R21 Curriculum and Syllabus
Bachelor in Pharmaceutical Technology
(B. Pharm)

JIS University
Agarpara, Kolkata

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP101T	Human Anatomy and Physiology I - Theory	3	1	0	4
2		BP102T	Pharmaceutical Analysis I - Theory	3	1	0	4
3		BP103T	Pharmaceutics I - Theory	3	1	0	4
4		BP104T	Pharmaceutical Inorganic Chemistry - Theory	3	1	0	4
5		BP105T	Communication Skills - Theory	2	0	0	2
6		BP106 RBT / RMT	Remedial Biology/Remedial Mathematics - Theory	2	0	0	2
PRACTICAL							
7		BP107P	Human Anatomy and Physiology - Practical	0	0	4	2
8		BP108P	Pharmaceutical Analysis I - Practical	0	0	4	2
9		BP109P	Pharmaceutics I -Practical	0	0	4	2
10		BP110P	Pharm. Inorganic Chemistry - Practical	0	0	4	2
11		BP111P	Communication Skills - Practical*	0	0	2	1
12		BP112RBP	Remedial Biology - Practical*	0	0	2	1
MANDATORY NON-CGPA COURSE							
13		BSD181	Seminar and Group Discussion	0	0	0	1
14		BSD182	Skill X and Other Activities (MOOCs Courses)	0	0	0	1
TOTAL				**12/ 14$/ 16#**	**4**	**20**	**27/ 29$/ 30#**

[1] 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.

*Non University Examination (NUE)

[1]#

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP201T	Human Anatomy and Physiology II - Theory	3	1	0	4
2		BP202T	Pharmaceutical Organic Chemistry I - Theory	3	1	0	4
3		BP203T	Biochemistry - Theory	3	1	0	4
4		BP204T	Pathophysiology I - Theory	3	1	0	4
5		BP205T	Computer Applications in Pharmacy - Theory*	3	0	0	3
6		BP206T	Environmental Science - Theory*	3	0	0	3
PRACTICAL							
7		BP207P	Human Anatomy and Physiology II - Practical	0	0	4	2
8		BP208P	Pharm. Organic Chemistry I - Practical	0	0	4	2
9		BP209P	Biochemistry I - Practical	0	0	4	2
10		BP210P	Computer Applications in Pharmacy - Practical*	0	0	2	1
MANDATORY NON-CGPA COURSE							
11	MC	BSD281	Seminar and Group Discussion	0	0	0	1
12	MC	BSD281	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**18**	**4**	**14**	**29**

[2]

[2]***Non University Examination (NUE)**

SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	0	4
2		BP302T	Physical Pharmaceutics I – Theory	3	1	0	4
3		BP303T	Pharmaceutical Microbiology – Theory	3	1	0	4
4		BP304T	Pharmaceutical Engineering – Theory	3	1	0	4
PRACTICAL							
5		BP305P	Pharmaceutical Organic Chemistry II – Practical	0	0	4	2
6		BP306P	Physical Pharmaceutics I – Practical	0	0	4	2
7		BP307P	Pharmaceutical Microbiology – Practical	0	0	4	2
8		BP308P	Pharmaceutical Engineering – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
9		BSD381	Seminar and Group Discussion	0	0	0	1
10		BSD382	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**12**	**4**	**16**	**24**

UNIVERSITY

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	0	4
2		BP402T	Medicinal Chemistry I – Theory	3	1	0	4
3		BP403T	Physical Pharmaceutics II – Theory	3	1	0	4
4		BP404T	Pharmacology I – Theory	3	1	0	4
5		BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	0	4
PRACTICAL							
6		BP406P	Medicinal Chemistry I – Practical	0	0	4	2
7		BP407P	Physical Pharmaceutics II – Practical	0	0	4	2
8		BP408P	Pharmacology I – Practical	0	0	4	2
9		BP409P	Pharmacognosy and Phytochemistry I – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
10	MC	BSD481	Seminar and Group Discussion	0	0	0	1
11	MC	BSD482	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**15**	**5**	**16**	**28**

UNIVERSITY

SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP501T	Medicinal Chemistry II – Theory	3	1	0	4
2		BP502T	Industrial Pharmacy I– Theory	3	1	0	4
3		BP503T	Pharmacology II – Theory	3	1	0	4
4		BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	0	4
5		BP505T	Pharmaceutical Jurisprudence – Theory	3	1	0	4
PRACTICAL							
6		BP506P	Industrial Pharmacy I – Practical	0	0	4	2
7		BP507P	Pharmacology II – Practical	0	0	4	2
8		BP508P	Pharmacognosy and Phytochemistry II – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
9	MC	BSD581	Seminar and Group Discussion	0	0	0	1
10	MC	BSD582	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**15**	**5**	**12**	**26**

UNIVERSITY

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP601T	Medicinal Chemistry III - Theory	3	1	0	4
2		BP602T	Pharmacology III – Theory	3	1	0	4
3		BP603T	Herbal Drug Technology – Theory	3	1	0	4
4		BP604T	Biopharmaceutics and Pharmacokinetics –Theory	3	1	0	4
5		BP605T	Pharmaceutical Biotechnology – Theory	3	1	0	4
6		BP606T	Quality Assurance –Theory	3	1	0	4
PRACTICAL							
7		BP607P	Medicinal chemistry III – Practical	0	0	4	2
8		BP608P	Pharmacology III – Practical	0	0	4	2
9		BP609P	Herbal Drug Technology – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
10	MC	BSD681	Seminar and Group Discussion	0	0	0	1
11	MC	BSD682	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**18**	**6**	**12**	**30**

UNIVERSITY

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP701T	Instrumental Methods of Analysis – Theory	3	1	0	4
2		BP702T	Industrial Pharmacy II – Theory	3	1	0	4
3		BP703T	Pharmacy Practice – Theory	3	1	0	4
4		BP704T	Novel Drug Delivery System – Theory	3	1	0	4
PRACTICAL							
5		BP705P	Instrumental Methods of Analysis – Practical	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
6		BP706PS	Practice School*	0	0	12	6
MANDATORY NON-CGPA COURSE							
7	MC	BSD781	Seminar and Group Discussion	0	0	0	1
8	MC	BSD782	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**12**	**4**	**16**	**24**

[3]

[3]**Non University Examination**

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP801T	Bio statistics and Research Methodology - Theory	3	1	0	4
2		BP802T	Social and Preventive Pharmacy - Theory	3	1	0	4
3		BP803ET	Pharmaceutical Marketing Management - Theory	3	1	0	4
4		BP804ET	Pharmaceutical Regulatory Science - Theory	3	1	0	4
5		BP805ET	Pharmacovigilance - Theory	3	1	0	4
6		BP806ET	Quality Control and Standardization of Herbals - Theory	3	1	0	4
7		BP807ET	Computer Aided Drug Design - Theory	3	1	0	4
8		BP808ET	Cell and Molecular Biology - Theory	3	1	0	4
9		BP809ET	Cosmetic Science - Theory	3	1	0	4
10		BP810ET	Experimental Pharmacology - Theory	3	1	0	4
11		BP811ET	Advanced Instrumentation Techniques - Theory	3	1	0	4
12		BP812ET	Dietary Supplements and Nutraceuticals - Theory	3	1	0	4
SESSIONAL(ONLY INTERNAL EVALUATION)							
13		BP813PW	Project Work	0	0	12	6
MANDATORY NON-CGPA COURSE							
14	MC	BSD881	Seminar and Group Discussion	0	0	0	1
15	MC	BSD882	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**12**	**4**	**12**	**22**

UNIVERSITY

Credit Distribution Ratio:

Category	Credit Allocation As Per PCI	Credit Allocation As per University
Semester I	27/29*/30	27/29*/30
Semester II	29	29
Semester III	24	24
Semester IV	28	28
Semester V	26	26
Semester VI	30	30
Semester VII	24	24
Semester VIII	22	22
Credit Distribution Details		
Humanities, Social Sciences & Management Courses	6	6
Basic Science Courses like Remedial Biology, Mathematics, Computer Fundamentals and Professional Communication	9	9
Professional Core Courses	178	178*
Professional Elective Courses	8	8*
Open Elective Courses-Electives from other technical and /or emerging subjects	0	0*
Practice School, Project work, seminar and internship in industry or elsewhere	12	12*
Mandatory Courses [UHV, Induction, Indian Constitution, Seminar, Skill Development and other Co & extracurricular activities	1	16
Total	214	230*

UNIVERSITY

Credit Distribution in details:

A. Humanities, Social Sciences & Management Courses (HS)							
Sl. No.	Paper Code	Theory and Practical	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	BP105T	Communication skills	2	0	0	2	2
2	BP111P	Communication skills	0	0	2	2	1
		Total Credit:					**3**

B. Basic Sciences Courses (BS)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
1	BP106RBT	Remedial Biology	2	0	0	2	2
2	BP106RMT	Remedial Mathematics	2	0	0	2	2
3	BP106RBP	Remedial Biology	0	0	2	2	1
4	BP205T	Computer Applications in Pharmacy	3	0	0	3	3
5	BP210P	Computer Applications in Pharmacy	0	0	2	2	1
		Total Credit:					**9**

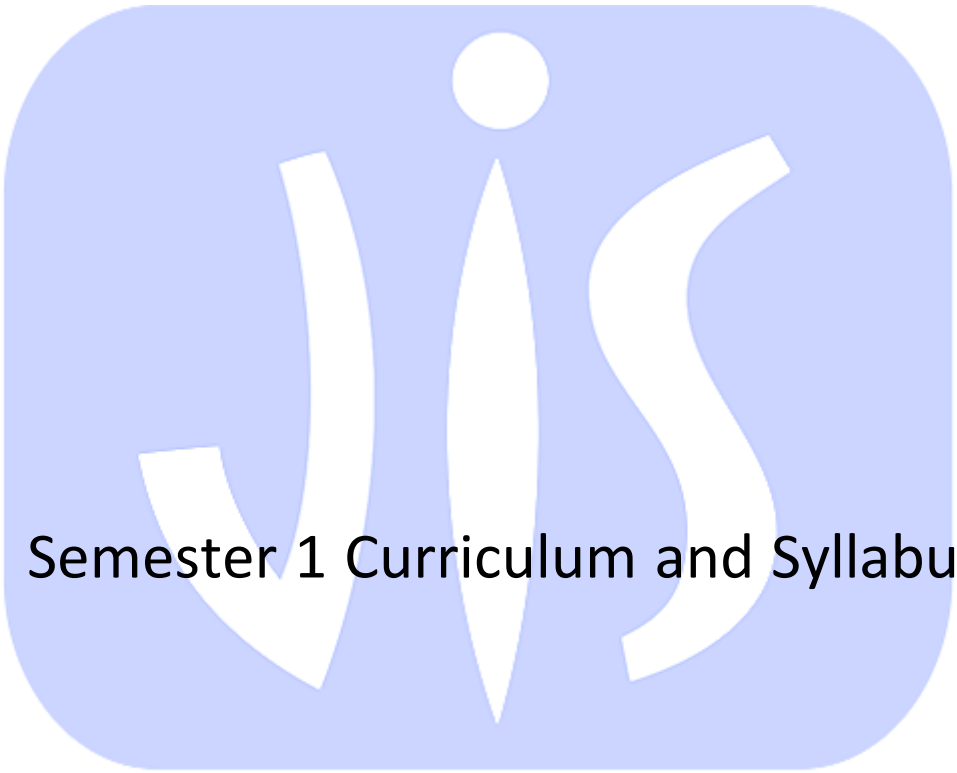
D. Pharmacy Core Courses (PC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
		Total Credit:					**178**

E. Professional Elective Courses (PE)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
		Total Credit:					**8**

F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
		Total Credit:					**0**

G. Project work, seminar and internship in industry or elsewhere (PW)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	BP706PS	Practice School	0	0	12	12	6
1	BP713PW	Project Work	0	0	12	12	6
		Total Credit:					**12**

H. Mandatory Courses [Environmental Science, UHV, Induction, Indian Constitution, Seminar, Skill Development and other Co & extracurricular activities] (MC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	BP206T	Environmental Science	3	0	0	3	3
2	BSD(1-8)81	Seminar and Group Discussion*	0	0	0	0	8
3	BSD(1-8)82	Skill X and Other Activities*	0	0	0	0	8
		Total Credit:					**3+16***



Semester 1 Curriculum and Syllabus

UNIVERSITY

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP101T	Human Anatomy and Physiology I - Theory	3	1	0	4
2		BP102T	Pharmaceutical Analysis I - Theory	3	1	0	4
3		BP103T	Pharmaceutics I - Theory	3	1	0	4
4		BP104T	Pharmaceutical Inorganic Chemistry - Theory	3	1	0	4
5		BP105T	Communication Skills - Theory	2	0	0	2
6		BP106 RBT / RMT	Remedial Biology/Remedial Mathematics - Theory	2	0	0	2
PRACTICAL							
7		BP107P	Human Anatomy and Physiology - Practical	0	0	4	2
8		BP108P	Pharmaceutical Analysis I - Practical	0	0	4	2
9		BP109P	Pharmaceutics I -Practical	0	0	4	2
10		BP110P	Pharm. Inorganic Chemistry - Practical	0	0	4	2
11		BP111P	Communication Skills - Practical*	0	0	2	1
12		BP112RBP	Remedial Biology - Practical*	0	0	2	1
MANDATORY NON-CGPA COURSE							
13		BSD181	Seminar and Group Discussion	0	0	0	1
14		BSD182	Skill X and Other Activities (MOOCs Courses)	0	0	0	1
TOTAL				**12/ 14$/ 16#**	**4**	**20**	**27/ 29$/ 30#**

[4] 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.

*Non University Examination (NUE)

[4] #

Course Code	BP101T			
Course Title	Human Anatomy and Physiology I - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

Upon completion of the course the students shall be able to:

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system
5. Appreciate coordinated working pattern of different organs of each system

Course Content:

UNIT I: **[10L]**

Introduction to human body: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization:Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization: Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues

UNIT II: **[10L]**

Integumentary system: Structure and functions of skin

Skeletal system: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

Joints: Structural and functional classification, types of joints movements and its articulation

UNIT III: **[10L]**

Body fluids and blood: Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

UNIT IV: **[8L]**

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.

Special senses:Structure and functions of eye, ear, nose and tongue and their disorders.

UNIT V: **[7L]**

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

Recommended Books (Latest Edition):

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

Reference Books (Latest Edition):

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP101T.1	3	-	-	1	-	-	-	-	-	-	3
BP101T.2	3	-	-	1	-	1	-	-	-	-	3
BP101T.3	-	-	-	3	-	1	-	-	-	1	2
BP101T.4	-	3	1	1	1	-	-	1	-	-	-
BP101T.5	3	-	1	-	2	1	-	-	-	-	1

Course Code	BP102T			
Course Title	Pharmaceutical Analysis - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This course deals with the fundamentals of analytical chemistry and principles of electro-chemical analysis of drugs

Objectives:

Upon completion of the course the students shall be able to:

1. understand the principles of volumetric and electro chemical analysis.
2. carryout various volumetric and electrochemical titrations
3. develop analytical skills

Course Content:

UNIT I: **[10L]**

a) Pharmaceutical analysis:Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

b) Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures

c) Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.

UNIT II: **[10L]**

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

UNIT III: **[10L]**

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.

Basic Principles,methods and application of diazotisation titration.

UNIT IV:Redox Titrations [8L]

(a) Concepts of oxidation and reduction

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

UNIT V: Electrochemical Methods of Analysis [7L]

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

Recommended Books (Latest Edition):

1. A.H. Beckett & J.B. Stenlake ”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, ”Textbook of Pharmaceutical Chemistry”
5. John H. Kennedy, ”Analytical chemistry principles”

Reference Books (Latest Edition):

1. ”Indian Pharmacopoeia”, Govt. of India.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP102T.1	1	1	3	-	-	-	-	-	1	-	-
BP102T.2	3	-	3	-	-	2	-	-	-	-	3
BP102T.3	3	-	-	3	-	1	-	-	-	-	2
BP102T.4	-	-	-	-	-	3	-	-	2	-	1
BP102T.5	3	2	-	1	-	-	-	-	-	-	2
BP102T.6	-	-	-	-	-	3	-	-	2	-	1

UNIVERSITY

Course Code	BP103T			
Course Title	Pharmaceutics I - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives:

Upon completion of the course the students shall be able to:

1. Know the history of profession of pharmacy
2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
3. Understand the professional way of handling the prescription
4. Preparation of various conventional dosage forms

Course Content:

UNIT I: **[10L]**

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.

UNIT II: **[10L]**

Pharmaceutical calculations: Weights and measures – Imperial Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

Powders: Definition, classification, advantages and disadvantages,Simple compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

UNIT III: [10L]

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Biphasic liquids:

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension stability problems and methods to overcome.

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation stability problems and methods to overcome.

UNIT IV: [8L]

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value its calculations, evaluation of suppositories.

Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

UNIT V: Semisolid dosage forms [7L]

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

Recommended Books (Latest Edition):

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. Lachmann. ”Theory and Practice of Industrial Pharmacy”, Lea & Febiger Publisher, The University of Michigan.
5. Alfonso R. Gennaro Remington. ”The Science and Practice of Pharmacy”, Lippincott Williams, New Delhi.
6. Carter S.J., ”Cooper and Gunn‘s. Tutorial Pharmacy, CBS Publications, New Delhi.
7. E.A. Rawlins, ”Bentley‘s Text Book of Pharmaceutics”, English Language Book Society, Elsevier Health Sciences, USA.

8. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.

9. Dilip M. Parikh ”Handbook of Pharmaceutical Granulation Technology”, Marcel Dekker, INC, New York.

10. Francoise Nieloud and Gilberte Marti Mestres, ”Pharmaceutical Emulsions and Suspensions”, Marcel Dekker, INC, New York

Reference Books (Latest Edition):

1. ”Indian Pharmacopoeia”, Govt. of India.

2. ”British Pharmacopoeia”,.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP103T.1	3	-	-	-	-	1	2	2	3	-	-
BP103T.2	3	-	-	-	-	1	2	2	3	-	-
BP103T.3	3	-	-	-	-	1	1	-	3	-	-
BP103T.4	3	-	-	-	-	3	-	-	3	-	-

Course Code	BP104T			
Course Title	Pharmaceutical Inorganic Chemistry - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives:

Upon completion of the course the students shall be able to:

1. know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
2. understand the medicinal and pharmaceutical importance of inorganic compounds

Course Content:

UNIT I: **[10L]**

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

UNIT II: **[10L]**

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.

UNIT III:Gastrointestinal Agents **[10L]**

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

UNIT IV: Miscellaneous Compounds **[8L]**

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite

Astringents: Zinc Sulphate, Potash Alum

UNIT V:Radiopharmaceuticals **[7L]**

Radio activity, Measurement of radioactivity, Properties of , , radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions pharmaceutical application of radioactive substances.

Recommended Books (Latest Edition):

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"

Reference Books (Latest Edition):

1. "Indian Pharmacopoeia", Govt. of India.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP104T.1	3	-	-	2	1	-	-	-	2	1	2
BP104T.2	3	-	-	2	-	-	-	-	1	-	2
BP104T.3	3	-	-	1	-	-	2	-	1	-	2
BP104T.4	3	-	-	3	-	-	-	-	1	-	3
BP104T.5	3	-	-	-	-	-	-	-	1	-	2
BP104T.6	3	-	-	-	-	-	-	-	1	-	2

UNIVERSITY

Course Code	BP105T			
Course Title	Communication Skills - Theory			
Category				
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	30			
Pre-requisites	None			

Scope:

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Objectives:

Upon completion of the course the students shall be able to:

1. Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
2. Communicate effectively (Verbal and Non Verbal)
3. Effectively manage the team as a team player
4. Develop interview skills
5. Develop Leadership qualities and essentials

Course Content:

UNIT I: **[7L]**

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Re-ceiver, Feedback, Context

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT II: **[7L]**

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

UNIT III: **[7L]**

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations

Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion‘ Required, Shades of Meaning, Formal Communication

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT IV: **[5L]**

Interview Skills: Purpose of an interview, Do‘s and Dont‘s of an interview

Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT V: **[4L]**

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

Recommended Books (Latest Edition):

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP105T.1	3	2	1	-	3	3	2	1	-	-	1
BP105T.2	2	-	-	-	3	3	-	3	-	-	2
BP105T.3	1	3	3	-	3	3	1	3	-	-	2
BP105T.4	3	1	2	-	1	3	-	3	-	-	-
BP105T.5	3	2	3	-	3	3	1	3	-	-	2

UNIVERSITY

Course Code	BP106RBT			
Course Title	Remedial Biology - Theory			
Category				
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	30			
Pre-requisites	None			

Scope:

To learn and understand the components of living world, structure and functional system of plant and animal kingdom

Objectives:

Upon completion of the course the students shall be able to:

1. know the classification and salient features of five kingdoms of life
2. understand the basic components of anatomy physiology of plant
3. know understand the basic components of anatomy physiology animal with special reference to human

Course Content:

UNIT I: **[7L]**

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 mono-cotyledons & Dicotylidones.

UNIT II: **[7L]**

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 diges-tive 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 Respira-tory volumes

UNIT III: **[7L]**

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

UNIT IV: **[5L]**

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.

UNIT V: **[4L]**

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.

Recommended Books (Latest Edition):

1. S. B. Gokhale, ”A Text book of Biology”
2. Dr. Thulajappa and Dr. Seetaram, ”A Text book of Biology”

Reference Books (Latest Edition):

1. B.V. Sreenivasa Naidu, ”A Text book of Biology”
2. Naidu and Murthy, ”A Text book of Biology”
3. A.C.Dutta, ”Botany for Degree students”
4. M. Ekambaranatha ayyer and T. N. Ananthakrishnan, ”Outlines of Zoology”.
5. S.B. Gokhale and C. K. Kokate, ”A manual for pharmaceutical biology practical”

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP106RBT.1	3	1	-	-	-	2	-	-	1	1	2
BP106RBT.2	3	1	2	-	-	2	-	-	1	-	2
BP106RBT.3	3	-	3	2	-	1	-	-	-	-	3
BP106RBT.4	3	-	2	1	-	1	-	-	1	1	2
BP106RBT.5	3	1	2	-	-	-	-	-	-	-	2
BP106RBT.6	3	1	2	1	-	1	-	1	-	2	2

UNIVERSITY

Course Code	BP106RMT			
Course Title	Remedial Mathematics - Theory			
Category				
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	30			
Pre-requisites	None			

Scope:

This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform

Objectives:

Upon completion of the course the students shall be able to:

1. Know the theory and their application in Pharmacy
2. Solve the different types of problems by applying theory
3. Appreciate the important application of mathematics in Pharmacy

Course Content:

UNIT I: **[6L]**

Partial Fractions: 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 (definition) ,

UNIT II:Matrices and Determinant: **[2L]**

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

UNIT III: Calculus **[6L]**

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 xn w.r.t x,where n is any rational number, Derivative of ex,, Derivative of loge x , Derivative of ax, 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

UNIT IV:Analytical Geometry **[6L]**

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

UNIT V: **[6L]**

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP106RMT.1	-	2	3	2	2	-	-	-	-	-	2
BP106RMT.2	-	2	3	2	2	-	-	-	-	-	2
BP106RMT.3	-	1	3	2	2	-	-	-	-	-	3
BP106RMT.4	-	1	3	2	2	-	-	-	-	-	3

Course Code	BP107P			
Course Title	HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Learning Objective:

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.

Course Objective:

Upon completion of the course the students shall be able to:

1. Evaluate the working principle, handling of instruments, glasswares, equipment's required for practical.
2. Understand the significance of Bleeding time, Blotting time, Blood group detection, Haemoglobin detection and measurement of blood pressure.
3. Gain knowledge of mechanism of White Blood Cell Count and Red Blood Cell Count of blood sample.
4. Determine of heart rate, pulse rate, blood pressure.

Suggestive List of Experiments:

1. Study of compound microscope. **[1 day(s)]**
2. Microscopic study of epithelial and connective tissue **[1 day(s)]**
3. Microscopic study of muscular and nervous tissue **[1 day(s)]**
4. Identification of axial bones **[1 day(s)]**
5. Identification of appendicular bones **[1 day(s)]**
6. Introduction to hemocytometry **[1 day(s)]**

7. Enumeration of white blood cell (WBC) count **[1 day(s)]**
:

8. Enumeration of total red blood corpuscles (RBC) count **[1 day(s)]**
:

9. Determination of bleeding time **[11 day(s)]**
:

10. Determination of clotting time **[11 day(s)]**
:

11. Estimation of hemoglobin content **[1 day(s)]**
:

12. Determination of blood group **[11 day(s)]**
:

13. Determination of erythrocyte sedimentation rate (ESR). **[1 day(s)]**
:

14. Determination of heart rate and pulse rate. **[1 day(s)]**
:

15. Recording of blood pressure. **[1 day(s)]**

:

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP107P.1	3	3	-	-	2	1	-	-	-	-	2
BP107P.2	3	3	1	2	2	2	-	-	1	-	2
BP107P.3	3	3	1	2	2	2	-	-	1	-	2
BP107P.4	3	3	1	1	2	2	-	-	1	-	2

Course Code	BP108P			
Course Title	PHARMACEUTICAL ANALYSIS (Practical)			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Learning Objective:

¡¡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.¿¿

Course Objective:

Upon completion of the course the students shall be able to:

1. Understand the apparatus and glassware used in analytical chemistry

2. Know the importance of calibration in analysis of compound.

3. Understand the principle, reaction condition and factor calculation for data analysis for various volumetric methods of analysis.

4. Study the interpretation of data and computing the results.

Suggestive List of Experiments:

1. Limit Test of the following 1) Chloride 2) Sulphate; 3) Iron; 4) Arsenic **[1 day(s)]**

   .

2. Preparation and standardization of 1) Sodium hydroxide; 2) Sulphuric acid; 3) Sodium thiosulfate; 4) Potassium permanganate; 5) Ceric ammonium sulphate **[1 day(s)]**

   .

3. III Assay of the following compounds along with Standardization of Titrant (1) Ammonium chloride by acid base titration (2) Ferrous sulphate by Cerimetry (3) Copper sulphate by Iodometry (4) Calcium gluconate by complexometry (5) Hydrogen peroxide by Permanganometry (6) Sodium benzoate by non-aqueous titration (7) Sodium Chloride by precipitation titration **[1 day(s)]**

4. IV Determination of Normality by electro-analytical methods (1) Conductometric titration of strong acid against strong base (2) Conductometric titration of strong acid and weak acid against strong base (3) Potentiometric titration of strong acid against strong base **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP108P.1	3	-	-	2	-	1	-	-	-	-	-
BP108P.2	-	-	3	-	-	2	-	-	-	-	1
BP108P.3	1	-	3	2	-	-	-	-	-	-	-
BP108P.4	-	-	3	-	-	2	-	-	-	-	1

JIS UNIVERSITY

Course Code	BP109P			
Course Title	PHARMACEUTICS-I (Practical)			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Learning Objective:

¡¡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.¿¿

Course Objective:

Upon completion of the course the students shall be able to:

1. Describe the definition, advantages and disadvantages of various dosage forms.
2. Demonstrate skill in the operation of common pharmaceutical measuring, weighing and compounding devices.
3. Identify and differentiate between various solid and liquid dosage forms for oral and topical use.
4. Practice the different pharmaceutical/medical terminology, abbreviations and symbols commonly used in the prescribing, dispensing..

Suggestive List of Experiments:

1. Syrups a) Syrup IP‘66 b) Compound syrup of Ferrous Phosphate BPC‘68. **[1 day(s)]**
2. Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir **[1 day(s)]**
3. Linctus a) Terpin Hydrate Linctus IP‘66 **[1 day(s)]**
4. Solutions b) Iodine Throat Paint (Mandles Paint) a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol‘s solution **[1 day(s)]**
5. Suspensions a) Calamine lotion b) Magnesium Hydroxide mixture c) Aluminimum Hydroxide gel **[1 day(s)]**
6. Emulsions a) Turpentine Liniment b) Liquid paraffin emulsion **[1 day(s)]**

7. Powders and Granules a) ORS powder (WHO) b) Effervescent granules c)Dusting powder d)Divded powders **[1 day(s)]**

8. Suppositories a) Glycero gelatin suppository b) Coca butter suppository c) Zinc Oxide suppository **[1 day(s)]**

9. Semisolids a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopal gel **[11 day(s)]**

10. Determination of clotting time **[1 day(s)]**

11. Gargles and Mouthwashes a) Iodine gargle b) Chlorhexidine mouthwash **[1 day(s)]**

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CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP109P.1	3	-	-	-	-	1	-	-	-	-	3
BP109P.2	3	3	3	3	-	3	1	-	2	-	3
BP109P.3	3	1	1	1	-	1	1	-	3	-	3
BP109P.4	3	1	1	1	-	1	3	3	3	-	3

Course Code	BP110P			
Course Title	PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Learning Objective:

¡¡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.¿¿

Course Objective:

Upon completion of the course the students shall be able to:

1. Perform qualitative analysis of given inorganic mixtures.
2. Evaluation test of given inorganic compounds.
3. Perform limit test for chlorides, sulphates etc. Prepare inorganic compounds.

Suggestive List of Experiments:

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 **[1 day(s)]**

   .

2. Identification test Magnesium hydroxide; Ferrous sulphate; Sodium bicarbonate; Calcium gluconate; Copper sulphate **[1 day(s)]**

   .

3. Test for purity Swelling power of Bentonite; Neutralizing capacity of aluminum hydroxide gel; Determination of potassium iodate and iodine in potassium Iodide **[1 day(s)]**

   .

4. Preparation of inorganic pharmaceuticals Boric acid; Potash alum; Ferrous sulphate **[1 day(s)]**

   :

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP110P.1	3	1	2	-	-	-	-	-	-	1	3
BP110P.2	3	-	2	-	1	1	1	-	-	1	3
BP110P.3	3	1	1	-	1	-	1	-	1	1	3

Course Code	BP111P			
Course Title	COMMUNICATION SKILLS (Practical)			
Category				
LTP & Credits	L	T	P	Credits
			2	1
Total Contact Hours	30			
Pre-requisites	None			

Learning Objective:

The following learning modules are to be conducted using wordsworth® English language lab software

Course Objective:

Upon completion of the course the students shall be able to:

1. Understand the knowledge of soft skills and communication skill.
2. Understand the concept of teamwork, leadership, personal development skills.
3. Acquire the knowledge of technical writing skill.
4. Acquire the knowledge of body language and presentation skill.

Suggestive List of Experiments:

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

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CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP111P.1	0	2	1	1	2	3	-	3	-	-	2
BP111P.2	-	2	3	-	3	3	2	3	-	-	1
BP111P.3	2	1	2	1	2	3	-	1	-	-	2
BP111P.4	-	2	1	3	2	3	-	3	-	-	-

Course Code	BP112RBP			
Course Title	REMEDIAL BIOLOGY (Practical)			
Category				
LTP & Credits	L	T	P	Credits
			2	1
Total Contact Hours	30			
Pre-requisites	None			

Learning Objective:

¡¡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.¿¿

Course Objective:

Upon completion of the course the students shall be able to:

1. Study of cell and its inclusions.

2. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications.

3. Study of frog by using computer models.

4. Perform microscopic study and identification of different animal and plant.

4. Identify bones

4. Determine the blood group.

Suggestive List of Experiments:

1. Introduction to experiments in biology
   a) Study of Microscope; b) Section cutting techniques; c) Mounting and staining d) Permanent slide preparation **[1 day(s)]**
   .

2. Study of cell and its inclusions **[1 day(s)]**
   .

3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications **[1 day(s)]**

4. Detailed study of frog by using computer models **[1 day(s)]**
   .

5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower **[1 day(s)]**
   :

6. Identification of bones **[1 day(s)]**

.

7. Determination of blood group **[1 day(s)]**

.

8. Determination of blood pressure **[1 day(s)]**

.

9. Determination of tidal volume **[11 day(s)]**

.

Text/Reference Books:

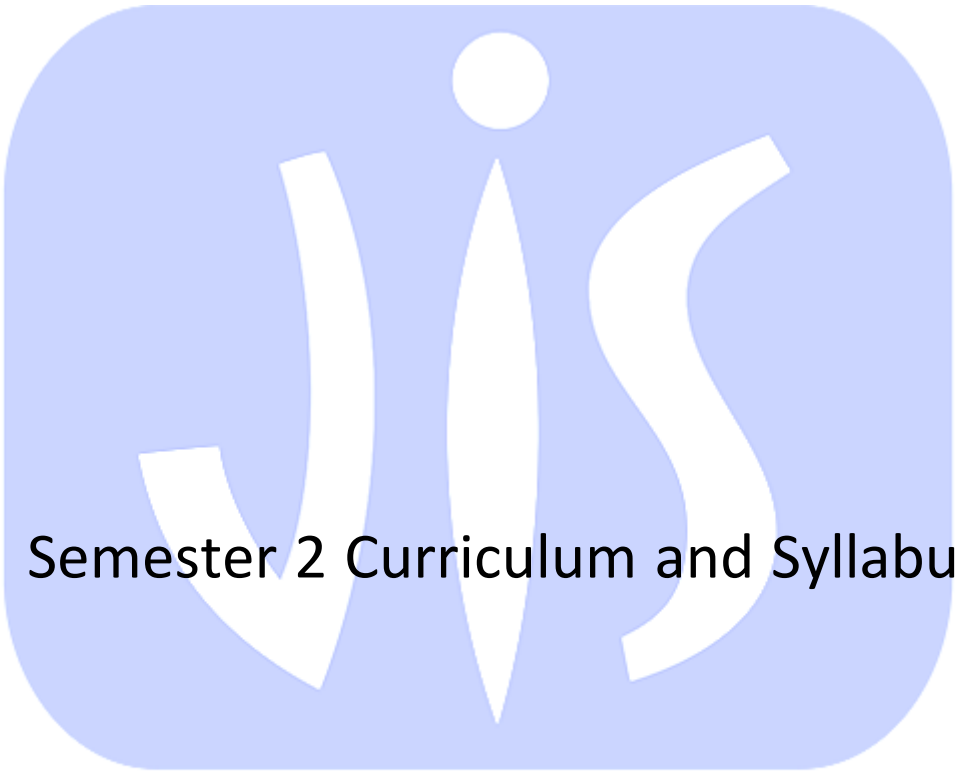
1. S.R.Kale and R.R.Kale "Practical human anatomy and physiology"

2. S.B.Gokhale, C.K.Kokate and S.P.Shriwastava "A Manual of pharmaceutical biology practical"

3. Prof .M.J.H.Shafi "Biology practical manual according to National core curriculum"Biology forum of Karnataka

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP112P.1	3	-	1	1	-	1	-	-	-	1	3
BP112P.2	3	1	1	1	-	1	-	-	-	1	2
BP112P.3	3	-	1	2	-	-	-	-	-	-	2
BP112P.4	3	-	2	1	-	1	-	-	-	-	3
BP112P.5	3	-	2	1	-	1	-	-	-	-	1
BP112P.6	3	-	2	3	-	2	-	-	-	-	3



Semester 2 Curriculum and Syllabus

UNIVERSITY

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP201T	Human Anatomy and Physiology II - Theory	3	1	0	4
2		BP202T	Pharmaceutical Organic Chemistry I - Theory	3	1	0	4
3		BP203T	Biochemistry - Theory	3	1	0	4
4		BP204T	Pathophysiology I - Theory	3	1	0	4
5		BP205T	Computer Applications in Pharmacy - Theory*	3	0	0	3
6		BP206T	Environmental Science - Theory*	3	0	0	3
PRACTICAL							
7		BP207P	Human Anatomy and Physiology II - Practical	0	0	4	2
8		BP208P	Pharm. Organic Chemistry I - Practical	0	0	4	2
9		BP209P	Biochemistry I - Practical	0	0	4	2
10		BP210P	Computer Applications in Pharmacy - Practical*	0	0	2	1
MANDATORY NON-CGPA COURSE							
11	MC	BSD281	Seminar and Group Discussion	0	0	0	1
12	MC	BSD281	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**18**	**4**	**14**	**29**

[5]

[5]***Non University Examination (NUE)**

Course Code	BP201T			
Course Title	HUMAN ANATOMY AND PHYSIOLOGY II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

Upon completion of the course the students shall be able to:

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. 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.
5. Appreciate coordinated working pattern of different organs of each system
5. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Content:

UNIT I:Nervous system **[10L]**

Introduction to human body: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization:Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization: Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues

UNIT II: **[10L]**

Integumentary system: Structure and functions of skin

Skeletal system: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

Joints: Structural and functional classification, types of joints movements and its articulation

UNIT III: **[10L]**

Body fluids and blood: Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

UNIT IV: **[8L]**

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.

Special senses:Structure and functions of eye, ear, nose and tongue and their disorders.

UNIT V: **[7L]**

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

Recommended Books (Latest Edition):

1. K. Sembulingam and P. Sembulingam “Essentials of Medical Physiology”, Jaypee brothers medical publishers, New Delhi
2. Kathleen J.W. Wilson, “Anatomy and Physiology in Health and Illness”, Churchill Livingstone, New York.
3. Best and Tailor, “Physiological basis of Medical Practice”, Williams & Wilkins Co, Riverview, MI USA.
4. Arthur C,Guyton andJohn.E. Hall., “Text book of Medical Physiology”, Miamisburg, OH, U.S.A.
5. Tortora Grabowski, “Principles of Anatomy and Physiology”, Palmetto, GA, U.S.A.

6. Inderbir Singh,"Textbook of Human Histology" Jaypee brother's medical publishers, New Delhi.

7. C.L. Ghai "Textbook of Practical Physiology" Jaypee brother's medical publishers, New Delhi.

8. K. Srinageswari and Rajeev Sharma, "Practical workbook of Human Physiology", Jaypee brother's medical publishers, New Delhi.

Reference Books (Latest Edition):

1. Best and Tailor "Physiological basis of Medical Practice", Williams & Wilkins Co, Riverview, MI USA

2. Arthur C, Guyton and John. E. Hall."Text book of Medical Physiology", Miamisburg, OH, U.S.A.

3. C.C. Chatterjee "Human Physiology (vol 1 and 2)", Academic Publishers Kolkata

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP201T.1	3	-	-	-	-	-	-	-	-	-	2
BP201T.2	3	-	-	-	-	-	-	-	-	-	2
BP201T.3	3	-	-	-	-	-	-	-	-	-	3
BP201T.4	3	-	-	-	-	-	-	-	-	-	2
BP201T.5	3	-	-	2	-	-	-	-	-	-	3

UNIVERSITY

Course Code	BP202T			
Course Title	PHARMACEUTICAL ORGANIC CHEMISTRY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Course Objective:

Upon completion of the course the students shall be able to:

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. identify/confirm the identification of organic compound

Course Content:

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

UNIT I: Classification, nomenclature and isomerism [7L]

Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds

UNIT II: Alkanes*, Alkenes* and Conjugated dienes* [10L]

SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP2 hybridization in alkenes.

E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT III: Alkyl halides* [10L]

SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.

SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions

Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform

Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT IV: Carbonyl compounds* (Aldehydes and ketones) [10L]

Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

UNIT V: ICarboxylic acids* [8L]

Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

Aliphatic amines* - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

Recommended Books (Latest Editions):

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

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP202T.1	3	-	-	-	-	-	-	-	-	-	3
BP202T.2	2	1	-	-	-	-	-	-	-	-	2
BP202T.3	-	2	1	-	-	-	-	-	-	-	-
BP202T.4	-	-	1	-	-	2	-	-	-	-	1

Course Code	BP203T			
Course Title	BIOCHEMISTRY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero autocatalytic functions of DNA

Course Objective:

Upon completion of the course the students shall be able to:

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

Course Content:

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

UNIT I: Biomolecules and Bioenergetics [8L]

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

UNIT II: [10L]

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 phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers level

UNIT III: [10L]

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

UNIT IV: Nucleic acid metabolism and genetic information transfer [10L]

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

UNIT V: Enzymes [7L]

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

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.
11. Practical Biochemistry by Harold Varley.

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP203T.1	3	-	-	-	-	-	-	-	1	-	2
BP203T.2	3	-	3	1	-	-	-	-	1	-	2
BP203T.3	3	-	3	1	-	-	-	-	1	-	2

Course Code	BP204T			
Course Title	PATHOPHYSIOLOGY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Course Objective:

Upon completion of the course the students shall be able to:

1. Describe the etiology and pathogenesis of the selected disease states;
2. Name the signs and symptoms of the diseases
3. Mention the complications of the diseases

Course Content:

UNIT I: [10L]

Basic principles of Cell injury and Adaptation:
Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage),Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia),Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis Alkalosis, Electrolyte imbalance

Basic mechanism involved in the process of inflammation and repair:
Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis

UNIT II: [10L]

Cardiovascular System:
Hypertension, congestive heart failure, ischemic heart disease (angina,myocardial infarction, atherosclerosis and arteriosclerosis)

Respiratory system:
Asthma, Chronic obstructive airways diseases.

Renal system:
Acute and chronic renal failure.

UNIT III: [10L]

Haematological Diseases:
Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia

Endocrine system:
Diabetes, thyroid diseases, disorders of sex hormones

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

Gastrointestinal system:
Peptic Ulcer

UNIT IV: [8L]

Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.

Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout

Principles of cancer: classification, etiology and pathogenesis of cancer

Diseases of bones and joints:Rheumatoid Arthritis, Osteoporosis, Gout

Principles of Cancer: Classification, etiology and pathogenesis of Cancer

UNIT V: [7L]

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;William and Wilkins, Baltimore;1991 [1990 printing].
5. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
6. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
7. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.

8. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
9. 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.

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP204T.1	3	1	2	1	-	2	2	-	1	1	3
BP204T.2	3	2	2	1	-	2	1	-	2	1	3
BP204T.3	3	1	1	1	-	2	3	-	2	2	3

UNIVERSITY

Course Code	BP205T			
Course Title	COMPUTER APPLICATIONS IN PHARMACY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	30			
Pre-requisites	None			

Scope:

This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Course Objective:

Upon completion of the course the students shall be able to:

1. know the various types of application of computers in pharmacy
2. know the various types of databases
3. know the various applications of databases in pharmacy

Course Content:

UNIT I: [6L]

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

Concept of Information Systems and Software: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project

UNIT II: [6L]

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

UNIT III: [6L]

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System

UNIT IV: [6L]

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery

UNIT V: [6L]

Computers as data analysis in Preclinical development: Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)

Recommended Books (Latest Editions):

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 Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP205T.1	1	1	3	-	2	-	-	1	-	1	1
BP205T.2	2	3	2	2	2	2	1	2	-	2	1
BP205T.3	3	2	1	2	1	2	1	2	1	-	1

UNIVERSITY

Course Code	BP206T			
Course Title	ENVIROMENTAL SCIENCES - Theory			
Category				
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	30			
Pre-requisites	None			

Scope:

Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Course Objective:

Upon completion of the course the students shall be able to:

1. Create the awareness about environmental problems among learners
2. Impart basic knowledge about the environment and its allied problems
3. Develop an attitude of concern for the environment
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

Course Content:

UNIT I: [10L]

The Multidisciplinary nature of environmental studies Natural Resources

Renewable and non-renewable resources:

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

UNIT II: [10L]

Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem.

Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III: [10L]

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest Editions):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP206T.1	2	-	3	-	-	-	1	2	2	2	-
BP206T.2	3	-	-	-	-	-	-	-	2	3	2
BP206T.3	1	2	2	-	-	-	-	1	1	3	2
BP206T.4	2	1	2	2	-	-	-	-	2	3	-
BP206T.5	-	1	-	1	-	-	-	-	-	3	3
BP206T.6	-	1	-	1	-	-	-	-	-	3	3

Course Code	BP207P			
Course Title	HUMAN ANATOMY AND PHYSIOLOGY-II (Practical)			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Learning Objective:

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.

Course Objective:

Upon completion of the course the students shall be able to:

1. get the knowledge of the integumentary and special senses using specimen, models, etc.
2. get the knowledge of the nervous system using specimen, models, etc.
3. study the endocrine system using specimen, models, etc.
4. demonstrate the general neurological examination.

Suggestive List of Experiments:

1. To study the integumentary and special senses using specimen, models, etc., **[1 day(s)]**
.
2. To study the nervous system using specimen, models, etc., **[1 day(s)]**
.
3. To study the endocrine system using specimen, models, etc **[1 day(s)]**
.
4. To demonstrate the general neurological examination **[1 day(s)]**
.
5. To demonstrate the function of olfactory nerve **[1 day(s)]**
.
6. To examine the different types of taste **[1 day(s)]**
:

7. To demonstrate the visual acuity **[1 day(s)]**

.

8. To demonstrate the reflex activity **[1 day(s)]**

.

9. Recording of body temperature **[11 day(s)]**

.

10. To demonstrate positive and negative feedback mechanism **[11 day(s)]**

.

11. Determination of tidal volume and vital capacity **[1 day(s)]**

.

12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens. **[11 day(s)]**

.

13. Recording of basal mass index **[1 day(s)]**

.

14. Study of family planning devices and pregnancy diagnosis test. **[1 day(s)]**

.

15. Demonstration of total blood count by cell analyser. **[1 day(s)]**

.

16. Permanent slides of vital organs and gonads. **[1 day(s)]**

.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP207P.1	3	-	-	-	-	-	-	-	-	-	2
BP207P.2	3	-	-	-	-	-	-	-	-	-	2
BP207P.3	3	-	-	-	-	-	-	-	-	-	2
BP207P.4	3	-	-	-	-	-	-	-	-	-	2

Course Code	BP208P			
Course Title	PHARMACEUTICAL ORGANIC CHEMISTRY - Practical			
Category				
LTP & Credits	L	T	P	Credits
	0	0	4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. Detect elements like Nitrogen, Sulphur and Halogen.
2. perform solubility test.
3. test different functional groups.
4. Evaluate the melting point/Boiling point of organic compounds.
5. Identify the unknown compound.

Suggestive List of Experiments:

1. Systematic qualitative analysis of unknown organic compounds like **[1 day(s)]**

   (a) Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.

   (b) Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test

   (c) Solubility test

   (d) Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.

   (e) Melting point/Boiling point of organic compounds

   (f) Identification of the unknown compound from the literature using melting point/ boiling point.

   (g) Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.

   (h) Minimum 5 unknown organic compounds to be analysed systematically.

2. Preparation of suitable solid derivatives from organic compounds **[1 day(s)]**

3. Construction of molecular models **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP208P.1	2	-	1	-	-	-	-	-	-	-	-
BP208P.2	2	-	1	-	-	-	-	-	-	-	-
BP208P.3	-	2	1	-	-	1	-	-	-	-	-
BP208P.4	-	2	1	-	1	-	-	-	-	-	2
BP208P.5	3	-	2	-	-	1	-	-	-	-	-

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Course Code	BP209P			
Course Title	BIOCHEMISTRY - Practical			
Category				
LTP & Credits	L	T	P	Credits
	0	0	4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. evaluate qualitative and quantitative analysis of carbohydrates.
2. identify the proteins in the given sample.
3. demonstrate the qualitative analysis of urine for abnormal constituents.
4. prepare the buffer solution.
5. estimate the blood creatinine, blood sugar and serum total cholesterol.

Suggestive List of Experiments:

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch) **[1 day(s)]**
2. Identification tests for Proteins (albumin and Casein) **[1 day(s)]**
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method) **[1 day(s)]**
4. Qualitative analysis of urine for abnormal constituents **[1 day(s)]**
5. Determination of blood creatinine **[1 day(s)]**
6. Determination of blood sugar **[1 day(s)]**
7. Determination of serum total cholesterol **[1 day(s)]**
8. Preparation of buffer solution and measurement of pH **[1 day(s)]**
9. Study of enzymatic hydrolysis of starch **[1 day(s)]**

10. Determination of Salivary amylase activity **[1 day(s)]**

11. Study the effect of Temperature on Salivary amylase activity **[1 day(s)]**

12. Study the effect of substrate concentration on salivary amylase activity. **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP209P.1	3	-	2	3	-	1	-	-	1	-	3
BP209P.2	3	-	2	3	-	1	-	-	1	-	3
BP209P.3	3	-	2	3	-	1	-	-	1	-	3
BP209P.4	3	-	2	3	-	1	-	-	1	-	3
BP209P.5	3	-	2	3	-	1	-	-	1	-	3

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Course Code	BP210P			
Course Title	COMPUTER APPLICATIONS IN PHARMACY - Practical			
Category				
LTP & Credits	L	T	P	Credits
	0	0	2	1
Total Contact Hours	30			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. Create a HTML web page to show personal information.
2. Retrieve the information of a drug and its adverse effects using online tools.
3. Create mailing labels Using Label Wizard , generating label in MS WORD.
4. Create a database in MS Access to store the patient information with the required fields Using access.

Suggestive List of Experiments:

1. Design a questionnaire using a word processing package to gather information about a particular disease. **[1 day(s)]**
2. Create a HTML web page to show personal information. **[1 day(s)]**
3. Retrieve the information of a drug and its adverse effects using online tools **[1 day(s)]**
4. Creating mailing labels Using Label Wizard, generating label in MS WORD **[1 day(s)]**
5. Create a database in MS Access to store the patient information with the required fields Using access **[1 day(s)]**
6. Design a form in MS Access to view, add, delete and modify the patient record in the database **[1 day(s)]**
7. Generating report and printing the report from patient database **[1 day(s)]**
8. Creating invoice table using – MS Access **[1 day(s)]**
9. Drug information storage and retrieval using MS Access **[1 day(s)]**

10. Creating and working with queries in MS Access **[1 day(s)]**

11. Exporting Tables, Queries, Forms and Reports to web pages **[1 day(s)]**

12. Exporting Tables, Queries, Forms and Reports to XML pages **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP210P.1	-	-	2	2	2	3	-	1	-	-	-
BP210P.2	-	1	-	-	-	1	2	1	2	1	-
BP210P.3	2	3	1	2	2	1	-	1	1	-	-
BP210P.4	2	3	1	2	2	1	-	1	1	-	-

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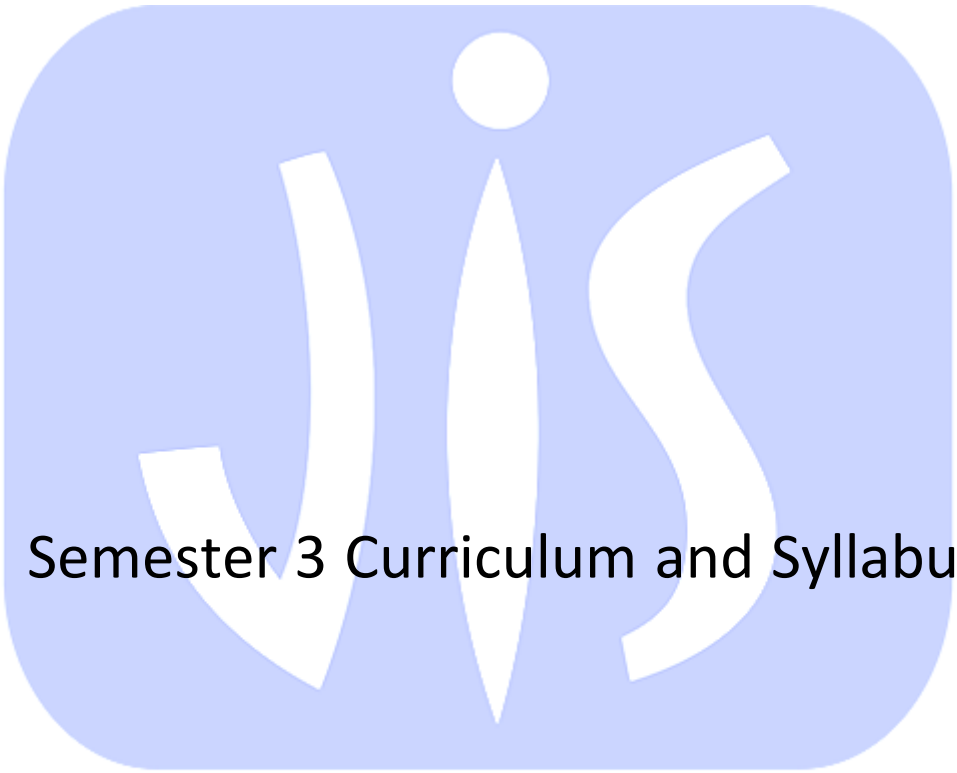

Semester 3 Curriculum and Syllabus

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SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	0	4
2		BP302T	Physical Pharmaceutics I – Theory	3	1	0	4
3		BP303T	Pharmaceutical Microbiology – Theory	3	1	0	4
4		BP304T	Pharmaceutical Engineering – Theory	3	1	0	4
PRACTICAL							
5		BP305P	Pharmaceutical Organic Chemistry II – Practical	0	0	4	2
6		BP306P	Physical Pharmaceutics I – Practical	0	0	4	2
7		BP307P	Pharmaceutical Microbiology – Practical	0	0	4	2
8		BP308P	Pharmaceutical Engineering – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
9		BSD381	Seminar and Group Discussion	0	0	0	1
10		BSD382	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**12**	**4**	**16**	**24**

Course Code	BP301T			
Course Title	PHARMACEUTICAL ORGANIC CHEMISTRY II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives:

Upon completion of the course the students shall be able to:

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds
4. prepare organic compounds

Course Content:

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

UNIT I: Benzene and its derivatives **[10L]**

A Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule

B Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.

C Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction

D Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II: **[10L]**

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.

UNIT III:Fats and Oils **[10L]**

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.

UNIT IV:Polynuclear Hydrocarbons **[8L]**

Synthesis, reactions

Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.

UNIT V:Cyclo alkanes* **[7L]**

Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only

Recommended Books (Latest Edition):

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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP301T.1	3	2	1	-	-	2	-	-	-	-	3
BP301T.2	3	2	2	-	-	2	-	-	-	-	3
BP301T.3	3	2	1	-	1	2	-	-	-	-	3
BP301T.4	3	2	1	-	1	2	-	-	-	-	3
BP301T.5	3	1	1	-	-	2	-	-	-	-	3
BP301T.6	3	1	1	-	-	2	-	-	-	-	3

UNIVERSITY

Course Code	BP302T			
Course Title	PHYSICAL PHARMACEUTICS-I Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms

Objectives:

Upon completion of the course the students shall be able to:

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT I: Solubility of drugs **[10L]**

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

UNIT II: **[10L]**

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

UNIT III:Surface and interfacial phenomenon [10L]

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.

UNIT IV:Complexation and protein binding [8L]

Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants

UNIT V:pH, buffers and Isotonic solutions [7L]

Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

Recommended Books (Latest Edition):

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP302T.1	3	-	2	1	-	-	-	-	1	-	1
BP302T.2	3	-	2	1	-	-	-	-	1	-	1
BP302T.3	3	-	2	1	-	-	-	-	1	-	1

Course Code	BP303T			
Course Title	PHARMACEUTICAL MICROBIOLOGY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc

Objectives:

Upon completion of the course the students shall be able to:

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. Understand the importance and implementation of sterilization in pharmaceutical processing and industry
3. Learn sterility testing of pharmaceutical products
4. Carried out microbiological standardization of Pharmaceuticals
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course Content:

UNIT I: **[10L]**

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.

UNIT II: **[10L]**

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.

Equipment employed in large scale sterilization. Sterility indicators

UNIT III: [10L]

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.

UNIT IV: [8L]

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

UNIT V: [7L]

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research

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. I.P., B.P., U.S.P.- latest editions.

10. Ananthnarayan : Text Book of Microbiology,Orient-Longman, Chennai

11. Edward: Fundamentals of Microbiology.

12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi

13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP303T.1	2	-	2	3	-	-	-	-	-	-	1
BP303T.2	2	-	2	3	-	-	-	-	-	-	1
BP303T.3	2	-	2	3	-	-	-	-	1	1	1
BP303T.4	2	-	2	3	-	-	-	-	1	1	1
BP303T.5	2	-	2	3	-	-	-	-	1	1	1

Course Code	BP304T			
Course Title	PHARMACEUTICAL ENGINEERING - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry

Objectives:

Upon completion of the course the students shall be able to:

1. To know various unit operations used in Pharmaceutical industries
2. To understand the material handling techniques
3. To perform various processes involved in pharmaceutical manufacturing process
4. To carry out various test to prevent environmental pollution
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries

Course Content:

UNIT I: [10L]

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.

UNIT II: [10L]

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

UNIT III: [10L]

Drying: Objectives, applications mechanism of drying process, measurements applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

Mixing: Objectives, applications factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles Silverson Emulsifier,

UNIT IV: [8L]

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.

UNIT V: [7L]

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 Edition):

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP304T.1	2	-	-	3	-	-	-	-	-	-	-
BP304T.2	2	-	-	3	-	-	-	-	-	-	-
BP304T.3	2	-	-	3	-	-	-	-	-	-	-
BP304T.4	2	-	-	3	-	-	-	-	-	-	-
BP304T.5	2	-	-	3	-	-	-	-	-	-	-
BP304T.6	-	-	2	3	-	-	-	-	-	2	-

Course Code	BP305P			
Course Title	PHARMACEUTICAL ORGANIC CHEMISTRY II -Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. Perform experiments like recrystallization, steam distillation.
2. Determine oil values of different compounds.
3. Synthesize different compounds.

Suggestive List of Experiments:

I Experiments involving laboratory techniques **[1 day(s)]**

1. Recrystallization
2. Steam distillation

II Determination of following oil values (including standardization of reagents) **[1 day(s)]**

3. Acid value
4. Saponification Value
5. Iodine Value

III Preparation of compounds **[1 day(s)]**

6. Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
7. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline
8. Acetanilide by halogenation (Bromination) reaction.
9. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
10. Benzoic acid from Benzyl chloride by oxidation reaction.
11. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
12. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.

13. Benzil from Benzoin by oxidation reaction.

14. Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction

15. Cinnammic acid from Benzaldehyde by Perkin reaction

16. Para Iodo benzoic acid from Para-amino benzoic acid

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP305P.1	3	1	2	3	-	1	-	-	-	-	3
BP305P.2	3	1	2	2	-	1	-	-	-	-	3
BP305P.1	3	1	2	3	-	1	-	-	-	-	3

UNIVERSITY

Course Code	BP306P			
Course Title	PHYSICAL PHARMACEUTICS I - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. determine the solubility of drug
2. evaluate the pKa value and partition co-efficient
3. determine particle size distribution, bulk density, true density and porosity
4. demonstrate the determination of angle of repose and stability constant

Suggestive List of Experiments:

1. Determination the solubility of drug at room temperature **[1 day(s)]**
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation. **[1 day(s)]**
3. Determination of Partition co- efficient of benzoic acid in benzene and water **[1 day(s)]**
4. Determination of Partition co- efficient of Iodine in CCl4 and water **[1 day(s)]**
5. Determination of percentage composition of NaCl in a solution using phenol-water system by CST method **[1 day(s)]**
6. Determination of surface tension of given liquids by drop count and drop weight method **[1 day(s)]**
7. Determination of HLB number of a surfactant by saponification method **[1 day(s)]**
8. Determination of Freundlich and Langmuir constants using activated char coal **[1 day(s)]**
9. Determination of critical micellar concentration of surfactants **[1 day(s)]**
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method **[1 day(s)]**
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP306P.1	1	-	3	2	-	-	-	-	-	-	-
BP306P.2	1	-	3	2	-	-	-	-	-	-	1
BP306P.1	1	-	2	3	-	-	-	-	-	-	-

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Course Code	BP307P			
Course Title	PHARMACEUTICAL MICROBIOLOGY - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. learn Sterilization of glassware, preparation and sterilization of media
2. Perform sub culturing of bacteria and fungus.
3. Prepare nutrient stabs and slants.
4. Demonstrate the different staining methods
5. Isolate pure culture of micro-organisms
6. Perform microbiological assay of antibiotics

Suggestive List of Experiments:

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, micro-scopes used in experimental microbiology. **[1 day(s)]**
2. Sterilization of glassware, preparation and sterilization of media. **[1 day(s)]**
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations. **[1 day(s)]**
4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical). **[1 day(s)]**
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques. **[1 day(s)]**
6. Microbiological assay of antibiotics by cup plate method and other methods **[1 day(s)]**
7. Motility determination by Hanging drop method **[1 day(s)]**
8. Sterility testing of pharmaceuticals **[1 day(s)]**
9. Bacteriological analysis of water **[1 day(s)]**
10. Biochemical test **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP307P.1	1	3	3	1	-	-	-	-	-	-	1
BP307P.2	2	1	-	-	-	-	-	-	-	-	-
BP307P.3	1	-	-	-	-	-	-	-	-	-	-
BP307P.4	2	-	-	-	-	-	-	-	-	-	-
BP307P.5	3	-	-	-	-	-	-	-	-	-	-
BP307P.6	3	2	2	2	-	-	-	-	-	-	2

UNIVERSITY

Course Code	BP308P			
Course Title	PHARMACEUTICAL ENGINEERING - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. understand the basic principles involved in unit operations such as size reduction, size separation, distillation and drying
2. demonstrate and explain about the construction, working and applications of pharmaceutical equipments such as colloid mill, planetary mixer, fluidized bed dryer and freeze dryer.
3. experiment with the process variables of filtration, evaporation and infer the same and determine radiation constant of brass, iron, unpainted and painted glass
4. determine overall heat transfer coefficient by heat exchanger and calculate the efficiency of steam distillation
5. estimate moisture content, loss on drying and construct drying curves for calcium carbonate and starch

Suggestive List of Experiments:

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

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. **[1 day(s)]**

10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment. **[1 day(s)]**

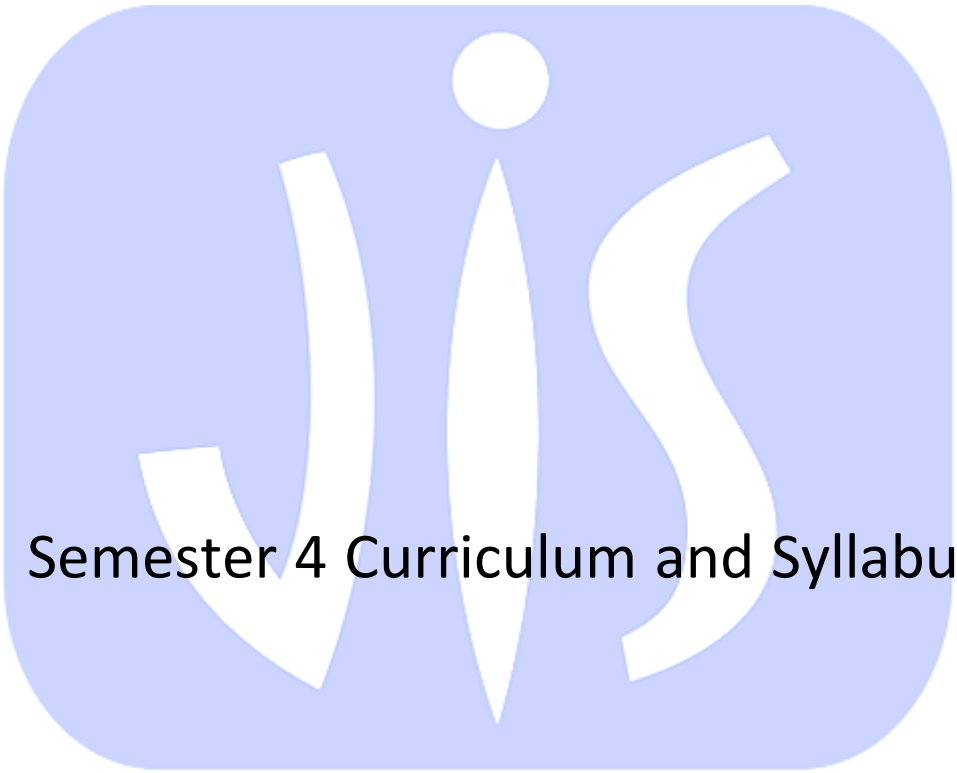
11. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity **[1 day(s)]**

12. To study the effect of time on the Rate of Crystallization **[1 day(s)]**

13. To calculate the uniformity Index for given sample by using Double Cone Blender **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP308P.1	2	-	-	3	-	-	-	-	-	-	-
BP308P.2	2	-	-	3	-	-	-	-	-	-	-
BP308P.3	2	-	-	3	-	-	-	-	-	-	-
BP308P.4	2	-	-	3	-	-	-	-	-	-	-
BP308P.5	2	-	-	3	-	-	-	-	-	-	-



Semester 4 Curriculum and Syllabus

UNIVERSITY

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	0	4
2		BP402T	Medicinal Chemistry I – Theory	3	1	0	4
3		BP403T	Physical Pharmaceutics II – Theory	3	1	0	4
4		BP404T	Pharmacology I – Theory	3	1	0	4
5		BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	0	4
PRACTICAL							
6		BP406P	Medicinal Chemistry I – Practical	0	0	4	2
7		BP407P	Physical Pharmaceutics II – Practical	0	0	4	2
8		BP408P	Pharmacology I – Practical	0	0	4	2
9		BP409P	Pharmacognosy and Phytochemistry I – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
10	MC	BSD481	Seminar and Group Discussion	0	0	0	1
11	MC	BSD482	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**15**	**5**	**16**	**28**

Course Code	BP401T			
Course Title	Pharmaceutical Organic Chemistry III - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Course Objective:

Upon completion of the course the students shall be able to:

1. understand the methods of preparation and properties of organic compounds
2. explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. know the medicinal uses and other applications of organic compounds

Course Content:

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

UNIT I: Stereo isomerism [10L]

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

UNIT II: Geometrical Isomerism [10L]

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

UNIT III: Heterocyclic Compounds [10L]

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

UNIT IV:) [8L]

Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole; Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT V:Reactions of synthetic importance [7L]

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 by Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry by Morrison and Boyd
5. Heterocyclic Chemistry by T L Gilchrist

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP401T.1	1	-	3	2	-	-	-	-	-	-	-
BP401T.2	1	-	2	3	-	-	-	-	-	-	-
BP401T.3	1	-	3	2	-	-	-	-	-	-	-

Course Code	BP402T			
Course Title	MEDICINAL CHEMISTRY – I Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Course Objective:

Upon completion of the course the students shall be able to:

1. understand the chemistry of drugs with respect to their pharmacological activity
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. know the Structural Activity Relationship (SAR) of different class of drugs
4. write the chemical synthesis of some drugs

Course Content:

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 (*)

UNIT I: Introduction to Medicinal Chemistry [10L]

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.

UNIT II: [10L]

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.

UNIT III: [10L]

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.

UNIT IV: Drugs acting on Central Nervous System) [8L]

A. 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

Miscellaneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde their derivatives: Triclofos sodium, Paraldehyde.

B. 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

UNIT V: Drugs acting on Central Nervous System [7L]

General anesthetics: Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Recommended Books (Latest Editions):

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

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP402T.1	3	-	1	-	-	-	-	-	-	-	1
BP402T.2	3	-	-	-	-	-	-	-	-	-	-
BP402T.3	3	-	3	-	-	-	-	-	-	-	-
BP402T.3	3	-	-	-	-	-	-	-	-	-	-

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Course Code	BP403T			
Course Title	PHYSICAL PHARMACEUTICS II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Course Objective:

Upon completion of the course the students shall be able to:

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT I: [7L]

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

UNIT II: [10L]

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

UNIT III: [7L]

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.

UNIT IV: [10L]

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.

UNIT V: [10L]

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

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. Remington's Pharmaceutical Sciences
6. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
7. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1,2, 3. Marcel Dekkar Inc.
8. Physical Pharmaceutics by Ramasamy C, and Manavalan R

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP403T.1	3	-	2	1	-	-	-	-	1	-	1
BP403T.2	3	-	2	1	-	-	-	-	1	-	1
BP403T.3	3	-	2	1	-	-	-	-	1	-	1

Course Code	BP404T			
Course Title	PHARMACOLOGY I - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Course Objective:

Upon completion of the course the students shall be able to:

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences

Course Content:

UNIT I: 1. General Pharmacology [8L]

a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT II: General Pharmacology [12L]

a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

b. Adverse drug reactions

c. Drug interactions (pharmacokinetic and pharmacodynamic)

d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, pre-clinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance

UNIT III: 2. Pharmacology of drugs acting on peripheral nervous system [10L]

a. Organization and function of ANS.

b. Neurohumoral transmission,co-transmission and classification of neurotransmitters.

c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).

e. Local anesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma

UNIT IV: 3. Pharmacology of drugs acting on central nervous system [8L]

a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.

b. General anesthetics and pre-anesthetics.

c. Sedatives, hypnotics and centrally acting muscle relaxants.

d. Anti-epileptics

e. Alcohols and disulfiram

UNIT V: 3. Pharmacology of drugs acting on central nervous system [7L]

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.

b. Drugs used in Parkinsons disease and Alzheimer's disease.

c. CNS stimulants and nootropics.

d. Opioid analgesics and antagonists

e. Drug addiction, drug abuse, tolerance and dependence.

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. VallabhPrakashan,

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP404T.1	3	-	2	1	-	-	-	-	-	-	-
BP404T.2	3	-	2	1	-	-	-	-	-	-	-
BP404T.3	3	-	2	1	-	-	-	-	-	-	-
BP404T.4	2	-	1	3	-	-	-	-	-	-	-
BP404T.5	2	-	3	1	-	-	-	-	-	-	-

Course Code	BP405T			
Course Title	PHARMACOGNOSY AND PHYTOCHEMISTRY I - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties

Course Objective:

Upon completion of the course the students shall be able to:

1. know the techniques in the cultivation and production of crude drugs
2. know the crude drugs, their uses and chemical nature
3. know the evaluation techniques for the herbal drugs
4. carry out the microscopic and morphological evaluation of crude drugs

Course Content:

UNIT I: [10L]

Introduction to Pharmacognosy: 1. Definition, history, scope and development of Pharmacognosy 2. Sources of Drugs – Plants, Animals, Marine Tissue culture 3. Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf-constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT II: [10L]

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT III: [7L]

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

UNIT IV: [10L]

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT V: [8L]

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 Primary metabolites:

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

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 by M.A. Iyengar

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP405T.1	3	-	-	-	-	-	-	-	-	-	2
BP405T.2	3	-	-	-	-	-	-	-	-	-	2
BP405T.3	3	-	-	2	-	1	-	-	-	-	-
BP405T.4	3	-	-	2	-	-	-	-	-	2	-
BP405T.5	3	-	-	-	-	-	-	-	-	-	2

Course Code	BP406P			
Course Title	MEDICINAL CHEMISTRY I - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. synthesize and recrystalize drugs/ intermediates
2. perform assay of selected drugs
3. determine the partition coefficient of selected drugs

Suggestive List of Experiments:

1. Preparation of drugs/ intermediates **[1 day(s)]**

   (a) 1,3-pyrazole
   (b) 1,3-oxazole
   (c) Benzimidazole
   (d) Benztriazole
   (e) 2,3- diphenyl quinoxaline
   (f) Benzocaine
   (g) Phenytoin
   (h) Phenothiazine
   (i) Barbiturate

2. Assay of drugs **[1 day(s)]**

   (a) Chlorpromazine
   (b) Phenobarbitone
   (c) Atropine
   (d) Ibuprofen
   (e) Aspirin
   (f) Furosemide

3. Determination of Partition coefficient for any two drugs **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP406P.1	3	3	2	1	-	-	-	-	-	-	1
BP406P.2	3	3	2	1	-	-	-	-	-	-	1
BP406P.3	3	3	-	1	-	-	-	-	-	-	1

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Course Code	BP407P			
Course Title	PHYSICAL PHARMACEUTICS II - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. Determine the particle size, particle size distribution
2. Evaluate bulk density, true density, porosity
3. Perform test of viscosity of liquid
4. Determine the sedimentation volume
5. Evaluate the reaction rate

Suggestive List of Experiments:

1. Determination of particle size, particle size distribution using sieving method **[1 day(s)]**
2. Determination of particle size, particle size distribution using Microscopic method **[1 day(s)]**
3. Determination of bulk density, true density and porosity **[1 day(s)]**
4. Determine the angle of repose and influence of lubricant on angle of repose **[1 day(s)]**
5. Determination of viscosity of liquid using Ostwald's viscometer **[1 day(s)]**
6. Determination sedimentation volume with effect of different suspending agent **[1 day(s)]**
7. Determination sedimentation volume with effect of different concentration of single suspending agent **[1 day(s)]**
8. Determination of viscosity of semisolid by using Brookfield viscometer **[1 day(s)]**
9. Determination of reaction rate constant first order **[1 day(s)]**

10. Determination of reaction rate constant second order **[1 day(s)]**

11. Accelerated stability studies **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP407P.1	1	-	2	3	-	-	-	-	-	-	-
BP407P.2	2	-	3	1	-	-	-	-	-	-	-
BP407P.3	3	-	2	1	-	-	-	-	-	-	-
BP407P.4	2	-	3	1	-	-	-	-	-	-	-
BP407P.5	3	-	1	2	-	-	-	-	-	-	-

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Course Code	BP408P			
Course Title	PHARMACOLOGY I - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. Study the commonly used instruments in experimental pharmacology.
2. Study of common laboratory animals
3. Know the maintenance of laboratory animals as per CPCSEA guidelines.
4. Evaluate the common laboratory techniques.
5. Study different routes of drugs administration in mice/rats.

Suggestive List of Experiments:

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

1. Introduction to experimental pharmacology **[1 day(s)]**
2. Commonly used instruments in experimental pharmacology **[1 day(s)]**
3. Study of common laboratory animals **[1 day(s)]**
4. Maintenance of laboratory animals as per CPCSEA guidelines **[1 day(s)]**
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies **[1 day(s)]**
6. Study of different routes of drugs administration in mice/rats **[1 day(s)]**
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice **[1 day(s)]**
8. Effect of drugs on ciliary motility of frog oesophagus **[1 day(s)]**

9. Effect of drugs on rabbit eye **[1 day(s)]**

10. Effects of skeletal muscle relaxants using rota-rod apparatus **[1 day(s)]**

11. Effect of drugs on locomotor activity using actophotometer **[1 day(s)]**

12. Anticonvulsant effect of drugs by MES and PTZ method **[1 day(s)]**

13. Study of stereotype and anti-catatonic activity of drugs on rats/mice **[1 day(s)]**

14. Study of anxiolytic activity of drugs using rats/mice **[1 day(s)]**

15. Study of local anesthetics by different methods **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP408P.1	3	-	-	2	1	1	-	-	-	-	3
BP408P.2	3	-	1	1	1	1	2	-	-	-	2
BP408P.3	3	-	-	-	-	1	3	-	-	2	1
BP408P.4	3	2	1	1	1	-	-	-	-	-	2
BP408P.5	3	3	2	2	1	3	-	-	-	-	-

Course Code	BP409P			
Course Title	PHARMACOGNOSY AND PHYTOCHEMISTRY I - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. remember different morphological and microscopical characteristic features of crude drugs
2. understand the cellular structure of crude drugs
3. evaluate the crude drugs by quantitative evaluation methods
4. illustrate various physical and chemical methods of crude drugs.

Suggestive List of Experiments:

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP409P.1	3	-	-	2	1	1	-	-	-	-	3
BP409P.2	3	-	1	1	1	1	2	-	-	-	2
BP409P.3	3	-	-	-	-	1	3	-	-	2	1
BP409P.4	3	2	1	1	1	-	-	-	-	-	2
BP409P.5	3	3	2	2	1	3	-	-	-	-	-

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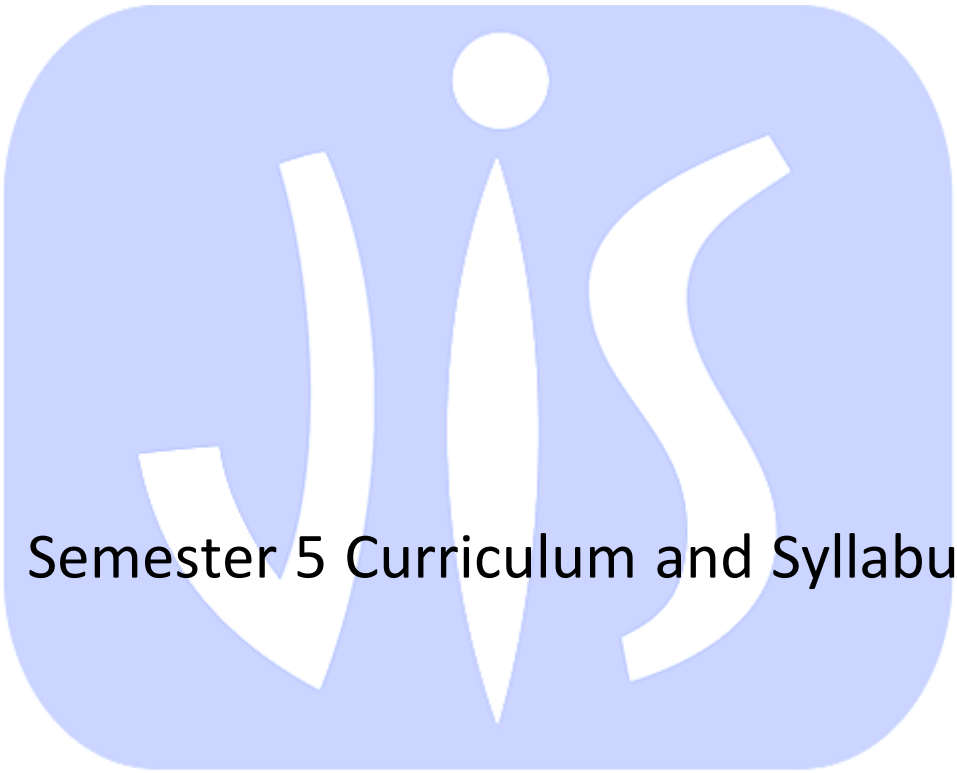

Semester 5 Curriculum and Syllabus

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SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP501T	Medicinal Chemistry II – Theory	3	1	0	4
2		BP502T	Industrial Pharmacy I– Theory	3	1	0	4
3		BP503T	Pharmacology II – Theory	3	1	0	4
4		BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	0	4
5		BP505T	Pharmaceutical Jurisprudence – Theory	3	1	0	4
PRACTICAL							
6		BP506P	Industrial Pharmacy I – Practical	0	0	4	2
7		BP507P	Pharmacology II – Practical	0	0	4	2
8		BP508P	Pharmacognosy and Phytochemistry II – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
9	MC	BSD581	Seminar and Group Discussion	0	0	0	1
10	MC	BSD582	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**15**	**5**	**12**	**26**

Course Code	BP501T			
Course Title	MEDICINAL CHEMISTRY II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives:

Upon completion of the course the student shall be able to

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

Course Content:

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 (*)

UNIT I: **[10L]**

Antihistaminic agents: Histamine, receptors and their distribution in the human body

H1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H2-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.

UNIT II: **[10L]**

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.

Calcium channel 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 hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT III: **[10L]**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol

Coagulant and Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

UNIT IV: **[8L]**

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.

UNIT V: **[7L]**

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 Edition):

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP501T.1	2	-	3	-	-	-	-	-	-	-	2
BP501T.2	3	-	1	2	-	-	-	-	-	-	-
BP501T.3	-	-	2	3	-	-	-	-	-	-	1
BP501T.4	1	-	2	3	-	-	-	-	-	-	-

Course Code	BP502T			
Course Title	Industrial Pharmacy I - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

Objectives:

Upon completion of the course the student shall be able to

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course Content:

UNIT I: Preformulation Studies: **[7L]**

Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances.

a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization

BCS classification of drugs its significant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

UNIT II: **[10L]**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling.

b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

c. 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

UNIT III: **[8L]**

Capsules:

a. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.

b. Soft gelatin capsules: Nature of shell and capsule content, size of capsules,importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.

Pellets:

Introduction, formulation requirements, pelletization process, equipment for manufacture of pellets

UNIT IV: **[10L]**

Parenteral Products:

a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity

b. Production procedure, production facilities and controls, aseptic processing

c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products.

d. 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

UNIT V: **[10L]**

Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

Recommended Books (Latest Edition):

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman and J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1 and 2 by Liberman and Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman and Lachman
4. Modern Pharmaceutics by Gilbert S. Banker and C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman and 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 and Febiger, Philadelphia, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen and C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP502T.1	3	-	-	-	-	2	-	-	-	-	1
BP502T.2	3	-	-	-	-	2	-	-	1	-	-
BP502T.3	3	-	-	-	-	1	-	-	-	-	2

Course Code	BP503T			
Course Title	PHARMACOLOGY II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition,emphasis on the basic concepts of bioassay.

Objectives:

Upon completion of the course the student shall be able to

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course Content:

UNIT I: Pharmacology of drugs acting on cardio vascular system [10L]

a. Introduction to hemodynamic and electrophysiology of heart.
b. Drugs used in congestive heart failure
c. Anti-hypertensive drugs.
d. Anti-anginal drugs.
e. Anti-arrhythmic drugs.
f. Anti-hyperlipidemic drugs.

UNIT II: Pharmacology of drugs acting on cardio vascular system [10L]

a. Drug used in the therapy of shock.
b. Hematinics, coagulants and anticoagulants.
c. Fibrinolytics and anti-platelet drugs
d. Plasma volume expanders
2. Pharmacology of drugs acting on urinary system

a. Diuretics

b. Anti-diuretics.

UNIT III:Autocoids and related drugs **[10L]**

a. Introduction to autacoids and classification

b. Histamine, 5-HT and their antagonists.

c. Prostaglandins, Thromboxanes and Leukotrienes.

d. Angiotensin, Bradykinin and Substance P.

e. Non-steroidal anti-inflammatory agents

f. Anti-gout drugs

g. Antirheumatic drugs

UNIT IV:Pharmacology of drugs acting on endocrine system **[8L]**

a. Basic concepts in endocrine pharmacology.

b. Anterior Pituitary hormones- analogues and their inhibitors.

c. Thyroid hormones- analogues and their inhibitors.

d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.

d. Insulin, Oral Hypoglycemic agents and glucagon.

e. ACTH and corticosteroids.

UNIT V: Pharmacology of drugs acting on endocrine system **[7L]**

a. Androgens and Anabolic steroids.

b. Estrogens, progesterone and oral contraceptives.

c. Drugs acting on the uterus.

6. Bioassay

a. Principles and applications of bioassay.

b.Types of bioassay

c. Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine,digitalis, histamine and 5-HT

Recommended Books (Latest Edition):

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 and 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 and Robert.

9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton and Company, Kolkata.

10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP503T.1	3	1	-	-	-	-	-	-	-	-	-
BP503T.2	-	-	-	-	-	-	-	-	-	-	3
BP503T.3	3	1	-	-	-	-	-	-	-	-	-
BP503T.4	2	-	-	3	-	-	-	-	-	-	-

UNIVERSITY

Course Code	BP504T			
Course Title	PHARMACOGNOSY AND PHYTOCHEMISTRY II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

Objectives:

Upon completion of the course, the student shall be able

1. To know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
2. To understand the preparation and development of herbal formulation.
3. To understand the herbal drug interactions
4. To carryout isolation and identification of phytoconstituents

Course Content:

UNIT I: Metabolic pathways in higher plants and their determination [7L]

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.

b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT II: [14L]

General introduction, composition, chemistry and 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 and 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 and Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT III:Isolation, Identification and Analysis of Phytoconstituents [6L]

a) Terpenoids: Menthol, Citral, Artemisin

b) Glycosides: Glycyrhetinic acid and Rutin

c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine

d) Resins: Podophyllotoxin, Curcumin

UNIT IV: [10L]

Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT V:Basics of Phytochemistry [8L]

Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

Recommended Books (Latest Edition):

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders and Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers and 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 and 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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP504T.1	3	-	-	-	-	-	-	-	-	-	2
BP504T.2	3	-	-	-	-	-	-	-	-	-	2
BP504T.3	3	-	-	-	-	-	-	-	-	-	2
BP504T.4	2	-	-	3	-	-	-	-	-	-	-

UNIVERSITY

Course Code	BP505T			
Course Title	PHARMACEUTICAL JURISPRUDENCE - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.

Objectives:

Upon completion of the course, the student shall be able to understand:

1. recall the Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals
2. understand Various Indian pharmaceutical Acts and Laws
3. Understand the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. Understand the code of ethics during the pharmaceutical practice

Course Content:

UNIT I: Drugs and Cosmetics Act, 1940 and its rules 1945: [10L]

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.

UNIT II:Drugs and Cosmetics Act, 1940 and its rules 1945 [10L]

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F and DMR (OA)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties

Labeling and 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

UNIT III: **[10L]**

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 and Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic and 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

UNIT IV: **[8L]**

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)

UNIT V: **[7L]**

Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

Code of Pharmaceutical ethics : Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

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 by Government. Reference books (Theory)

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP504T.1	2	-	-	-	-	1	3	-	-	-	-
BP504T.2	2	-	-	-	-	1	3	-	-	-	-
BP504T.3	2	-	-	-	-	1	3	-	-	-	-
BP504T.4	2	-	-	-	-	1	3	-	-	-	-

UNIVERSITY

Course Code	BP506P			
Course Title	INDUSTRIAL PHARMACY I -Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. erform the preformulation studies of drug
2. Prepare and evaluate some tablets
3. Prepare and evaluate some capsules
4. Prepare and evaluate some injections
5. Perform the Quality control test

Suggestive List of Experiments:

1. Preformulation studies on paracetamol/asparin/or any other drug **[1 day(s)]**
2. Preparation and evaluation of Paracetamol tablets **[1 day(s)]**
3. Preparation and evaluation of Aspirin tablets **[1 day(s)]**
4. Coating of tablets- film coating of tables/granules **[1 day(s)]**
5. Preparation and evaluation of Tetracycline capsules **[1 day(s)]**
6. Preparation of Calcium Gluconate injection **[1 day(s)]**
7. Preparation of Ascorbic Acid injection **[1 day(s)]**
8. Qulaity control test of (as per IP) marketed tablets and capsules **[1 day(s)]**

9. Preparation of Eye drops/ and Eye ointments **[1 day(s)]**

.

10. Preparation of Creams (cold / vanishing cream) **[1 day(s)]**

.

11. Evaluation of Glass containers (as per IP) **[1 day(s)]**

.

Text/Reference Books:

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman and J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1 and 2 by Liberman and Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman and Lachman
4. Modern Pharmaceutics by Gilbert S. Banker and C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman and 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 and Febiger, Philadelphia, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen and C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP506P.1	1	3	-	2	-	-	-	-	-	-	-
BP506P.2	-	2	-	3	-	-	-	-	-	-	1
BP506P.3	2	-	-	3	-	-	-	-	-	-	1
BP506P.4	1	-	-	3	-	-	-	-	-	-	2
BP506P.5	2	-	3	-	-	1	-	-	-	-	-

Course Code	BP507P			
Course Title	PHARMACOLOGY II - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. perform bioassay study through simulated software
2. evaluate the in-vitro pharmacology of various drugs
3. evaluate drug action in animal model
4. prepare dose response curve

Suggestive List of Experiments:

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

1. Introduction to in-vitro pharmacology and physiological salt solutions. **[1 day(s)]**
   .
2. Effect of drugs on isolated frog heart. **[1 day(s)]**
   .
3. Effect of drugs on blood pressure and heart rate of dog. **[1 day(s)]**
4. Study of diuretic activity of drugs using rats/mice. **[1 day(s)]**
   .
5. DRC of acetylcholine using frog rectus abdominis muscle. **[1 day(s)]**
   .
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively. **[1 day(s)]**
   .
7. Bioassay of histamine using guinea pig ileum by matching method. **[1 day(s)]**
   .
8. Bioassay of oxytocin using rat uterine horn by interpolation method. **[1 day(s)]**
   :

9. Bioassay of serotonin using rat fundus strip by three point bioassay **[1 day(s)]**

.

10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay. **[1 day(s)]**

.

11. Determination of PA2 value of prazosin using rat anococcygeus muscle (by Schilds plot method). **[1 day(s)]**

.

12. Determination of PD2 value using guinea pig ileum. **[1 day(s)]**

.

13. Effect of spasmogens and spasmolytics using rabbit jejunum. **[1 day(s)]**

.

14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model. **[1 day(s)]**

.

15. Analgesic activity of drug using central and peripheral methods **[1 day(s)]**

.

Text/Reference Books:

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 and 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 and Robert.

9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton and Company, Kolkata.

10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP507P.1	3	-	-	3	-	-	-	-	-	-	-
BP507P.2	-	3	-	2	-	-	-	-	-	-	-
BP507P.3	2	-	-	-	-	-	2	2	-	-	2
BP507P.4	-	3	-	2	-	-	-	-	-	-	-

UNIVERSITY

Course Code	BP508P			
Course Title	PHARMACOGNOSY AND PHYTOCHEMISTRY II- Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. remember the wide variety of the crude drugs and their sources by morphological characteristics.
2. identify the powder mixture and to report the types of adulterants and substituents present
3. analyze and evaluate the powdered crude drug samples by morphological and micro-scopical characteristics.
4. isolate the drug from the given crude drug sample.
5. predict the crude drug by performing chromatographic techniques.

Suggestive List of Experiments:

1. Morphology, histology and powder characteristics and extraction and detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander **[1 day(s)]**

2. Exercise involving isolation and detection of active principles **[5 day(s)]**
   a. Caffeine - from tea dust.
   b. Diosgenin from Dioscorea
   c. Atropine from Belladonna
   d. Sennosides from Senna

3. Separation of sugars by Paper chromatography **[1 day(s)]**

4. TLC of herbal extract **[1 day(s)]**

5. Distillation of volatile oils and detection of phytoconstitutents by TLC **[2 day(s)]**

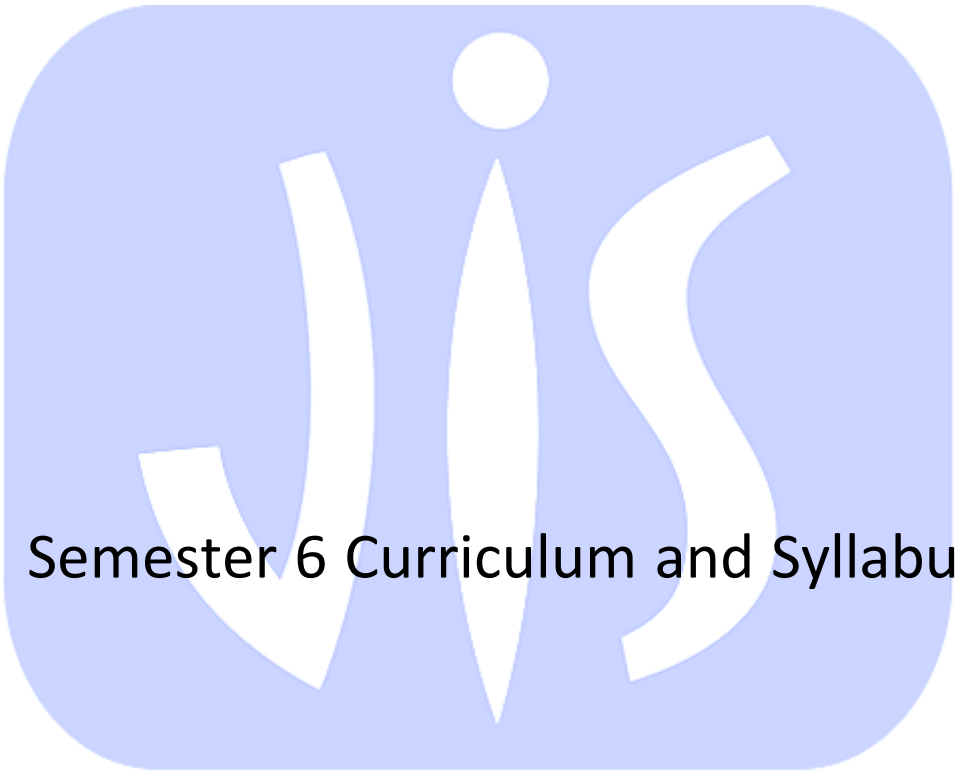
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh **[5 day(s)]**

Text/Reference Books:

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders and Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers and 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 and 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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP508P.1	3	-	-	-	-	-	-	-	-	-	2
BP508P.2	3	-	-	2	-	-	-	-	-	-	-
BP508P.3	3	-	-	-	-	-	-	-	-	-	2
BP508P.4	3	-	-	2	-	-	-	-	-	-	-
BP508P.5	3	-	-	2	-	-	-	-	-	-	-



Semester 6 Curriculum and Syllabus

UNIVERSITY

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP601T	Medicinal Chemistry III - Theory	3	1	0	4
2		BP602T	Pharmacology III – Theory	3	1	0	4
3		BP603T	Herbal Drug Technology – Theory	3	1	0	4
4		BP604T	Biopharmaceutics and Pharmacokinetics –Theory	3	1	0	4
5		BP605T	Pharmaceutical Biotechnology – Theory	3	1	0	4
6		BP606T	Quality Assurance –Theory	3	1	0	4
PRACTICAL							
7		BP607P	Medicinal chemistry III – Practical	0	0	4	2
8		BP608P	Pharmacology III – Practical	0	0	4	2
9		BP609P	Herbal Drug Technology – Practical	0	0	4	2
MANDATORY NON-CGPA COURSE							
10	MC	BSD681	Seminar and Group Discussion	0	0	0	1
11	MC	BSD682	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**18**	**6**	**12**	**30**

Course Code	BP601T			
Course Title	MEDICINAL CHEMISTRY II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

Objectives:

Upon completion of the course the students shall be able to:

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Course Content:

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 (*)

UNIT I:Antibiotics **[10L]**

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

UNIT II:Antibiotics **[10L]**

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, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone

UNIT III: **[10L]**

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.

UNIT IV: **[8L]**

Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.

Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT V: **[7L]**

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 and applications of combination chemistry: solid phase and solution phase synthesis.

Recommended Books (Latest Edition):

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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP601T.1	-	-	3	2	-	-	-	-	-	-	-
BP601T.2	3	-	-	-	-	-	-	-	3	1	-
BP601T.3	3	-	-	2	-	-	-	-	2	1	-
BP601T.4	2	-	-	3	1	-	-	-	-	-	-

Course Code	BP602T			
Course Title	PHARMACOLOGY III - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immunopharmacology and in addition, emphasis on the principles of toxicology and chronopharmacology.

Objectives:

Upon completion of the course the students shall be able to:

1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisonings.
3. Appreciate correlation of pharmacology with related medical sciences.

Course Content:

UNIT I: **[10L]**

1. **Pharmacology of drugs acting on Respiratory system**

a) Anti -asthmatic drugs

b) Drugs used in the management of COPD

c) Expectorants and antitussives

d) Nasal decongestants

e) Respiratory stimulants

2. **Pharmacology of drugs acting on the Gastrointestinal Tract**

a) Antiulcer agents.

b) Drugs for constipation and diarrhoea.

c) Appetite stimulants and suppressants.

d) Digestants and carminatives.

e) Emetics and anti-emetics.

UNIT II: Chemotherapy **[10L]**

a) General principles of chemotherapy.

b) Sulfonamides and cotrimoxazole.

c) Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT III:Chemotherapy **[10L]**

a) Antitubercular agents

b) Antileprotic agents

c) Antifungal agents

d) Antiviral drugs

e) Anthelmintics

f) Antimalarial drugs

g) Antiamoebic agents

UNIT IV: **[8L]**

3. **Chemotherapy**

a) Urinary tract infections and sexually transmitted diseases.

b) Chemotherapy of malignancy.

4. **Immunopharmacology**

a) Immunostimulants

b) Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT V: **[7L]**

5. **Principles of toxicology**

a) Definition and basic knowledge of acute, subacute and chronic toxicity.

b) Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity

c) General principles of treatment of poisoning

d) Clinical symptoms and management of barbiturates, morphine, organo-phosphosphorus compound and lead, mercury and arsenic poisoning.

6. **Chronopharmacology**

a) Definition of rhythm and cycles.

b) Biological clock and their significance leading to chronotherapy.

Recommended Books (Latest Edition):

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. Vallabh Prakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP602T.1	3	1	-	-	-	-	-	-	-	-	-
BP602T.2	2	-	-	-	-	-	-	-	-	-	2
BP602T.3	3	-	2	-	-	-	-	-	-	-	2

Course Code	BP603T			
Course Title	HERBAL DRUG TECHNOLOGY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Objectives:

Upon completion of the course the students shall be able to:

1. understand raw material as source of herbal drugs from cultivation to herbal drug product.
2. know the WHO and ICH guidelines for evaluation of herbal drugs.
3. know the herbal cosmetics, natural sweeteners, nutraceuticals.
4. appreciate patenting of herbal drugs, GMP

Course Content:

UNIT I: **[11 Hr]**

Herbs as raw materials: Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation

Source of Herbs

Selection, identification and authentication of herbal materials

Processing of herbal raw material

Biodynamic Agriculture:

Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine:

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy

b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

UNIT II: **[7 Hr]**

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, Gin-seng, Garlic, Pepper Ephedra.

UNIT III: **[10 Hr]**

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 perfume

Herbal formulations:

Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT IV: **[10 Hr]**

Evaluation of Drugs:

WHO ICH guidelines for the assessment of herbal drugs

Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy

b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma Neem.

Regulatory Issue:

Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs Cosmetics Act for ASU drugs.

UNIT V: **[7 Hr]**

General Introduction to Herbal Industry:

Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India

Schedule T – Good Manufacturing Practice of Indian systems of medicine

Components of GMP (Schedule – T) and its objectives

Infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation and records.

Recommended Books (Latest Edition):

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

Reference Books (Latest Edition):

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP603T.1	3	1	-	2	-	-	-	-	-	-	-
BP603T.2	3	-	1	-	-	-	-	-	-	-	-
BP603T.3	3	-	-	2	-	-	1	-	-	-	-
BP603T.4	3	2	-	-	1	-	-	-	-	-	-

Course Code	BP604T			
Course Title	BIOPHARMACEUTICS AND PHARMACOKINETICS - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arisen therein.

Course Objective:

Upon completion of the course the students shall be able to:

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
4. Understand various pharmacokinetic parameters, their significance and applications.

Course Content:

UNIT I: Introduction to Biopharmaceutics [10L]

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

UNIT II: [10L]

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.

UNIT III:Pharmacokinetics [10L]

Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - KE ,t1/2,Vd,AUC,Ka, Clt and CLR- definitions methods of eliminations, understanding of their significance and application.

UNIT IV: Multicompartment models [8L]

Two compartment open model. IV bolus

Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.

UNIT V:Nonlinear Pharmacokinetics [7L]

a. Introduction, b. Factors causing Non-linearity. c. 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 and Sunil B.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 Rowland and
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington‘s Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

CO-PO Mapping:

CO	Program Outcome										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP604T.1	1	2	1	-	2	1	3	2	2	-	2
BP604T.2	2	2	1	-	2	1	3	2	2	-	2
BP604T.3	-	-	-	-	-	-	-	-	-	-	-
BP604T.4	1	2	1	-	2	1	3	2	2	-	1

JIS UNIVERSITY

Course Code	BPT605T			
Course Title	PHARMACEUTICAL BIOTECHNOLOGY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

Biotechnology has a long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises lot more. It is basically a research-based subject.

Objectives:

Upon completion of the course the students shall be able to:

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

Course Content:

UNIT I: **[10L]**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.

b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.

c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries

d) Brief introduction to Protein Engineering

e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase,Catalase, Peroxidase, Lipase, Protease, Penicillinase

f) Basic principles of genetic engineering

UNIT II: **[10L]**

a) Study of cloning vectors, restriction endonucleases and DNA ligase.

b) Recombinant DNA technology. Application of genetic engineering in medicine. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

c) Application of r DNA technology and genetic engineering in the products

d) Interferon b) Vaccines- hepatitis- B c) Hormones- Insulin.

e) Brief introduction to PCR

Types of immunity- humoral immunity, cellular immunity

UNIT III:Types of immunity- humoral immunity, cellular immunity [10L]

a) Structure of Immunoglobulins

b) Structure and Function of MHC

c) Hypersensitivity reactions, Immune stimulation and Immune suppressions

d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.

e) Storage conditions and stability of official vaccines

f) Hybridoma technology- Production, Purification and Applications

UNIT IV: [8L]

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting. .

b) Genetic organization of Eukaryotes and Prokaryotes

c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.

d) Introduction to Microbial biotransformation and applications.

e) Mutation.

UNIT V: [7L]

a) Types of mutation/mutants

b) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.

c) Large scale production fermenter design and its various controls.

d) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,

Recommended Books (Latest Edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Re-combinantDNA: 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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BPT605T.1	3	-	-	1	-	-	-	-	-	-	3
BPT605T.2	3	-	-	1	-	1	-	-	-	-	3
BPT605T.3	-	-	-	3	-	1	-	-	-	1	2
BPT605T.4	-	3	1	1	1	-	-	1	-	-	-

Course Code	BPT606T			
Course Title	PHARMACEUTICAL QUALITY ASSURANCE - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

Objectives:

Upon completion of the course the students shall be able to:

1. understand the cGMP aspects in a pharmaceutical industry
2. Appreciate the importance of documentation
3. Understand the scope of quality certifications applicable to pharmaceutical industries
4. Understand the responsibilities of QA & QC departments

Course Content:

UNIT I **[10L]**

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 procedure

UNIT II: **[10L]**

Organization and personnel: Personnel responsibilities, training, hygiene and personal records.

Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

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

UNIT III: **[10L]**

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

UNIT IV: **[8L]**

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. .

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT V: **[7L]**

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management

Recommended Books (Latest Edition):

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of 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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BPT606T.1	3	-	-	1	-	-	-	-	-	-	3
BPT606T.2	3	-	-	1	-	1	-	-	-	-	3
BPT606T.3	-	-	-	3	-	1	-	-	-	1	2
BPT606T.4	-	3	1	1	1	-	-	1	-	-	-

UNIVERSITY

Course Code	BP607P			
Course Title	MEDICINAL CHEMISTRY III - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. Understand the importance of drug design and different techniques of drug design
2. Preparation of drugs and intermediates and their Assay
3. Drawing structures and reactions using chem draw
4. Determination of physicochemical properties such as logP, clogP, MR

Practical:

I. Preparation of drugs and intermediates:

1. Sulphanilamide **[1 day(s)]**
2. 7-Hydroxy, 4-methyl coumarin **[1 day(s)]**
3. Chlorobutanol **[1 day(s)]**
4. Triphenyl imidazole **[1 day(s)]**
5. Tolbutamide **[1 day(s)]**
6. Hexamine **[1 day(s)]**

II. Assay of drugs:

1. Isonicotinic acid hydrazide **[1 day(s)]**
2. Chloroquine **[1 day(s)]**
3. Metronidazole **[1 day(s)]**
4. Dapsone **[1 day(s)]**
5. Chlorpheniramine maleate **[1 day(s)]**
6. Benzyl penicillin **[1 day(s)]**

III. Preparation of medicinally important compounds or intermediates by Microwave irradiation technique.

[1 day(s)]

IV. Drawing structures and reactions using chem draw®.

[1 day(s)]

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

[1 day(s)]

Text/Reference Books:

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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP607P.1	3 -	2	-	-	-	-	-	-	-	-	-
BP607P.2	3	-	2	-	-	-	-	-	-	-	-
BP607P.3	3	-	2	3	-	-	-	-	-	-	-
BP607P.4	3	-	2	-	-	-	-	-	-	-	-

Course Code	BP608P			
Course Title	PHARMACOLOGY III - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. calculate doses in pharmacological experiments for animal studies
2. determine of various toxicity of a drug using simulated softwares
3. evaluate drug action in animal model
4. evaluate biostatistical methods in experimental pharmacology

Practical:

Experiments are demonstrated by simulated experiments/videos

1. Dose calculation in pharmacological experiments. **[1 day(s)]**
2. Antiallergic activity by mast cell stabilization assay. **[1 day(s)]**
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model. **[1 day(s)]**
4. Study of effect of drugs on gastrointestinal motility. **[1 day(s)]**
5. Effect of agonist and antagonists on guinea pig ileum **[1 day(s)]**
6. Estimation of serum biochemical parameters by using semi- autoanalyser. **[1 day(s)]**
7. Effect of saline purgative on frog intestine **[1 day(s)]**
8. Insulin hypoglycemic effect in rabbit. **[1 day(s)]**
9. Test for pyrogens (rabbit method). **[1 day(s)]**
10. Determination of acute oral toxicity (LD50) of a drug from a given data. **[1 day(s)]**
11. Determination of acute skin irritation / corrosion of a test substance. **[1 day(s)]**
12. Determination of acute eye irritation / corrosion of a test substance. **[1 day(s)]**
13. Calculation of pharmacokinetic parameters from a given data. **[1 day(s)]**
14. Biostatistics methods in experimental pharmacology(student's t test, ANOVA). **[1 day(s)]**
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test). **[1 day(s)]**

Recommended Books:

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 and Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacol.
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 and Robert.
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton and Company, Kol.
9. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP608P.1	3	-	2	-	-	-	-	-	-	-	-
BP608P.2	-	3	3	-	-	-	-	-	-	-	-
BP608P.3	3	2	-	-	-	-	-	-	-	-	-
BP608P.4	-	-	3	-	-	-	-	-	-	2	-

Course Code	BP609P			
Course Title	HERBAL DRUG TECHNOLOGY - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. remember different preliminary phytochemical screening of crude drugs
2. evaluate the various herbal formulations.
3. apply monographic analysis of herbal drugs as per pharmacopoeias
4. evaluate parameters such as aldehyde and phenol contents
5. assess the total alkaloid content in herbal formulations.

Practical:

1. To perform preliminary phytochemical screening of crude drugs. **[1 day(s)]**
2. Determination of Ash value. **[1 day(s)]**
3. Determination of moisture content of crude drugs. **[1 day(s)]**
4. Determination of Extractive values of crude drugs. **[1 day(s)]**
5. Determination of the alcohol content of Asava and Arista. **[1 day(s)]**
6. Preparation of herbal cosmetics. **[1 day(s)]**
7. Preparation and standardization of herbal formulation. **[1 day(s)]**
8. Determination of swelling index and foaming index. **[1 day(s)]**
9. Monograph analysis of herbal drugs from recent Pharmacopoeias. **[1 day(s)]**
10. Analysis of fixed oils. **[1 day(s)]**

Recommended Books:

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale.
4. Essential of Pharmacognosy by Dr.S.H.Ansari.

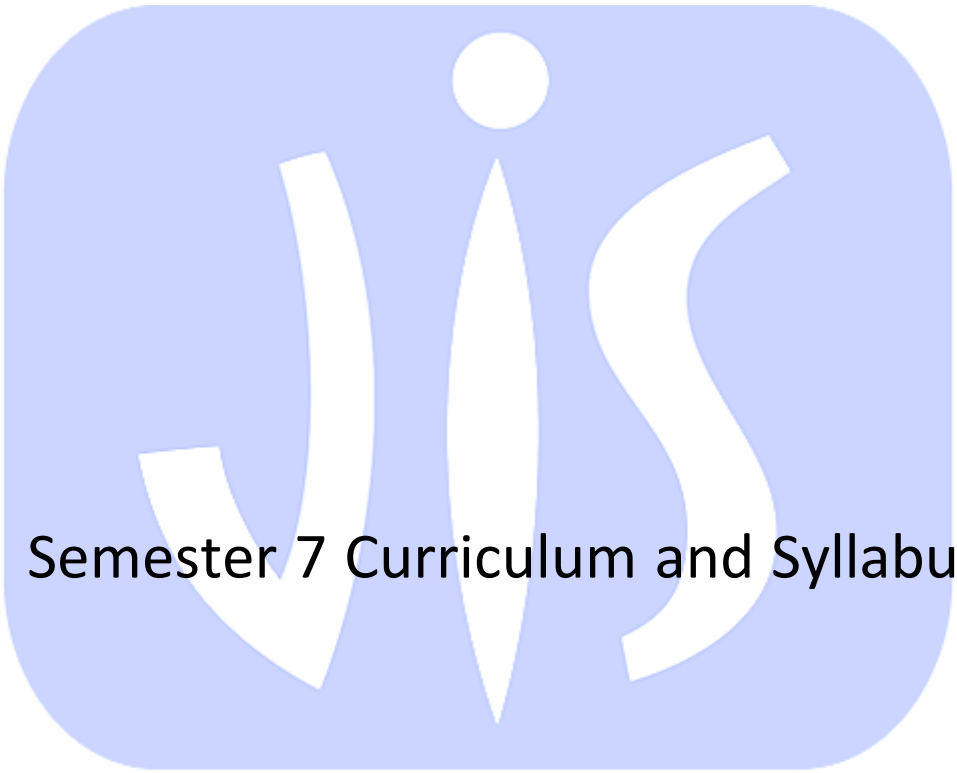
5. Pharmacognosy & Phytochemistry by V.D.Rangari.

6. Pharmacopoeial 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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP609P.1	3	-	2	-	-	-	-	-	-	-	-
BP609P.2	3	-	2	-	-	-	-	-	-	-	-
BP609P.3	3	2	-	-	-	-	-	-	-	-	-
BP609P.4	3	-	2	-	-	-	-	-	-	-	-
BP609P.5	3	-	2	-	-	-	-	-	-	-	-



Semester 7 Curriculum and Syllabus

UNIVERSITY

[6]

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP701T	Instrumental Methods of Analysis – Theory	3	1	0	4
2		BP702T	Industrial PharmacyII – Theory	3	1	0	4
3		BP703T	Pharmacy Practice – Theory	3	1	0	4
4		BP704T	Novel Drug Delivery System – Theory	3	1	0	4
PRACTICAL							
5		BP705P	Instrumental Methods of Analysis – Practical	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
6		BP706PS	Practice School*	0	0	12	6
MANDATORY NON-CGPA COURSE							
7	MC	BSD781	Seminar and Group Discussion	0	0	0	1
8	MC	BSD782	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**12**	**4**	**16**	**24**

[6]***Non University Examination**

Course Code	BP701T			
Course Title	INSTRUMENTAL METHODS OF ANALYSIS - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives:

Upon completion of the course the student shall be able to:

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis.
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course Content:

UNIT I: **[10L]**

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

UNIT II: **[10L]**

IR spectroscopy:

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications

Flame Photometry: Principle, interferences, instrumentation and applications

Atomic Absorption Spectroscopy: Principle, interferences, instrumentation and applications

N**ephelo**t**urbidometry:** Principle, instrumentation and applications

UNIT III: **[10L]**

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

UNIT IV: **[8L]**

Gas chromatography:

Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications

High performance liquid chromatography (HPLC):

Introduction, theory, instrumentation, advantages and applications.

UNIT V: **[7L]**

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

Recommended Books (Latest Edition):

1. Instrumental Methods of Chemical Analysis by B.K Sharma
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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP701T.1	3	-	-	3	-	-	-	-	-	-	-
BP701T.2	3	-	-	3	-	-	-	-	-	-	2
BP701T.3	3	-	-	3	-	-	-	-	-	-	1

Course Code	BP702T			
Course Title	INDUSTRIAL PHARMACY II - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market

Objectives:

Upon completion of the course, the student shall be able to:

1. Know the process of pilot plant and scale up of pharmaceutical dosage forms
2. Understand the process of technology transfer from lab scale to commercial batch
3. Know different Laws and Acts that regulate pharmaceutical industry
4. Understand the approval process and regulatory requirements for drug products

Course Content:

UNIT I: Pilot Plant Scale up Techniques **[10L]**

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

UNIT II:Technology Development and Transfer **[10L]**

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

UNIT III: **[10L]**

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.

UNIT IV: Quality Management Systems **[8L]**

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

UNIT V: Indian Regulatory Requirements **[7L]**

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 Edition):

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available 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 by learning plus, inc. available at http.//www.cgmp.com/ra.htm.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP702T.1	3	2	1	-	-	2	-	-	-	-	2
BP702T.2	3	3	-	1	-	3	-	-	-	-	2
BP702T.3	3	3	-	-	-	2	-	-	1	-	2
BP702T.4	-	2	-	-	3	3	-	-	1	-	-

Course Code	BP703T			
Course Title	PHARMACY PRACTICE - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

Objectives:

Upon completion of the course the student shall be able to:

1. know various drug distribution methods in a hospital
2. appreciate the pharmacy stores management and inventory control
3. monitor drug therapy of patient through medication chart review and clinical review
4. obtain medication history interview and counsel the patients
5. identify drug related problems
6. detect and assess adverse drug reactions
7. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
8. know pharmaceutical care services
9. do patient counseling in community pharmacy;
10. appreciate the concept of Rational drug therapy.

Course Content:

UNIT I: **[10L]**

a) **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.

b) **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.

c) **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 drug store.

UNIT II: **[10L]**

a) **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

b) **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.

c) **Therapeutic drug monitoring:**

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) **Medication adherence:**

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

e) **Patient medication history interview:**

Need for the patient medication history interview, medication interview forms.

f) **Community pharmacy management:**

Financial, materials, staff, and infrastructure requirements.

UNIT III: **[10L]**

a) **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.

b) **Drug information services:**

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

c) **Patient counseling:**

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

d) **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.

e) **Prescribed medication order and communication skills:**

Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

UNIT IV: **[8L]**

a) **Budget preparation and implementation:**

Budget preparation and implementation

b) **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.

c) **Over the counter (OTC) sales:**

Introduction and sale of over the counter, and Rational use of common over the counter medications.

UNIT V: **[7L]**

a) **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

b) **Investigational use of drugs:**

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

c) **Interpretation of Clinical Laboratory Tests:**

Blood chemistry, hematology, and urinalysis

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. Hospital pharmacy, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. Basic skills in interpreting laboratory data, 4th ed. 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)

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP703T.1	3	-	-	-	-	3	-	-	3	1	2
BP703T.2	-	2	-	-	3	3	2	2	3	1	-
BP703T.3	2	-	-	-	-	3	-	-	2	2	1
BP703T.4	2	-	-	-	-	3	-	2	3	-	1
BP703T.5	2	-	-	-	-	2	3	-	3	2	1
BP703T.6	2	-	-	-	-	-	-	-	-	-	1
BP703T.7	2	-	-	-	-	-	1	-	-	-	1
BP703T.8	2	-	-	-	-	-	-	-	-	-	-
BP703T.9	2	-	-	-	-	-	-	-	-	-	-
BP703T.10	2	-	-	-	-	-	-	-	-	-	-

Course Code	BP704T			
Course Title	NOVEL DRUG DELIVERY SYSTEMS - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

Objectives:

Upon completion of the course student shall be able

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course Content:

UNIT I: **[10L]**

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

Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

UNIT II: **[10L]**

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

UNIT III: **[10L]**

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

UNIT IV: **[8L]**

Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications

UNIT V: **[7L]**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications

Recommended Books (Latest Edition):

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers Distributors, New Delhi, First 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 (Elsevier Sciences)

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP704T.1	2	-	-	-	-	2	-	-	-	-	1
BP704T.2	3	-	-	-	-	3	-	-	-	-	1

UNIVERSITY

Course Code	BP705P			
Course Title	INSTRUMENTAL METHODS OF ANALYSIS - Practical			
Category				
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	60			
Pre-requisites	None			

Course Objective:

Upon completion of the course the students shall be able to:

1. determine the absorption maxima and explain the effect of solvents on absorption maxima of organic compounds
2. estimate dextrose, sulphanilamide by colorimetry and paracetamol, ibuprofen by UV-vis spectrophotometry
3. determine the sodium, potassium by flame phtometry and chlorides, sulphates by nephlotubidometry
4. separate the aminoacids by paper chromatography and sugars by thin layer chromatography
5. separate plant pigments by column chromatography
5. demonstrate the HPLC and GC

Practical:

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds **[1 day(s)]**
2. Estimation of dextrose by colorimetry **[1 day(s)]**
3. Estimation of sulfanilamide by colorimetry **[1 day(s)]**
4. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy **[1 day(s)]**
5. Assay of paracetamol by UV- Spectrophotometry **[1 day(s)]**
6. Estimation of quinine sulfate by fluorimetry **[1 day(s)]**
7. Study of quenching of fluorescence **[1 day(s)]**
8. Determination of sodium by flame photometry **[1 day(s)]**
9. Determination of potassium by flame photometry **[1 day(s)]**
10. Determination of chlorides and sulphates by nephelo turbidometry **[1 day(s)]**
11. Separation of amino acids by paper chromatography **[1 day(s)]**

12. Separation of sugars by thin layer chromatography **[1 day(s)]**

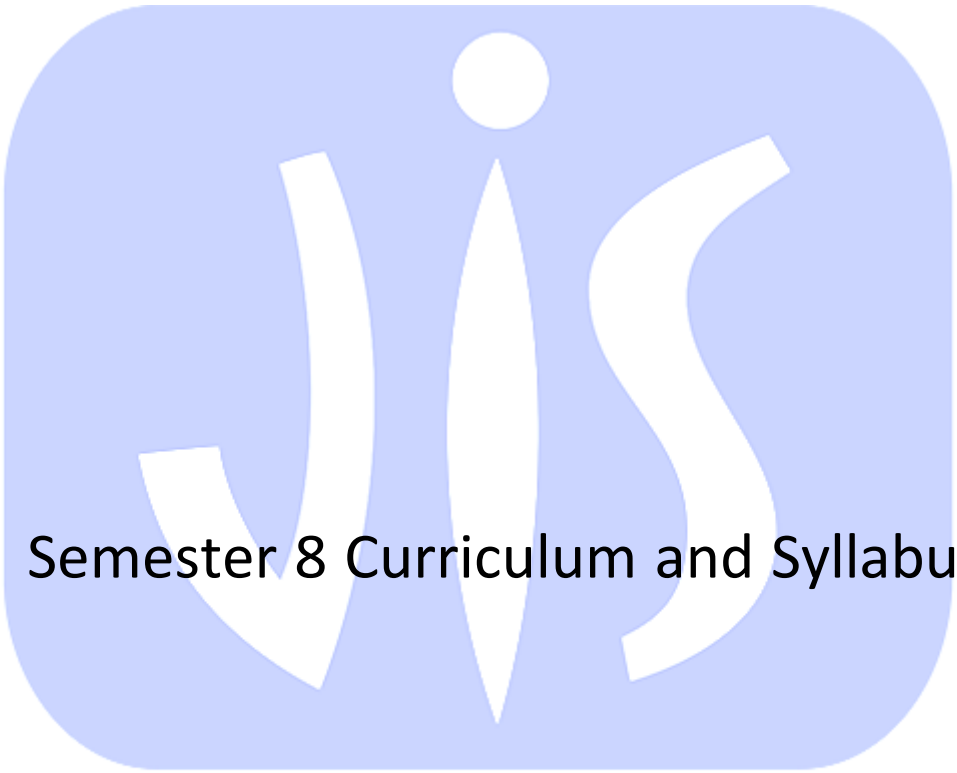
13. Separation of plant pigments by column chromatography **[1 day(s)]**

14. Demonstration experiment on HPLC **[1 day(s)]**

15. Demonstration experiment on Gas Chromatography **[1 day(s)]**

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP705P.1	3	2	1	3	-	3	- -	-	-	-	1
BP705P.2	3	2	2	3	-	3	-	-	-	-	2
BP705P.3	3	2	2	3	-	3	-	-	-	-	2
BP705P.4	3	2	2	3	-	3	-	-	-	-	2
BP705P.5	3	2	2	3	-	3	-	-	-	-	2
BP705P.6	3	2	2	3	-	3	-	-	-	-	2



Semester 8 Curriculum and Syllabus

UNIVERSITY

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1		BP801T	Bio statistics and Research Methodology - Theory	3	1	0	4
2		BP802T	Social and Preventive Pharmacy - Theory	3	1	0	4
3		BP803ET	Pharmaceutical Marketing Management - Theory	3	1	0	4
4		BP804ET	Pharmaceutical Regulatory Science - Theory	3	1	0	4
5		BP805ET	Pharmacovigilance - Theory	3	1	0	4
6		BP806ET	Quality Control and Standardization of Herbals - Theory	3	1	0	4
7		BP807ET	Computer Aided Drug Design - Theory	3	1	0	4
8		BP808ET	Cell and Molecular Biology - Theory	3	1	0	4
9		BP809ET	Cosmetic Science - Theory	3	1	0	4
10		BP810ET	Experimental Pharmacology - Theory	3	1	0	4
11		BP811ET	Advanced Instrumentation Techniques - Theory	3	1	0	4
12		BP812ET	Dietary Supplements and Nutraceuticals - Theory	3	1	0	4
SESSIONAL(ONLY INTERNAL EVALUATION)							
13		BP813PW	Project Work	0	0	12	6
MANDATORY NON-CGPA COURSE							
14	MC	BSD881	Seminar and Group Discussion	0	0	0	1
15	MC	BSD882	Skill X and Other activities (MOOCs courses)	0	0	0	1
TOTAL				**12**	**4**	**12**	**22**

Course Code	BP801T			
Course Title	BIOSTATISITCS AND RESEARCH METHODOLOGY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.

Objectives:

Upon completion of the course the students shall be able to:

1. Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)
2. Know the various statistical techniques to solve statistical problems.
3. Appreciate statistical techniques in solving the problems.

Course Content:

UNIT I: **[10L]**

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

UNIT II: **[10L]**

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x= a + by, Multiple regression, standard error of regression– Pharmaceutical Examples.

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems. Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference.

UNIT III: **[10L]**

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallistest, 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, Re-portwriting and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

UNIT IV: **[8L]**

Blocking and confounding system for Two-level factorials.

Regression modeling: Hypothesis testing in Simple and Multiple regression models.

Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R -Online Statistical Software's to Industrial and Clinical trial approach.

UNIT V: **[7L]**

Design and Analysis of experiments:

Factorial Design: Definition, 22, 23 design. 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.Pannerselva.
4. Design and Analysis of Experiments Wiley Students Edition, Douglas and C. Montgomery.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP801T.1	1	2	3	-	-	2	-	1	-	3	-
BP801T.2	-	2	3	3	-	2	-	-	-	1	-
BP801T.3	-	3	3	-	-	2	-	-	-	1	-

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Course Code	BP802T			
Course Title	SOCIAL AND PREVENTIVE PHARMACY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives:

After the successful completion of this course, the student shall be able to:

1. Acquire high consciousness/realization of current issuesrelated to health and pharmaceutical problems within the country and worldwide.
2. Have a critical way of thinking based on current healthcare development.
3. Evaluate alternative ways of solving problems related to health and pharmaceutical issues.

Course Content:

UNIT I: **[10L]**

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.

UNIT II: **[10L]**

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.

UNIT III: **[10L]**

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.

UNIT IV: **[8L]**

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program.

UNIT V: **[7L]**

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, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications.
3. . Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications.
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications.
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011,ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad.

Recommended Journals:

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

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP802T.1	2	2	-	-	3	-	-	3	2	2	-
BP802T.2	-	1	2	-	3	2	-	3	2	1	-
BP802T.3	-	-	-	-	-	-	-	-	-	-	-

Course Code	BP803ET			
Course Title	PHARMA MARKETING MANAGEMENT - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.

Objectives:

The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

Course Content:

UNIT I: **[10L]**

Marketing: Definition, general concepts and scope of marketing; Distinction between marketing and 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.

UNIT II: **[10L]**

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.

UNIT III: **[10L]**

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.

UNIT IV: **[10L]**

Pharmaceutical Marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels,physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR): Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

UNIT V: **[10L]**

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 Edition):

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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP803ET.1	3	-	-	1	-	-	-	-	-	-	-
BP803ET.2	3	-	-	2	-	-	-	-	-	-	-

Course Code	BP804ET			
Course Title	PHARMACEUTICAL REGULATORY SCIENCE - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

Objectives:

Upon completion of the subject student shall be able to;

1. Know about the process of drug discovery and development
2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
3. Know the regulatory approval process and their registration in Indian and international markets.

Course Content:

UNIT I: **[10L]**

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.

UNIT II: **[10L]**

Regulatory Approval Process: Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies: Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

UNIT III: **[10L]**

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.

UNIT IV: **[8L]**

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.

UNIT V: **[7L]**

Regulatory Concepts: Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book.

Recommended Books (Latest Edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics Syllabus for Bachelor in Pharmaceutical Technology (B.Pharm), JIS UNIVERSITY Page 204 /edited by Douglas J. Pisano, David Mantus.
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 Rick Ng

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP804ET.1	3	-	-	-	-	-	-	-	-	-	1
BP804ET.2	2	-	-	-	-	-	-	-	-	-	1
BP804ET.3	-	-	-	3	-	-	-	-	-	-	1
BP804ET.4	2	-	-	-	-	-	-	-	-	-	1
BP804ET.5	1	-	-	-	-	-	-	-	-	-	1

Course Code	BP805ET			
Course Title	PHARMACOVIGILANCE - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenarioof Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.

Objectives:

At completion of this paper it is expected that students will be able to (know, do, and appreciate):

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance
3. National and international scenario of pharmacovigilance
4. Dictionaries, coding and terminologies used in pharmacovigilance
5. Detection of new adverse drug reactions and their assessment
6. International standards for classification of diseases and drugs
7. Adverse drug reaction reporting systems and communication in pharmacovigilance
8. Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
10. Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
11. ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
12. CIOMS requirements for ADR reporting
13. Writing case narratives of adverse events and their quality.

Course Content:

UNIT I: [10L]

Introduction to Pharmacovigilance

History and development of Pharmacovigilance

Importance of safety monitoring of Medicine

WHO international drug monitoring programme

Pharmacovigilance Program of India(PvPI)

Introduction to adverse drug reactions

Definitions and classification of ADRs

Detection and reporting

Methods in Causality assessment

Severity and seriousness assessment

Predictability and preventability assessment

Management of adverse drug reactions

Basic terminologies used in pharmacovigilance

Terminologies of adverse medication related events

Regulatory terminologies

UNIT II: [10L]

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 in pharmacovigilance

WHO adverse reaction terminologies

MedDRA and Standardised MedDRA queries

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

UNIT III: **[10L]**

Vaccine safety surveillance

Vaccine Pharmacovigilance

Vaccination failure

Adverse events following immunization

Pharmacovigilance methods

Passive surveillance – Spontaneous reports and case series

Stimulated reporting

Active surveillance – Sentinel sites, drug event monitoring and registries

Comparative observational studies – Cross sectional study, case control study and co-hort 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 Me-dia

UNIT IV: **[8L]**

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

UNIT V: **[7L]**

Pharmacogenomics of adverse drug reactions

Genetics related ADR with example focusing PK parameters.

Drug safety evaluation in special population

Paediatrics

Pregnancy and lactation

Geriatrics

CIOMS

CIOMS Working Groups

CIOMS Form

CDSCO (India) and Pharmacovigilance

DC 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. 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=105825mn1=7347mn2=7259mn 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/pvhome.html

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP805ET.1	3	-	-		-	2	-	-	3	2	1
BP805ET.2	3	-	1	-	-	3	-	1	3	2	2
BP805ET.3	2	1	1		-	3	-	1	3	2	1
BP805ET.4	2	3			2	3	-	1	3	2	1
BP805ET.5	3	2	-	-		3	-	-	2	2	1

JIS UNIVERSITY

Course Code	BP806ET			
Course Title	QUALITY CONTROL AND STANDARDIZATION OF HERBALS - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

Objectives:

Upon completion of the subject student shall be able to;

1. know WHO guidelines for quality control of herbal drugs.
2. know Quality assurance in herbal drug industry.
3. know the regulatory approval process and their registration in Indian and international markets.
4. Appreciate EU and ICH guidelines for quality control of herbal drugs.

Course Content:

UNIT I: **[10L]**

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.

UNIT II: **[10L]**

Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP intraditional system of medicine.

WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines.

WHO Guidelines on GACP for Medicinal Plants.

UNIT III: **[10L]**

EU and ICH guidelines for quality control of herbal drugs.

Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines.

UNIT IV: **[8L]**

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.

UNIT V: **[7L]**

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 Edition):

1. Pharmacognosy by Trease and Evans.
2. Pharmacognosy by Kokate, Purohit and Gokhale.
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , CarrierPub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products.
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. 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 of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopoeia, Vol. 2: Quality Specifications, 3rd edn.World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP806ET.1	3	-	1	-	-	-	-	-	-	-	-
BP806ET.2	3	-	2	-	-	-	-	-	-	-	-
BP806ET.3	2	-	-	1	-	-	-	-	-	-	-
BP806ET.4	3	-	-	2	-	-	-	-	-	-	-
BP806ET.5	2	-	-	-	-	-	-	-	-	-	1

UNIVERSITY

Course Code	BP807ET			
Course Title	COMPUTER AIDED DRUG DESIGN - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

Objectives:

Upon completion of the course, the student shall be able to understand:

1. Design and discovery of lead molecules.
2. The role of drug design in drug discovery process.
3. The concept of QSAR and docking.
4. Various strategies to develop new drug like molecules.
5. The design of new drug molecules using molecular modeling software.

Course Content:

UNIT I: **[10L]**

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

Lead discovery and Analog Based Drug Design: Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies.

UNIT II: **[10L]**

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.

UNIT III: **[10L]**

Molecular Modeling and virtual screening techniques.

Virtual Screening techniques: Drug likeness screening, Concept ofpharmacophore mapping and pharmacophore based Screening.

Molecular docking: Rigid docking, flexible docking, manual docking,Docking based screening. De novo drug design.

UNIT IV: **[8L]**

Informatics & Methods in drug design: Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

UNIT V: **[7L]**

Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.

Recommended Books (Latest Edition):

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 and Gisvolds's Text Book of OrganicMedicinal and Pharmaceutical Chemistry‖ Lippincott, New York.
4. "Foye WO —Principles of Medicinal chemistry" Lea and 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 and 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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP807ET.1	2	-	-	1	-	-	-	-	-	-	-
BP807ET.2	3	-	-	2	-	-	-	-	-	-	-
BP807ET.3	2	-	-	-	1	-	-	-	-	-	-
BP807ET.4	3	-	-	-	-3	-	-	-	-	-	-
BP807ET.5	-3	-	-	-	-	-	-	-	-	-	2

Course Code	BP808ET			
Course Title	CELL AND MOLECULAR BIOLOGY - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

1. Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function.

2. This is done both on a microscopic and molecular level.

3. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges.

Objectives:

Upon completion of the subject student shall be able to;

1. Summarize cell and molecular biology history.

2. Summarize cellular functioning and composition.

3. Describe the chemical foundations of cell biology.

4. Summarize the DNA properties of cell biology.

5. Describe protein structure and function.

6. Describe cellular membrane structure and function.

7. Describe basic molecular genetic mechanisms.

8. Summarize the Cell Cycle.

Course Content:

UNIT I: **[10L]**

a) Cell and Molecular Biology: Definitions theory and basics and Applications.

b) Cell and Molecular Biology: History and Summation.

c) Properties of cells and cell membrane.

d) Prokaryotic versus Eukaryotic.

e) Cellular Reproduction.

f) Chemical Foundations – an Introduction and Reactions (Types).

UNIT II: **[10L]**

a) DNA and the Flow of Molecular Information,

b) DNA Functioning.

c) DNA and RNA.

d) Types of RNA.

e) Transcription and Translation.

UNIT III: **[10L]**

a) Proteins: Defined and Amino Acids

b) Protein Structure.

c) Regularities in Protein Pathways.

d) Cellular Processes

e) Positive Control and significance of Protein Synthesis.

UNIT IV: **[8L]**

a) Science of Genetics.

b) Transgenics and Genomic Analysis.

c) Cell Cycle analysis.

d) Mitosis and Meiosis.

e) Cellular Activities and Checkpoints.

UNIT V: **[7L]**

a) Cell Signals: Introduction.

b) Receptors for Cell Signals.

c) Signaling Pathways: Overview.

d) Misregulation of Signaling Pathways.

e) 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 andApplications of Recom-binantDNA: ASM Press Washington D.C.
13. RA Goldshy et al, Kuby Immunology.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP808ET.1	3	-	-	-	-	-	-	-	-	-	1
BP808ET.2	3	-	-	-	-	-	-	-	-	-	2
BP808ET.3	3	-	-	-	-	-	-	-	-	-	1
BP808ET.4	3	-	-	-	2	-	-	-	-	-	-

Course Code	BP809ET			
Course Title	COSMETIC SCIENCE - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Objectives:

At the end of the course the student shall be able to:

1. Develop knowledge regarding anatomy of skin, hair.
2. Prepare and Evaluate various Skin Care , Hair care and Oral care Product.
3. Evaluate the Role of herbs and other ingredients in cosmetic preparation.
4. Distinguish the important regulations to prepare cosmeceuticals.

Course Content:

UNIT I: **[10L]**

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.

UNIT II: **[10L]**

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages anddisadvantages.

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.

UNIT III: **[10L]**

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 toothpaste.

UNIT IV: **[8L]**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps,and syndet bars. Evolution and skin benefits.

UNIT V: **[7L]**

Oily and dry skin, causes leading to dry skin, skin moisturization. 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 andbody odor.

Antiperspirants and Deodorants- Actives and mechanism of action.

Recommended Books (Latest Edition):

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 and Roop K. Khar, Tata Publishers.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP809ET.1	3	-	2	-	-	-	1	-	-	-	1
BP809ET.2	1	-	-	2	-	-	-	-	-	-	-
BP809ET.3	3	-	-	-	2	-	-	-	-	-	-
BP809ET.4	3	-	-	-	1	-	-	-	-	-	-
BP809ET.5	2	-	-	-	-	-	-	-	1	-	-

Course Code	BP810ET			
Course Title	PHARMACOLOGICAL SCREENING METHODS - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

Objectives:

Upon completion of the course the student shall be able to

1. Appreciate the applications of various commonly used laboratory animals.
2. Appreciate and demonstrate the various screening methods used in preclinical research.
3. Appreciate and demonstrate the importance of biostatistics and research methodology.
4. Design and execute a research hypothesis independently.

Course Content:

UNIT I: **[8L]**

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.

UNIT II: **[10L]**

Preclinical screening models:

a. 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.

b. Study of screening animal models for:

Diuretics, nootropics, anti-Parkinson's, antiasthmatics, Preclinical screening models: for CNS activity- analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease.

UNIT III: **[12L]**

Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics.

UNIT IV: **[10L]**

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.

UNIT V: **[5L]**

Research methodology and Bio-statistics:

Selection of research topic, review of literature, research hypothesisand 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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP810ET.1	3	-	-	1	-	-	-	-	-	-	1
BP810ET.2	3	-	-	1	-	-	-	-	-	-	1
BP810ET.3	2	-	-	1	-	-	-	-	-	-	1
BP810ET.4	2	-	-	1	-	-	-	-	-	-	1
BP810ET.5	2	-	-	-	2	-	-	-	-	-	2

Course Code	BP811ET			
Course Title	ADVANCED INSTRUMENTATION TECHNIQUES - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives:

Upon completion of the course the student shall be able to

1. Understand the advanced instruments used and its applications in drug analysis.
2. Understand the chromatographic separation and analysis of drugs.
3. Understand the calibration of various analytical instruments.
4. Know analysis of drugs using various analytical instruments.

Course Content:

UNIT I: **[10L]**

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.

UNIT II: **[10L]**

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.

UNIT III: **[10L]**

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.

UNIT IV: **[8L]**

Radio immune assay: Importance, various components, Principle, differentmethods, Limitation and Applications of Radio immuno assay.

Extraction techniques: General principle and procedure involved in the solidphase extraction and liquid-liquid extraction.

UNIT V: **[7L]**

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Edition):

1. Instrumental Methods of Chemical Analysis by B.K Sharma.
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.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP811ET.1	2	-	-	-	-	-	-	-	-	-	1
BP811ET.2	2	-	-	-	3	-	-	-	-	-	1
BP811ET.3	3	-	-	-	-	-	-	-	-	-	2
BP811ET.4	2	-	-	-	-	-	-	-	-	-	1
BP811ET.5	1	-	-	-	-	-	-	-	-	-	1

Course Code	BP812ET			
Course Title	DIETARY SUPPLEMENTS AND NUTRACEUTICALS - Theory			
Category				
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	45			
Pre-requisites	None			

Scope:

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Objectives:

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to:

1. Understand the need of supplements by the different group of people to maintain healthy life.
2. Understand the outcome of deficiencies in dietary supplements.
3. Appreciate the components in dietary supplements and the application.
4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

Course Content:

UNIT I: [7L]

a. **Definitions of Functional foods**, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

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

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds.

UNIT II: [15L]

Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following:

a) Carotenoids- and -Carotene, Lycopene, Xanthophylls, leutin.

b) Sulfides: Diallyl sulfides, Allyl trisulfide.

c) Polyphenolics: Reservetrol.

d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones.

e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum.

f) Phyto estrogens: Isoflavones, daidzein, Geebustin, lignans.

g) Tocopherols.

h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.

UNIT III: **[7L]**

a) 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.

b) Dietary fibres and complex carbohydrates as functional food ingredients.

UNIT IV: **[10L]**

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, - Lipoic acid, melatonin.

b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, - Lipoic acid, melatonin.

Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

c) Functional foods for chronic disease prevention.

UNIT V: **[6L]**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

Recommended Books (Latest Edition):

1. Dietetics by Sri Lakshmi.
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agustiand 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. Eighthedition. Lea and Febiger.

CO-PO Mapping:

	Program Outcome										
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP812ET.1	3	-	-	-	-	-	-	-	-	-	-
BP812ET.2	-	2	-	-	-	-	-	-	-	-	-
BP812ET.3	3	-	-	-	-	-	-	-	-	-	1
BP812ET.4	1	-	-	-	-	-	-	-	-	-	-
BP812ET.5	3	-	-	-	-	-	-	-	-	-	2