: 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

CO- IV: 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 biochemical functions

Practical

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

Recommended Books (Latest Editions)

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert 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 by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna. Practical Biochemistry by Harold Varley.

Course Name: PATHOPHYSIOLOGY
Course Code: 18PH1210
Semester: II / Year I L-T- P : 3-1-0 Credits : 4

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the conditions leading to a disease	1,7	1,2
CO2	Describe the etiology and pathogenesis of the selected disease states;	1,7	1,2
CO3	Name the signs and symptoms of the diseases; and	1,7	1,2
CO4	Mention the complications of the diseases.	1,7	1,2

Theory syllabus

CO-I: Basic principles of Cell injury and Adaptation: Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury**,** Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage)**,** Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia)**,** Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death. Acidosis & Alkalosis, Electrolyte imbalance. **Basic mechanism involved in the process of inflammation and repair:** Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin.

CO-II: Cardiovascular System: Definition, symptoms, causes and Pathophysiology: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis). **Haematological Diseases: Definition, symptoms, causes and Pathophysiology:** Iron deficiency, megaloblastic anemia (Vit B_{12} and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia. **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's

disease.

CO-III: Definition, causes and Pathophysiology of the following: Respiratory system: Asthma, Chronic obstructive airways diseases. **Renal system:** Acute and chronic renal failure. **Diseases of bones and joints:** Rheumatoid Arthritis, Osteoporosis,Gout. **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones. **Gastrointestinal system:** Peptic Ulcer, Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.

CO- IV: Definition, symptoms, causes, Modes of transmission and Pathophysiology of the following: 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 Asia edition; 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; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and 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: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone 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.

*****

Course Name: COMPUTER APPLICATIONS IN PHARMACY
Course Code: 18PH1211
Semester: II / Year I L-T- P : 3-0-2 Credits : 4

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	know the various types of application of computers in pharmacy	3,PSO2	2,3
CO2	know the various types of databases	3,PSO2	2,3
CO3	know the various applications of databases in pharmacy	3,PSO2	2,3
CO4	Know the web based tools for pharmacy practice	3,PSO2	2,3
CO5	Apply the knowledge to design and develp digital tools for pharmaceutical applications	6,PSO2	3,4

Theory syllabus

CO – I: Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division**. Web technologies**: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products. **Introduction to databases**, MYSQL, MS ACCESS, Pharmacy Drug database

CO –II: Computers in pharmaceutical research and development: Computers as data analysis and data management tools in preclinical development- E-clinical softwares, Statistical modeling in pharmaceutical research and development, Impact of bioinformatics on preclinical drug discovery. **Scientific information handling and enhancing productivity:** Chemoinformatics techniques for processing chemical structure databases, Electronic Laboratory Notebooks, Strategies for using information effectively in early stage drug discovery, Success stories of computer-aided design.

CO – III: Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile

technology and adherence monitoring. Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System

CO – IV: Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery. **Computers as data analysis in Preclinical development**: Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS). Computer optimization of biopharmaceutical properties, Clinical data collection and management, Computers in pharmaceutical formulation, Legal protection of innovative uses of computers in research and development.

Practical

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 online tools
4. Creating mailing labels Using Label Wizard, generating label in MS WORD
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 record in 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 MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages
13. Drawing the chemical structures in Chem Draw and calculating the properties
14. Predicting the probable Pharmacological activities of a chemical compound by using online tools
15. Predicting the metabolic patterns of a drug molecule by using online tools

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger,600 South Washington Square, 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 Publishersand Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. 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

*****

Course Name: ECOLOGY AND ENVIRONMENT
Course Code: 18UC0009
Semester: II / Year I L-T- P : 3-0-0 Credits : 3

Mapping of Course Outcomes (CO) to Student outcomes:

CO No:	CO	PO	BTL
CO 1	Understand the importance of Environmental education and conservation of natural resources.	6	1
CO 2	Understand the importance of ecosystems and biodiversity.	12	1
CO 3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process.	6	3

Syllabus:

The Multidisciplinary nature of Environmental Studies - Natural Resources- Forest resources - Mining its impact on environment - Water resources - Mineral resources-. Energy resources - Land resource s- Soil erosion - Ecosystems - Biodiversity and its ConservationEnvironnemental Pollution - Soil waste management - Electronic waste management, biomedical waste management - Disaster management –.Environmental Legislation Environmental Impact Assessment Process.

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, (2009).

Course Name: ENGLISH PROFICIENCY
Course Code: 18UC1202
Semester: II / Year I **L-T- P : 2-0-0** **Credits : 2**

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course outcome's	PO No	BTL
CO 1	Apply the concepts of accurate English while writing and become equally at ease in using good vocabulary and language skills.	8, 9, 10	3
CO 2	Understand the importance of pronunciation and apply the same day to day conversation.	8, 9, 10	3
CO 3	Apply the concepts of Ratios, Percentages, Averages and Analysing the given information, a student is required to understand the given information and thereafter answer the given questions on the basis of comparative analysis of the data in the form of tabulation, bar graphs, pie charts, line graphs. Analyse the given data to find whether it is sufficient or not.	1, 4	3
CO 4	Apply the basic functionality of Clocks and Calendars to find the solutions for the problems. Analyze the given symbols to understand the hidden meaning of the given expression and finding the solutions. Analyze the given conditions and finding out all the possible arrangements in linear & circular order.	1, 5	4

Theory syllabus

Writing Skills:How to Write a Definition, Defining Technical Terms**,**Product and Process Description. Advanced Grammar Skills**:** Transformation of Sentences,Phrases,Clauses,Sentences—Simple, Compound, Complex Sentences,Concord,Lexis 1**:**Synonyms**,** Antonyms, Analogies, Sentence Equivalence-One-Word Substitutes. **Language Laboratory Interactives:** Debate, Blind-fold, Role Play, Situation Reaction Test**--**Build an Island nation. **Quantitative Aptitude**: Data Interpretation, Data Sufficiency. **Reasoning**:Symbols and Notations, Clocks and Calendars, Analytical Reasoning-II

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 LaboratoryTeacher Manual, KLEFU

B. PHARMACY PROGRAM SYLLABUS
SEMESTER III

Course Name: PHARMACEUTICAL ORGANIC CHEMISTRY –II
Course Code: 18PH2113
Semester: III / Year II **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	write the structure, name and the type of isomerism of the organic compound	2,PSO1	1,2
CO2	write the reaction, name the reaction and orientation of reactions	2,PSO1	1,2
CO3	account for reactivity/stability of compounds,	2,PSO1	1,2
CO4	prepare organic compounds	2,PSO1	1,2
CO5	Apply the knowledge to synthesize various organic compounds	2,PSO1	2,3

Theory syllabus

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

CO- I: 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

CO- II: 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.

CO- III: 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.

CO- IV: 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 straintheory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.

Practical

Experiments involving laboratory techniques: Recrystallization & Steam distillation

Determination of following oil values (including standardization of reagents): Acid value; Saponification value & Iodine value

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

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 byB.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry byMann 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.

Course Name: PHYSICAL PHARMACEUTICS-I
Course Code: 18PH2114
Semester: III / Year II **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the principles of physical chemistry in pharmaceutical technology	1,2	1,2
CO2	Understand various physicochemical properties of drug molecules in the designing the dosage forms	1,2	1,2
CO3	Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations	1,2	1,2
CO4	Understand the use of physicochemical properties in the formulation development and evaluation of dosage forms.	1,2	1,2
CO5	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.	1,2	2,3

Theory syllabus

CO-I: Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

CO-II: 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

CO-III : 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.

CO-IV: 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 stabilityconstants. 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 isotonicsolutions.

Practical

1. Determination the solubility of drug at roomtemperature
2. Determination of pKa value byHalf Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene andwater
4. Determination of Partition co- efficient of Iodine in CCl_4 andwater
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 dropweight method
7. Determination of HLB number of a surfactant bysaponification method
8. Determination of Freundlich and Langmuir constants using activated charcoal
9. Determination of critical micellar concentration ofsurfactants
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

Recommended Books: (Latest Editions)

1. Physical Pharmacy by AlfredMartin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper andGunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms.Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C andManavalanR.
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

Course Name: PHARMACEUTICAL MICROBIOLOGY
Course Code: 18PH2115
Semester: III / Year II **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand methods of identification, cultivation and preservation of various microorganisms	1,4	1,2
CO2	To understand the importance and implementation of sterlization in pharmaceutical processing and industry	1,4	1,2
CO3	Learn sterility testing of pharmaceutical products.	1,4	1,2
CO4	Underastand microbiological standardization of Pharmaceuticals.	1,4	1,2
CO5	Apply microbiological testing tools in pharmaceutical products.	2,4	2,3

Theory syllabus

CO- I: 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 constrast microscopy, dark field microscopy and electron microscopy.

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

CO- III: Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants. Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions. Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

CO- IV: 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 microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry andresearch.

Practical

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 slantspreparations.
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 othermethods
7. Motility determination by Hanging dropmethod.
8. Sterility testing ofpharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test.

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, BlackwellScientific publications, Oxford London.
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: PharmaceuticalMicrobiology.
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 Waverlycompany

Course Name: PHARMACEUTICAL ENGINEERING
Course Code: 18PH2116
Semester: II / Year I **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	To know various unit operations used in Pharmaceutical industries.	1,4	1,2
CO2	To understand the material handling techniques.	1,4	1,2
CO3	Understand various processes involved in pharmaceutical manufacturing process.	1,4	1,2
CO4	Aquire knowledge on operation of pharmaceutical manufacturing equipment	1,4	1,2
CO5	Demonstrate the ability to use and operate pharmaceutical manufacturing equipment	1,2	2,3

Theory syllabus

CO-I: 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.

CO-II: Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers. Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator. Distillation: Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation.

CO- III: 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, freezedryer. 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,

CO-IV: 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.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

Practical

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 heatexchanger.
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 various size 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.

*****

Course Name: PROFESSIONAL COMMUNICATION SKILLS
Course Code: 18UC2103
Semester: III / Year II L-T- P : 0-0-4 Credits : 2

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course outcome's	PO No	BTL
CO 1	Able to spot the common grammatical errors related to Sentence Structure, Preposition, Concord, Relative and Conditional Clauses, and Parallel Structures. The learner should be efficient to construct a context-determined text in addition to learning Technical Writing Skills. One should be enabled to use English Language efficiently in the written medium to communicate Personal as well as Professional.	9, 10	3
CO 2	Able to read, understand, and interpret a text intrinsically as well as extrinsically. The learner can browse a text quickly to come-up with a gist and personal interpretation. One is able to create a healthy work-environment and prove to be an asset or one of the most reliable resources to the Organization. As a professional, one is mature to bridge the gulf between the existing behavior/ lifestyle and the expected corporate behaviour cum lifestyle.	8	4
CO 3	Apply the concepts of Time and Work, the students will be able to solve the questions related to Men-Time-Work, problems based on wages, pipes and cisterns. Apply the concepts of Time and Distance and solve the problems related to average speed, relative speed, problems based on trains, boats, circular tracks, races and games.	1	3
CO 4	Apply Venn diagrams to the given statements to find out whether the given conclusions can be deducted from the given statements. Apply the logical implications and also the negations of various connectives to find the solutions. Analyze the given data and representing the data in the form of Venn Diagrams to find relations between any given set of elements.	1,5	3

Syllabus

Grammarand Usage: Error Analysis. **WritingSkills:**Topic sentence, Linkers, Connectors and Transition, Paragraph Writing, Letter Writing **Reading Comprehension:** Techniques, Skimming and Scanning, Vertical Reading, Reading Perception Tests (RPT): (Graphic) Reading Perception Tests (RPT), Semantic Interpretation of the Text, Reading Speed Enhancement. **Soft Skills**: Interpersonal Skills**,** Adjusting Your Attitude**-**Arrogance has no Place in the Workplace, Cultural Sensitivity in the Workplace**,** Corporate Culture: Learning How to Fit In. **Quantitative Aptitude:** Time and Work, Time and Distance. **Reasoning:** Deductions, Logical Connectives, Venn Diagrams

Reference Books:

1. Gajendra Singh Chauhan and SmitaKashiramka. Technical Communication. Delhi:Cengage Learning India.2018.
2. Andrea Penruddocke and Christopher A. Warnasch.English for the Real World.USA:Living Language.2004
3. GeraldJ Alfred, Charles T Brusaw and Walter E.Oliu. *Hand Book of Technical Writing*. USA:Betford.2000.
4. Asher Cashdan: *Language, Reading and Learning.* Oxford:Basil Blackwell.1979.

B. PHARMACY PROGRAM SYLLABUS
SEMESTER IV

Course Name: PHARMACEUTICAL ORGANIC CHEMISTRY –III
Course Code: 18PH2217
Semester: IV / Year II **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand the methods of preparation and properties of organic compounds	1,4	1,2
CO2	explain the stereo chemical aspects of organic compounds and stereo chemical reactions	1,4	1,2
CO3	know the medicinal uses and other applications of organic compounds	1,4	1,2
CO4	Introduce to assymetric synthesis	1,4	1,2

Theory syllabus

To emphasize on definition, types, mechanisms, examples, uses/applications

CO-I: Stereo isomerism: Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules. DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers. Reactions of chiral molecules. Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute

CO-II: Geometrical isomerism: Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions.

CO-III : Heterocyclic compounds: Nomenclature and classification; Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene; Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

CO-IV: 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 of Metal hydride reduction (NaBH4 and LiAlH4), 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 byRaj K. Bansal
4. Organic Chemistry by Morrison and Boyd
5. Heterocyclic Chemistry byT.L. Gilchrist

Course Name: MEDICINAL CHEMISTRY – I
Course Code: 18PH2218
Semester: IV / Year II **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand the chemistry of drugs with respect to their pharmacological activity	1	1,2
CO2	understand the drug metabolic pathways, adverse effect and therapeutic value of drugs	1	1,2
CO3	know the Structural Activity Relationship (SAR) of different class of drugs	1,4	1,2
CO4	write the chemical synthesis of some drugs	1,4	1,2
CO5	Perform chemical synthesis of some drugs	4,PSO1	2,3

Theory syllabus

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

CO- I: 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.

CO- II: Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents; Direct acting: Nor-epinephrine,

Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol. Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

CO-III: Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. Parasympathomimetic agents: SAR of Parasympathomimetic agents. Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine. Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion. Cholinesterase reactivator: Pralidoxime chloride. Cholinergic Blocking agents: SAR of cholinolytic agents Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*. Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

CO- IV: Drugs acting on Central Nervous System: Sedatives and 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.

Practical

1. **Preparation of drugs/ intermediates:** 1,3-pyrazole, 1,3-oxazole, Benzimidazole, Benztriazole, 2,3- diphenyl quinoxaline, Benzocaine, Phenytoin, Phenothiazine, Barbiturate
2. **Assay of drugs:** Chlorpromazine, Phenobarbitone, Atropine, Ibuprofen, Aspirin, Furosemide
3. Determination of Partition coefficient for any two drugs

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.

Course Name: PHYSICAL PHARMACEUTICS-II
Course Code: 18PH2219
Semester: IV / Year II **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the principles of physical chemistry in pharmaceutical technology	1,4	1,2
CO2	Understand various physicochemical properties of drug molecules in the designing the dosage forms	1,4	1,2
CO3	Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations	1,4	1,2
CO4	Understand the use of physicochemical properties in the formulation development and evaluation of dosage forms.	1,4	1,2
CO5	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.	2,4	2,3

Theory syllabus

CO-I: Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protectiveaction.

CO-II: Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers. Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus. Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

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

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

Practical

1. Determination of particle size, particle size distribution using sievingmethod
2. Determination of particle size, particle size distribution using Microscopicmethod
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspendingagent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid byusing Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
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, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

Course Name: PHARMACOLOGY-I
Course Code: 18PH2220
Semester: IV / Year II **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the pharmacological actions of different categories of drugs	1,4	1,2
CO2	Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.	1,4	1,2
CO3	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.	1,4	1,2
CO4	Understand the effect of drugs on physiological systems	1,4	1,2
CO5	Observe the effect of drugs on animals by simulated experiments	4	2,3

Theory syllabus

CO-I : General Pharmacology: Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. **Pharmacokinetics**- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

CO-II: General Pharmacology: Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. Adverse drug reactions. Drug interactions (pharmacokinetic and pharmacodynamic). Drug discovery and clinical evaluation of new drugs -Drug discoveryphase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

CO-III: Pharmacology of drugs acting on peripheral nervous system: Organization and function of ANS. Neurohumoral transmission,co-transmission and classification of neurotransmitters. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anesthetic agents. Drugs used in myasthenia gravis and glaucoma

CO-IV: Pharmacology of drugs acting on central nervous system: Neurohumoral transmission in the C.N.S.special emphasis on importance ofvarious neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. General anesthetics and pre-anesthetics. Sedatives, hypnotics and centrally acting muscle relaxants. Anti-epileptics, Alcohols and disulfiram, Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxietyagents, anti-manics and hallucinogens. Drugs used in Parkinsons disease and Alzheimer's disease. CNS stimulants and nootropics. Opioid analgesics and antagonists. Drug addiction, drug abuse, tolerance and dependence.

Practical

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

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

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rangand Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, TataMc 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, New Delhi.
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. VallabhPrakashan,

*****

Course Name: PHARMACOGNOSY AND PHYTOCHEMISTRY I
Course Code: 18PH2221
Semester: IV / Year II L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	to know the techniques in the cultivation and production of crude drugs	1,PSO1	1,2
CO2	to know the crude drugs, their uses and chemical nature	1,PSO1	1,2
CO3	know the evaluation techniques for the herbal drugs	1,PSO1	1,2
CO4	Understand the microscopic and morphological features of crude drugs	1,PSO1	1,2
CO5	Perform the microscopic experiments and morphological evaluation of crude drugs	1,2	2,3

Theory syllabus

CO-I: Introduction to Pharmacognosy: Definition, history, scope and development of Pharmacognosy, Sources of Drugs – Plants, Animals, Marine &Tissue culture, Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins). **Classification of drugs:** Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs. **Quality control of Drugs of Natural Origin:** Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

CO-II: Cultivation, Collection, Processing and storage of drugs of natural origin: Cultivation and Collection of drugs of naturalorigin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants. **Conservation of medicinal plants Plant tissue culture:** Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines.

CO- III: Pharmacognosy in various systems of medicine: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathyand Chinese systems of medicine. **Introduction to secondary metabolites:** Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

CO- VI: Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs **Plant Products:** Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens; **Primary metabolites:** General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primarymetabolites: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey **Proteins and Enzymes :** Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin). **Lipids(Waxes, fats, fixed oils)** : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax **Marine Drugs:** Novel medicinal agents from marine sources.

Practical

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

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis

4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers& Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs byM.A. Iyengar

*****

Course Name: APTITUDE BUILDER -I
Course Code: 18UC2204
Semester: II / Year I L-T- P : 0-0-4 Credits : 2

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course outcome's	PO No	BTL
CO 1	Apply the concept of Critical Reading and Analytical Reading and comprehend the key ideas and gist of a passage. Understand the importance of the presentation skills, analyze the given topic, apply various strategies and the principles of grammar in written expression.	5,6	3
CO 2	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.	7,10	3
CO 3	Apply the concepts of Numbers to solve the problems related to divisibility rules, problems based on Unit's digit, Remainders, Successive Division, Prime Factorization, LCM & HCF problems. Apply the concepts of Averages &Alligations, students will be able to solve the problems related to Averages as well as problems based on Mixtures.	1, 5	3
CO 4	Apply the various concepts of cubes to find out how to cut a cube to get the maximum number of smaller identical pieces, how to minimize the number of cuts required to cut a cube into the given number of smaller identical pieces, how to count the number of smaller cubes which satisfy the given painting scheme. Apply the principles of binary logic to solve problems involving truth-tellers, liars and alternators. Analyze the given data to form an ordered arrangement from an unorganized raw data.	1, 5	4

Theory syllabus

Directed Listening and Thinking Activity (DLTA) Skills: Reading, Listening, Thinking,Writing, Presentation - Method: Flipped Classroom. Writing Skills**:**Paraphrasing,Summarizing,Notice, Circular, Agenda, Minutes, Memo; **Body Language (Kinesics)** :Postures, gestures,eye contact. Self-confidence:Self-esteem . SoftSkills: The Art of Compromise, Learn to Say: "I Don't Know", Being organized, Showing Self-awareness,An eye on success, being self-motivated, Showing self-awareness, Find Direction from Someone Who Is Lost: "The Drifter" Self-Assessment for Attainable Career Objectives--Defining a Career Objective **Quantitative Aptitude**: Numbers,Averages andAlligations, Mensuration. **Reasoning:** Cubes, Binary Logic, Ordering and Sequencing

Reference Books:

1.Daniel G.Riordan and Steven E. Pauley: *Technical Report Writing Today.* New Delhi*:* Biztantra.2004.
2.Ken Taylor.*Telephoning and Teleconferencing Skills*. Hyderabad:Orient Black Swan.2008.
3.E. Suresh Kumar, B. Sandhya.*Communication for Professional Success.* Delhi: Orient Black Swan.2013
4*Reasoning Trainer Plus*.:Hyderabad:Brain Mapping Academy.2012

B. PHARMACY PROGRAM SYLLABUS
SEMESTER V

Course Name: MEDICINAL CHEMISTRY – II
Course Code: 18PH3122
Semester: V / Year III **L-T- P : 3-1-0** **Credits : 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand the chemistry of drugs with respect to their pharmacological activity	1,4	1,2
CO2	understand the drug metabolic pathways, adverse effect and therapeutic value of drugs	1,4	1,2
CO3	know the Structural Activity Relationship (SAR) of different class of drugs	1,4	1,2
CO4	write the chemical synthesis of some drugs	1,4	1,2

Theory syllabus

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

CO- I : Antihistaminic agents: Histamine, receptors and their distribution in the humanbody. H_1–antagonists: Diphenhydramine*, Dimenhydrinate, Doxylamine, Clemastine, Diphenylphyraline, Tripelenamine, Chlorcyclizine, Meclizine, Buclizine, Chlorpheniramine, Triprolidine*, Phenidamine, Promethazine*, Trimeprazine, Cyproheptadine, Azatidine, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolynsodium. H_2-antagonists: Cimetidine*, Famotidine, Ranitidin. Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole. Anti-neoplastic agents: Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa. Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine. Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate Miscellaneous: Cisplatin, Mitotane.

CO– II: Anti-anginal: Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. Calciumchannel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine. Diuretics: Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide. Thiazides, Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid. Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol. Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril, Quinapril, Methyldopa,* Clonidine, Guanethidine, Guanabenz, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine.

CO- III: Anti-arrhythmic Drugs: Quinidine, Procainamide, Disopyramide *, Phenytoin, Lidocaine, Tocainide, Mexiletine, Lorcainide, Amiodarone, Sotalol. Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol. Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel. Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan. Drugs acting on Endocrine system: Nomenclature, Stereochemistry and metabolism of steroids. Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol. Drugs for erectile dysfunction: Sildenafil, Tadalafil. Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol. Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone. Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

CO- IV: Antidiabetic agents: Insulin and its preparations. Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acrabose, Voglibose. Local Anesthetics: SAR of Local anesthetics. Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine. Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate. Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

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 byLednicer, Vol. 1to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

Course Name: INDUSTRIAL PHARMACY I
Course Code: 18PH3123
Semester: V / Year III **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Know the design and layout of various procedures in pharmaceutical industry	1,PSO1	1,2
CO2	Know the various pharmaceutical dosage forms and their manufacturing techniques.	1,PSO1	1,2
CO3	Know various considerations in development of pharmaceutical dosage forms	1,PSO1	1,2
CO4	Understand the quality control of solid, liquid and semisolid dosage forms	1,PSO1	1,2
CO5	Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality	2,PSO1	2,3

Theory syllabus

CO-I: 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 dosageforms.

CO-II: Tablets: Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects incoating. 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, equipments for manufacture of pellets

CO-III: 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

CO-IV: 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.

Practical

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

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, LeonLachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 byLiberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rdEdition
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

9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

Course Name: PHARMACOLOGY-II

Course Code: 18PH3124

Semester: V / Year III **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the mechanism of drug action and its relevance in the treatment of different diseases	1,4	1,2
CO2	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.	1,4	1,2
CO3	Understand the effect of drugs on physiological systems	1,4	1,2
CO4	Appreciate correlation of pharmacology with related medical sciences	1,4	1,2
CO5	Perform various invitro experiments to demonstrate receptor actions using isolated tissue preparation	2,4	2,3

Theory syllabus

CO-I: Pharmacology of drugs acting on cardio vascular system: Introduction to hemodynamic and electrophysiology of heart. Drugs used in congestive heart failure. Anti-hypertensive drugs. Anti-anginal drugs. Anti-arrhythmic drugs. Anti-hyperlipidemic drugs.

CO-II: Pharmacology of drugs acting on cardio vascular 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-inflammatory agents, Anti-gout drugs, Antirheumatic drugs

CO-III: 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.

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

Practical

1. Introduction to in-vitro pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frogrectus abdominis muscle and rat ileum 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

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

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
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, New Delhi.
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

*****

Course Name: PHARMACOGNOSY AND PHYTOCHEMISTRY II
Course Code: 18PH3125
Semester: V / Year III L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents	1,PSO2	1,2
CO2	to understand the preparation and development of herbal formulation.	1,PSO2	1,2
CO3	to understand the herbal drug interactions	1,PSO2	1,2
CO4	Understand the isolation procedures and identification of phytoconstituents	1,PSO2	1,2
CO5	to carryout isolation and identification of phytoconstituents	2,PSO1	2,3

CO-I: Metabolic pathways in higher plantsand 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.

CO-II: 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, carotenoids

CO-III: Isolation, Identification and Analysis of Phytoconstituents: Terpenoids: Menthol, Citral, Artemisin, Glycosides: Glycyrhetinic acid & Rutin, Alkaloids: Atropine,Quinine,Reserpine,Caffeine, Resins: Podophyllotoxin, Curcumin

CO-IV: 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.

Practical

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles: Caffeine - from tea dust. Diosgenin from Dioscorea. Atropine from Belladonna. 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

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.

Course Name: PHARMACEUTICAL JURISPRUDENCE

Course Code: 18PH3126

Semester: V / Year III **L-T- P : 3-1-0** **Credits : 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.	1,8	1,2
CO2	Various Indian pharmaceutical Acts and Laws	1,8	1,2
CO3	The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	1,8	1,2
CO4	The code of ethics during the pharmaceutical practice	1,8	1,2

Theory syllabus

CO-I: 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.

CO-II: 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

CO-III: 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

CO-IV: 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)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM). 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 D efinition, 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.

Recommended books: (Latest Edition)

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

Course Name: APTITUDE BUILDER-II
Course Code: 18UC3105
Semester: V / Year III **L-T- P : 0-0-2** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course outcome's	PO No	BTL
CO 1	Apply the strategies and techniques learnt in carrying out conversations in different contexts. Analyse the different parameters and formats of written technical communication and apply in everyday work and life.	8, 10	3
CO 2	Analyse the concepts of critical and analytical reading skills. Apply the strategies and techniques learnt in handling interviews in different contexts.	8, 10	3
CO 3	Apply the concepts of Ratio & Proportion, Percentages, Profit &Loss, Simple & Compound Interest, students will be able to solve the problems based on Ratios, problems involving Percentages, problems related to cost price, selling price, profit, loss, marked price and discounts, problems involving interest.	1, 5	3
CO 4	Analyze the given series of numbers to predict the next number in the series. Analyze the given set of numbers or letters to find the analogy. Analyze the given data to find the code which is used to encode a given word and use the same code in the process of decoding. Apply the given set of conditions to select a team from a group of members.	1	4

Theory Syllabus

Critical Reading: Reading to Identify the Theme**,** Reading to Identify the Central Idea**;** Reading to Identify the Tone, Reading to Identify Writer's Attitude, Reading to Identify Parallel Ideas,Reading to Identify Logical Conclusions. Writing Skills**:**Note- making and Note- taking, Report Writing. Presentation Skills- Preparing for the Presentation, Audience Analysis, Processing Information, Ice-breakers, Quotations, Presentation Structure**,** Say what you want to say- Say it, Say what you have said to say**,** Preparing for Question Hour,Funnel Effect and How to Overcome it. **Trinity Guild Hall -** Communication Skills - Graded Evaluation and Testing-1-8 grades **Quantitative Aptitude**:Ratio andProportion, Percentages, Profit and Loss, Simple Interest and Compound Interest **Reasoning**:Number and Letter Series, Number and Letter Analogy, Coding and decoding, Odd man out. Selections

Reference Books

1. Dr. Meenakshi Raman and Dr. Sangeetha Sarma: *Technical Communication*.Oxford University Press: Delhi.2016.
2. M. Ashraf Rizvi: *Effective Technical Communication.* New Delhi:McGraw Hill Education(India) Private Limited
3. Tom Rath: Strengths Finder2.0. New York:Gallup Press.2007.
4. C. Weaver. *Reading Process and Practice*. Portsmouth US: Heinemann Educational Bokks.1988.

B. PHARMACY PROGRAM SYLLABUS
SEMESTER VI

Course Name: MEDICINAL CHEMISTRY – III
Course Code: 18PH3227
Semester: VI / Year III **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the importance of drug design and different techniques of drug design.	1,4	1,2
CO2	Understand the chemistry of drugs with respect to their biological activity.	1,4	1,2
CO3	Know the metabolism, adverse effects and therapeutic value of drugs.	1,4	1,2
CO4	Know the importance of SAR of drugs.	1,4	1,2
CO5	Perform synthesis and SAR of drugs.	2,PSO1	2,3

Theory syllabus

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

CO – I: 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

CO – II: 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 sulphate, Chloroquin*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil. Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

CO – III: Anti-tubercular Agents: Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Anti-tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate. Urinary tract anti-infective agents: Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine. Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

CO – IV: Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine, 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 approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. Combinatorial Chemistry: Concept of combinatorial and applications chemistry: solid phase and solution phase synthesis.

Practical

1. **Preparation of drugs and intermediates:** Sulphanilamide, 7-Hydroxy, 4-methyl coumarin, Chlorobutanol, Triphenyl imidazole, Tolbutamide, Hexamine
2. **Assay of drugs:** Isonicotinic acid hydrazide, Chloroquine, Metronidazole, Dapsone, Chlorpheniramine maleate, Benzyl penicillin
3. Preparation of medicinally important compounds or intermediates byMicrowave irradiation technique
4. Drawing structures and reactions using chem draw®
5. 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 (LipinskiesRO5)

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and PharmaceuticalChemistry.
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.

*****

Course Name: PHARMACOLOGY-III
Course Code: 18PH3228
Semester: VI / Year III **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand the mechanism of drug action and its relevance in the treatment of different infectious diseases	1,4	1,2
CO2	comprehend the principles of toxicology and treatment of various poisoningsand	1,4	1,2
CO3	appreciate correlation of pharmacology with related medical sciences.	1,4	1,2
CO4	To be able to ascertain the pharmacodynamics of medicinal agents	1,4	1,2
CO5	Perform various invitro experiments to demonstrate receptor actions using isolated tissue preparation	2,4	2,3

Theory syllabus

CO-I: 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.

CO-II: 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. Antiviral drugs e.Anthelmintics. Antimalarial drugs. Antiamoebic agents

CO-III: Chemotherapy: Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy. Immunopharmacology: Immunostimulants, Immunosuppressant, Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

CO-IV: 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. Chronopharmacology: Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.

Practical

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 modeland NSAIDS 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 usingsemi- autoanalyser
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 given data
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, Wilcoxon Signed Rank test)

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
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, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology 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.

*****

Course Name: HERBAL DRUG TECHNOLOGY
Course Code: 18PH3229
Semester: VI / Year III L-T- P : 3-1-4 Credits : 6

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand raw material as source of herbal drugs from cultivation to herbal drug product	1,PSO2	1,2
CO2	know the WHO and ICH guidelines for evaluation of herbal drugs	1,PSO2	1,2
CO3	know the herbal cosmetics, natural sweeteners, nutraceuticals	1,PSO2	1,2
CO4	appreciate patenting of herbal drugs, GMP .	1,PSO2	1,2
CO5	Prepare various herbal formulations	2,PSO1	2,3

Theory syllabus

CO-I: Herbs as raw materials: Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbalmaterials 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 Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

CO-II: Nutraceuticals: General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina. **Herbal-Drug and Herb-Food Interactions:** General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper &Ephedra.

CO-III: 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

CO- IV: 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 Z of Drugs & Cosmetics Act for ASU drugs. **General Introduction to Herbal Industry:** Herbal drugs industry: **Present scope and futureprospects**. 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.

Practical

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 like creams, 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 recentPharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease &Evans.
2. Textbook of Pharmacognosy byTyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit andGokhale
4. Essential of Pharmacognosy byDr.S.H.Ansari
5. Pharmacognosy & Phytochemistry byV.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. Business Horizons Publishers, New Delhi, India, 2002.

*****

Course Name: BIOPHARMACEUTICS AND PHARMACOKINETICS
Course Code: 18PH3230
Semester: VI / Year III L-T- P : 3-1-0 Credits : 4

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.	2,PSO1	1,2
CO2	Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.	2,PSO1	1,2
CO3	To understand the concepts of bioavailability and bioequivalence of drug products and their significance.	2,PSO1	1,2
CO4	Understand various pharmacokinetic parameters, their significance & applications.	2,PSO1	1,2

Theory syllabus

CO-I: Introduction to Biopharmaceutics: Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though 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

CO- II: Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs. Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

CO- III: 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 ,t1/2,Vd,AUC,Ka, Clt and CL_R- definitions methods of eliminations, understanding of their significance and application.

CO- IV: *Multicompartment models:* Two compartment open model. IV bolus. Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins. Nonlinear Pharmacokinetics: Introduction, Factors causing Non-linearity. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

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 PublishingCompany, Pennsylvnia

*****

Course Name: PHARMACEUTICAL BIOTECHNOLOGY
Course Code: 18PH3231
Semester: VI / Year III **L-T- P : 3-1-0** **Credits : 4**

Mapping of Course Outcomes (CO) to Student outcomes:

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

Theory syllabus

CO- I : Brief introduction to Biotechnologywith 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. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering.

CO- II: 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.

CO- III: 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 Substituties.

CO- IV: 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, equipments, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. 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 Substituties.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: 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, Aditya books Ltd., New Delhi

Course Name: PHARMACEUTICAL QUALITY ASSURANCE
Course Code: 18PH3232
Semester: VI / Year III **L-T- P : 3-1-0** **Credits : 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand the cGMP aspects in a pharmaceutical industry	1,PSO1	1,2
CO2	appreciate the importance of documentation	1,PSO1	1,2
CO3	understand the scope of quality certifications applicable to pharmaceutical industries	1,PSO1	1,2
CO4	understand the responsibilities of QA & QC departments	1,PSO1	1,2

Theory syllabus

CO – I: 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

CO – II: 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 ofcontamination. Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for rawmaterials.

CO – III: 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.

CO – IV: 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 byorganization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol.69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
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 Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

Course Name: CAMPUS TO CORPORATE
Course Code: 18UC3205
Semester: VI / Year III **L-T- P : 0-0-4** **Credits : 2**

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course outcome's	PO No	BTL
CO 1	Analyze basic concepts of critical and analytical reasoning skills apply strategies to analyze issues, arguments and some aspects of corporate communication.	5,6,9	3
CO 2	Creativity in writing of any given context like sending Emails, Reports, Proposals etc. Make the student to face HR interviews.	7,8,10	4
CO 3	Apply the concepts of Arithmetic, the students enhance their problem solving skills which helps them to succeed in campus drives, grooming the young learners into the corporate world.	1, 4, 5	3
CO 4	Analyze the basic concepts of Critical and Analytical Reasoning in meeting the challenges of the professional world.	1, 5	3

Theory syllabus

Lexis -2 : Vocabulary-Analogies–Advanced Level, Words often Confused, WordClassification,Idioms and Phrases, Sentence Completions, Paragraph Jumble. Writing Skills**–**Resume, Email Writing, Company Profile, Briefing and Debriefing, Press note, Catch Phrases, Caption Writing. **Critical Thinking**:Engineering Ethics through Case Analysis: Ford Pinto, Chernobyl, Hyatt Residency,Bhopal Gas Tragedy, Boys of Football Team-Rescue Operation from the ThanLuangCave in Thailand. **Interview Skills:**Personal Interview-Concept and Practice**,**Telephone-Etiquettes, Email-Etiquettes,Dress code and Grooming, Preparing Portfolio,Group Discussion**,** Mock Interviews, Unconventional HR questions. **SimulatedTesting:** Co-Cubes, E-Litmus and Amcat Practice, Infosys Placement Papers, Wipro Placement Papers, CTS and Accenture Paper Pattern

Reference Books

1.Ken Taylor. *Telephoning and Teleconferencing Skills*. Hyderabad: Orient Black Swan.2008.
2.E. Suresh Kumar, B. Sandhya.*Communication for Professional Success.* Delhi: Orient Black Swan.2013
3. Judith Verify: *Succeeding at Interview*. Mumbai: Viva Books Private Limited.2000
4. Norman L. Frigon, Sr.&Harry K.Jackson, Jr. *The Leader- Developing the Skills and Personal Qualities.* Mumbai*:* Magna Publishing Co Ltd.2000.

B. PHARMACY PROGRAM SYLLABUS
SEMESTER VII

Course Name: INSTRUMENTAL METHODS OF ANALYSIS
Course Code: 18PH4133
Semester: VII / Year IV **L-T- P : 3-1-4** **Credits : 6**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Know about various instruments and standard operating procedures	2,4	1,2
CO2	Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis	2,4	1,2
CO3	Understand the chromatographic separation and analysis of drugs.	2,4	1,2
CO4	Understand the principle and application of advanced analytical instruments.	2,4	1,2
CO5	Perform quantitative & qualitative analysis of drugs using various analytical instruments.	2,4	2,3

Theory syllabus

CO –I: 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

CO –II: 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 andapplications. Flame Photometry-Principle, interferences, instrumentation and applications. Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications. Nepheloturbidometry- Principle, instrumentation and applications

CO –III: 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

CO –IV: Gas chromatography-Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications. High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications. Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications. Gel chromatography- Introduction, theory, instrumentation and applications. Affinity chromatography- Introduction, theory, instrumentation and applications.

Practical

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

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.KSharma
2. Organic spectroscopy by Y.RSharma
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

*****

Course Name: INDUSTRIAL PHARMACY II
Course Code: 18PH4134
Semester: VII / Year IV L-T- P : 3-1-0 Credits : 4

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Know the process of pilot plant and scale up of pharmaceutical dosage forms	1,PSO1	1,2
CO2	Understand the process of technology transfer from lab scale to commercial batch	1,PSO1	1,2
CO3	Know different Laws and Acts that regulate pharmaceutical industry	1,PSO1	1,2
CO4	Understand the approval process and regulatory requirements for drug products	1,PSO1	1,2

Theory syllabus

CO-I: 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

CO-II: Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation -confidentiality agreement, licensing, MoUs, legal issues

CO-III : 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.

CO-IV: 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 Aprilavailable at http,//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 Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought bylearning plus, inc. available at http.//www.cgmp.com/ra.htm.

Course Name: PHARMACY PRACTICE
Course Code: 18PH4135
Semester: VII / Year IV **L-T- P : 3-1-0** **Credits : 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	know various drug distribution methods in a hospital	5,7	1,2
CO2	appreciate the pharmacy stores management and inventory control	5,7	1,2
CO3	monitor drug therapy of patient through medication chart review and clinical review	5,7	1,2
CO4	obtain medication history interview and counsel the patients	5,7	1,2

Theory syllabus

CO- I: 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.

CO- II: 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.

CO- III: 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.

CO- IV: 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*, 4thed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook ofClinical 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 System Pharmacists 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)
4. Pharmacy times (Monthly magazine)

*****

Course Name: NOVEL DRUG DELIVERY SYSTEMS
Course Code: 18PH4136
Semester: VII / Year IV L-T- P : 3-1-0 Credits : 4

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Know about current developments in drug delivery technolgies	2,PSO2	1,2
CO2	To understand various approaches for development of novel drug delivery systems.	2,PSO2	1,2
CO3	To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation	2,PSO2	1,2
CO4	To be able to design or recommend a drug delivery system	2,PSO2	1,2

Theory syllabus

CO-I: 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 deliverysystems.

CO-II: Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications. Mucosal Drug Delivery system: 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 implantsand osmotic pump

CO-III: 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

CO-IV: 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 andocuserts. Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised andexpanded, 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 edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, 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 (ElsevierSciences)

Course Name: UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS
Course Code: 18PH1207
Semester: VII / Year IV **L-T- P : 1-0-2** **Credits : 3**

Theory syllabus

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. **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. **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. **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. **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. R R Gaur, R Sangal and G P Bagaria, " A Foundation Course in Human Values and Professional Ethics", 1st Ed, Excel Books.

B. PHARMACY PROGRAM SYLLABUS
SEMESTER VIII

Course Name: BIOSTATISITCS AND RESEARCH METHODOLOGY
Course Code: 18PH4238
Semester: VIII / Year IV **L-T- P : 3-1-0** **Credits : 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)	4,5	1,2
CO2	Know the various statistical techniques to solve statistical problems	4,5	1,2
CO3	Appreciate statistical techniques in solving the problems.	4,5	1,2
CO4	Know the applications of statistics in clinical data management	4,5	1,2

Theory syllabus

CO-I: 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

CO-II: 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, alternativehypothesis, 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

CO-III: Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test. Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

CO-IV: Blocking and confounding system for Two-level factorials. Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels 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 Dekker Inc. 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

*****

Course Name: SOCIAL AND PREVENTIVE PHARMACY
Course Code: 18PH4239
Semester: VIII / Year VI **L-T- P : 3-1-0** **Credits : 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Acquire high consciousness/realization of current issuesrelated to health and pharmaceutical problems within the country and worldwide.	7,8	1,2
CO2	Have a critical way of thinking based on current healthcare development.	7,8	1,2
CO3	Evaluate alternative ways of solving problems related tohealth and pharmaceutical issues	7,8	1,2
CO4	Design a better health care service system	7,8	1,2

Theory syllabus

CO- I: Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick. **Social and health education:** Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. **Sociology and health:** Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health. **Hygiene and health:** personal

hygiene and health care; avoidable habits

CO- II: Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

CO- III: National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

CO- IV: National health intervention programme for mother and child, National family welfare programme, National tobacco controlprogramme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program. Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Recommended Books (Latest edition)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, , JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers,Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

*****

Course Name: PHARMA MARKETING MANAGEMENT
Course Code: 18PH4240ET
Semester: VIII / Year IV L-T- P : 3-0-0 Credits : 3

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	to provide an understanding of sales and marketing of pharmaceutical products.	6,PSO2	1,2
CO2	Know about various policies for drug inventory management	6,PSO2	1,2
CO3	Know about retail and wholesale marketing	6,PSO2	1,2
CO4	Understand business potential and development in product sales and manufacturing	6,PSO2	1,2

Theory syllabus

CO- I: 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.

CO- II: 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.

CO- III: 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:** Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

CO- IV: Pricing: Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority). Emerging concepts in marketing: Vertical & Horizontal Marketing; RuralMarketing; 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.

*****

Course Name: PHARMACEUTICAL REGULATORY SCIENCE
Course Code: 18PH4241ET
Semester: VIII / Year IV L-T- P : 3-0-0 Credits : 3

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Know about legal aspects and quality policies for drug manufacturing	1,PSO1	1,2
CO2	Know about the process of drug discovery and development	1,PSO1	1,2
CO3	Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	1,PSO1	1,2
CO4	Know the regulatory approval process and their registration in Indian and international markets	1,PSO1	1,2

Theory syllabus

CO- I: 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.

CO- II: 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 ofapplications)

CO- III: 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.

CO- IV: 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, Purplebook

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 ByRichard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. ByJohn Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices,and biologics /edited by Douglas J. Pisano, DavidMantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, Second Edition By RickNg

*****

Course Name: PHARMACOVIGILANCE
Course Code: 18PH4242ET
Semester: VIII / Year IV **L-T- P : 3-0-0** **Credits : 3**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Why drug safety monitoring is important?	6,PSO2	1,2
CO2	History and development of pharmacovigilance	6,PSO2	1,2
CO3	National and international scenario of pharmacovigilance	6,PSO2	1,2
CO4	Dictionaries, coding and terminologies used in pharmacovigilance	6,PSO2	1,2

Theory syllabus

CO- I : Introduction to Pharmacovigilance: Historyand development of Pharmacovigilance; Importance of safety monitoringof 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 preventabilityassessment; Management of adverse drug reactions. **Basic terminologies used inpharmacovigilance:** Terminologies of adverse medication related events; Regulatory terminologies

CO- II: 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 reactionterminologies, MedDRA and Standardised MedDRAqueries, 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

CO- III: Vaccine safety surveillance: Vaccine Pharmacovigilance, Vaccination failure, Adverse events followingimmunization. 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

CO- IV: 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 PKparameters. Drug safety evaluation in specialpopulation: 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.
3. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones& Bartlett Publishers.
7. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn 3=7297
13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/pv_home.html

Course Name: QUALITY CONTROL AND STANDARDIZATION OF HERBALS
Course Code: 18PH4243ET
Semester: VIII / Year IV **L-T- P : 3-0-0** **Credits : 3**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	know WHO guidelines for quality control of herbal drugs	2,PSO1	1,2
CO2	know Quality assurance in herbal drug industry	2,PSO1	1,2
CO3	know the regulatory approval process and their registration in Indian and international markets	2,PSO1	1,2
CO4	appreciate EU and ICH guidelines for quality control of herbal drugs	2,PSO1	1,2

Theory syllabus

CO- I: Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use

CO- II: Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.

CO- III: 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.

CO- IV: 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 andEvans
2. Pharmacognosy by Kokate, Purohit andGokhale
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/TraditionalMedicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluationof Botanicals. Business Horizons 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 ofHerbal 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. WorldHealth Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary andAlternative 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.

*****

Course Name: COMPUTER AIDED DRUG DESIGN
Course Code: 18PH4244ET
Semester: VIII / Year IV **L-T- P : 3-0-0** **Credits : 3**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Design and discovery of lead molecules	3,PSO2	1,2
CO2	The role of drug design in drug discovery process	3,PSO2	1,2
CO3	The concept of QSAR and docking	3,PSO2	1,2
CO4	Various strategies to develop new drug like molecules.	3,PSO2	1,2

Theory syllabus

CO-I: Introduction to Drug Discovery and Development: Stages of drug discovery and development, **Lead discovery and Analog Based Drug Design:** Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation. **Analog Based Drug Design:** Bioisosterism, Classification, Bioisosteric replacement. Any three casestudies

CO-II: 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.

CO-III: 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.

CO-IV: 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 & Pharmaceutical Chemistry" Lippincott, NY.
4. Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
5. Koro Ikovas 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.

*****

Course Name: CELL AND MOLECULAR BIOLOGY
Course Code: 18PH4245ET
Semester: VIII / Year IV L-T- P : 3-0-0 Credits : 3

Mapping of Course Outcomes (CO) to Student outcomes:

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

Theory syllabus

CO- I: 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)

CO- II: 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

CO- III: Science of Genetics, Transgenics and Genomic Analysis, Cell Cycle analysis, Mitosis and Meiosis, Cellular Activities and Checkpoints

CO- IV: 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, Oxford London.
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. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
13. RA Goldshy et. al., : Kuby Immunology.

Course Name: COSMETIC SCIENCE
Course Code: 18PH4246ET
Semester: VIII / Year IV **L-T- P : 3-0-0** **Credits : 3**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Principles of formulation and building blocks of skin care products	PSO1,PSO2	1,2
CO2	Principles of formulation and building blocks of Hair care products	PSO1,PSO2	1,2
CO3	Role of herbs in cosmetics	PSO1,PSO2	1,2
CO4	Principles of Cosmetic Evaluation	PSO1,PSO2	1,2

Theory syllabus

CO- I: 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**.**

CO- II: 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.

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

CO- IV: Principles of Cosmetic Evaluation:Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combingproperties. Soaps,and syndet bars. Evolution and skin benfits. Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding 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.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3) Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers.

*****

Course Name: EXPERIMENTAL PHARMACOLOGY
Course Code: 18PH4247ET
Semester: VIII / Year IV **L-T- P : 3-0-0** **Credits : 3**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Appreciate the applications of various commonly used laboratory animals.	2,4	1,2

CO2	Appreciate and demonstrate the various screening methods used in preclinical research	2,4	1,2
CO3	Appreciate and demonstrate the importance of biostatistics and researchmethodology	2,4	1,2
CO4	Design and execute a research hypothesis independently	2,4	1,2

Theory syllabus

CO –I : Laboratory Animals: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

CO –II: Preclinical screening models: Introduction: Dose selection, calculation and conversions, preparation of drug solution /suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study. **Study of screening animal models for** Diuretics, nootropics, anti-Parkinson's,antiasthmatics, **Preclinical screening models:** for CNS activity- analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedativeand hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease

CO –III: Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics. **Preclinical screening models:** for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants.Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

CO-IV: Research methodology and Bio-statistics: Selection of research topic, review of literature, research hypothesis and study design, Pre-clinical data analysis and interpretation using Students 't' test, and One-way ANOVA. Graphical representation of data

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

Course Name: ADVANCED INSTRUMENTATION TECHNIQUES
Course Code: 18PH4248 ET
Semester: VIII / Year IV L-T- P : 3-0-0 Credits : 3

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	understand the advanced instruments used and its applications in drug analysis	2,4	1,2
CO2	understand the chromatographic separation and analysis of drugs.	2,4	1,2
CO3	understand the calibration of various analytical instruments	2,4	1,2
CO4	know analysis of drugs using various analytical instruments.	2,4	1,2

Theory syllabus

CO-I: 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

CO-II: Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (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.

CO-III: 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

CO-IV: 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 by A.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

Course Name: DIETARY SUPPLEMENTS AND NUTRACEUTICALS
Course Code: 18PH4249ET
Semester: VIII / Year IV **L-T- P : 3-0-0** **Credits : 3**

Mapping of Course Outcomes (CO) to Student outcomes:

CO	Course Outcome's	PO/PSO	BTL
CO1	Understand the need of supplements by the different group of people to maintain healthy life.	PSO1,PSO2	1,2
CO2	Understand the outcome of deficiencies in dietary supplements.	PSO1,PSO2	1,2
CO3	Appreciate the components in dietary supplements and the application.	PSO1,PSO2	1,2
CO4	Appreciate the regulatory and commercial aspects of dietary supplements including health claims.	PSO1,PSO2	1,2

Theory syllabus

CO- I: 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

CO- II : 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, tea and the like.

CO- III : 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 and complex carbohydrates as functional food ingredients..

CO- IV : 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 Publishing Group, 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.
8. 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.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger

*****

Course Name: PROJECT WORK
Course Code: 18PH4250PW
Semester: VIII / Year IV **L-T- P : 0-0-12** **Credits : 6**