

DEPARTMENT OF Pharmacy
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A CENTRAL UNIVERSITY)

B. Pharm.

Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I–Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry –Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
	Total	32/34\$/36[#]	4	27/29\$/30[#]

#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)

Course of study for semester II

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II – Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
	Total	32	4	29

*Non University Examination (NUE)

Course of study for semester III

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
	Total	28	4	24

Course of study for semester IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4	-	2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
	Total	31	5	28

Course of study for semester V

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial Pharmacy I– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial Pharmacy I – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
	Total	27	5	26

Course of study for semester VI

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory	3	1	4
BP602T	Pharmacology III – Theory	3	1	4
BP603T	Herbal Drug Technology – Theory	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	3	1	4
BP606T	Quality Assurance –Theory	3	1	4
BP607P	Medicinal chemistry III – Practical	4	-	2
BP608P	Pharmacology III – Practical	4	-	2
BP609P	Herbal Drug Technology – Practical	4	-	2
	Total	30	6	30

Course of study for semester VII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial Pharmacy II – Theory	3	1	4
BP703T	Pharmacy Practice – Theory	3	1	4
BP704T	Novel Drug Delivery System – Theory	3	1	4
BP705P	Instrumental Methods of Analysis – Practical	4	-	2
BP706PS	Practice School*	12	-	6
	Total	28	5	24

*Non University Examination (NUE)

Course of study for semester VIII

Course code	Name of the course	No. of Hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802ET	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharma Marketing Management	3+3= 6	1+1 = 2	4+4 =8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work	12	-	6
	Total	24	4	22

Schemes for internal assessments and end semester examinations semester wise (Semester I)

Course Code	Name of Course	Internal Assessment				End SemesterExam		Total Marks
		Continuous Mode	Sessional Exams		Total	Mark s	Duration	
			Mark s	Duration				
BP101 T	Human Anatomy and Physiology I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP102 T	Pharmaceutical Analysis I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP103 T	Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP104 T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP105 T	Communication skills – Theory *	5	10	1 Hr	15	35	1.5 Hrs	50
BP106 RBT BP106 RMT	Remedial Biology/ Remedial Mathematics –Theory*	5	10	1 Hr	15	35	1.5 Hrs	50
BP107P	Human Anatomy and Physiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP108 P	Pharmaceutical Analysis I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP109 P	Pharmaceutics I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP111 P	Communication skills – Practical*	5	5	2 Hr	10	15	2 Hrs	25
BP112 RBP	Remedial Biology – Practical*	5	5	2 Hr	10	15	2 Hrs	25
	Total	70/75\$/80#	115/125\$/130#	23/24\$/ 26# Hrs	185/200\$ /210#	490/525\$/540#	31.5/33\$/ 35# Hrs	675/725\$ /750#

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

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

* Non University Examination (NUE)

Schemes for internal assessments and end semester examinations semester wise (Semester II)

Course Code	Name of Course	Internal Assessment				End Semester Exam		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP203T	Biochemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP204T	Pathophysiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP205T	Computer Applications in Pharmacy – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP206T	Environmental sciences – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP207P	Human Anatomy and Physiology II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4 Hr	15	35	4 Hrs	50
BP209P	Biochemistry – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP210P	Computer Applications in Pharmacy – Practical*	5	5	2 Hr	10	15	2 Hrs	25
	Total	80	125	20Hrs	205	520	30 Hrs	725

* The subject experts at college level shall conduct examinations

**Schemes for internal assessments and end semester examinations semester wise
(Semester III)**

Course Code	Name of Course	Internal Assessment				End Semester Exam		Total Marks
		Continu- ous Mode	Sessional Exams		Total	Marks	Duration	
			Mark s	Duration				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP302T	Physical Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP308P	Pharmaceutical Engineering –Practical	5	10	4 Hr	15	35	4 Hrs	50
	Total	60	100	20Hrs	160	440	28 Hrs	600

**Schemes for internal assessments and end semester examinations semester wise
(Semester IV)**

Course code	Name of the course	Internal Assessment				End semester Exams		Total Marks
		Continu ous Mode	Sessional Exams		Total	Marks	Durati on	
			Mark s	Durati on				
BP401T	Pharmaceutical Organic Chemistry III– Theory	10	15	1Hr	25	75	3Hrs	100
BP402T	Medicinal Chemistry I – Theory	10	15	1Hr	25	75	3Hrs	100
BP403T	Physical Pharmaceutics II – Theory	10	15	1Hr	25	75	3Hrs	100
BP404T	Pharmacology I – Theory	10	15	1Hr	25	75	3Hrs	100
BP405T	Pharmacognosy and Phytochemistry I– Theory	10	15	1Hr	25	75	3Hrs	100
BP406P	Medicinal Chemistry I – Practical	5	10	4Hr	15	35	4Hrs	50
BP407P	Physical Pharmaceutics II – Practical	5	10	4Hr	15	35	4Hrs	50
BP408P	Pharmacology I – Practical	5	10	4Hr	15	35	4Hrs	50
BP409P	Pharmacognosy I – Practical	5	10	4Hr	15	35	4Hrs	50
Total		70	115	21 Hrs	185	515	31 Hrs	700

**Schemes for internal assessments and end semester examinations semester wise
(Semester V)**

Course code	Name of the course	Internal Assessment				End semester Exams		Total Marks
		Continuo us Mode	Sessional Exams		Total	Marks	Durat ion	
			Marks	Durati on				
BP501 T	Medicinal Chemistry II – Theory	10	15	1Hr	25	75	3Hrs	100
BP502 T	Industrial PharmacyI– Theory	10	15	1Hr	25	75	3Hrs	100
BP503 T	Pharmacology II – Theory	10	15	1Hr	25	75	3Hrs	100
BP504 T	Pharmacognosy and Phytochemistry II– Theory	10	15	1Hr	25	75	3Hrs	100
BP505 T	Pharmaceutical Jurisprudence – Theory	10	15	1Hr	25	75	3Hrs	100
BP506 P	Industrial PharmacyI – Practical	5	10	4Hr	15	35	4Hrs	50
BP507 P	Pharmacology II – Practical	5	10	4Hr	15	35	4Hrs	50
BP508 P	Pharmacognosy and Phytochemistry II – Practical	5	10	4Hr	15	35	4Hrs	50
Total		65	105	17 Hrs	170	480	27 Hrs	650

**Schemes for internal assessments and end semester examinations semester wise
(Semester VI)**

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP601T	Medicinal Chemistry III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP602T	Pharmacology III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP603T	Herbal Drug Technology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP605T	Pharmaceutical Biotechnology–Theory	10	15	1 Hr	25	75	3 Hrs	100
BP606T	Quality Assurance– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP607P	Medicinal chemistry III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP608P	Pharmacology III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP609P	Herbal Drug Technology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		75	120	18 Hrs	195	555	30 Hrs	750

**Schemes for internal assessments and end semester examinations semester wise
(Semester VII)**

Course code	Name of the course	Internal Assessment				End Semes ter Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP701T	Instrumental Methods of Analysis – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP702T	Industrial Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP703T	Pharmacy Practice – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP704T	Novel Drug Delivery System – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP705 P	Instrumental Methods of Analysis – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP706 PS	Practice School*	25	-	-	25	125	5 Hrs	150
Total		70	70	8Hrs	140	460	21 Hrs	600

* The subject experts at college level shall conduct examinations

**Schemes for internal assessments and end semester examinations semester wise
(Semester VIII)**

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing – Theory	10 + 10 = 20	15 + 15 = 30	1 + 1 = 2 Hrs	25 + 25 = 50	75 + 75 = 150	3 + 3 = 6 Hrs	100 + 100 = 200
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardization of Herbals – Theory							
BP807ET	Computer Aided Drug Design – Theory							
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory							
BP812PW	Project Work	-	-	-	-	150	4 Hrs	150
Total		40	60	4 Hrs	100	450	16 Hrs	550

First Semester

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP101T	3	1	-	4 hours	25	75	100	4

45 Hours

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 this course the student should 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

10 hours

- **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

10 hours

- **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

10 hours

- **Body fluids and blood**

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

- **Lymphatic system**

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

Unit IV

08

hours

- **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

07 hours

- **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 Editions)

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

Reference Books (Latest Editions)

9. Physiological basis of Medical Practice-Best and Taylor. Williams & Wilkins Co, Riverview, MI USA

10. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata

Course Outcomes

The student will try to learn:

CO1. Recall the basics of life processes, structural organization, haemostatic mechanism cellular-level understanding of living beings, and understand the tissue level organization of human being

CO2. Explain the gross morphology, structure, and functions of the human integumentary and skeletal system

CO3 Summarize the gross morphology, structure, and functions of body fluids and the Lymphatic system.

CO4 Explain the morphology, structure, and functions of the peripheral nervous system and sense organs

CO5 Summarize the gross morphology, structure, and functions of Cardiovascular system.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	3	3	3	3	2	2	2
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	3	3	2	3	3	3	3
CO-4	2	3	2	2	3	2	2	3	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP107P	-	-	4	4 hours	15	35	50	2

4 Hours/week

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

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

Course Outcomes

The student will try to learn:

CO1. Recall the basics of life processes, structural organization, haemostatic mechanism cellular-level understanding of living beings, and understand the tissue level organization of human being

CO2. Explain the gross morphology, structure, and functions of the human integumentary and skeletal system

CO3 Summarize the gross morphology, structure, and functions of body fluids and the Lymphatic system.

CO4 Explain the morphology, structure, and functions of the peripheral nervous system and sense organs

CO5 Summarize the gross morphology, structure, and functions of Cardiovascular system.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	3	2	3	3	2	2	2
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	3	3	2	3	2	3	3
CO-4	2	3	2	2	1	2	2	3	1	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP102T	3	1	-	4 hours	25	75	100	4

45 Hours

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

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

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- develop analytical skills

Course Content:

UNIT-I

10 Hours

(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

10 Hours

Hours

- **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

10 Hours

- **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

08 Hours

- **Redox titrations**

(a) Concepts of oxidation and reduction

- Types of redox titrations (Principles and applications)

- Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

UNIT-V

07 Hours

• Electrochemical methods of analysis

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

Course Outcomes

The student will try to learn:

CO1. To understand the concepts Primary and Secondary standard, Errors in Analysis

CO2. To learn the concepts and importance of Acid Base and Non-aqueous Titration

CO3. To explain the importance Precipitation, Complexometry and Gravimetry

CO4. To understand the concept of Redox Titration

CO5. To know about the importance of Instrumental Analysis.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	3	3	2	1	3	2	2	3
CO-2	3	3	2	2	3	2	2	1	2	2	2
CO-3	2	2	3	2	2	3	2	3	3	3	3
CO-4	2	3	3	2	3	2	2	3	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP108P. PHARMACEUTICAL ANALYSIS (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP108P	-	-	4	4 hours	15	35	50	2

4 Hours / Week

I Limit Test of the following

- (1) Chloride
- (2) Sulphate
- (3) Iron
- (4) Arsenic

II Preparation and standardization of

- (1) Sodium hydroxide
- (2) Sulphuric acid
- (3) Sodium thiosulfate
- (4) Potassium permanganate
- (5) Ceric ammonium sulphate

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 complexometriy
- (5) Hydrogen peroxide by Permanganometry
- (6) Sodium benzoate by non-aqueous titration
- (7) Sodium Chloride by precipitation titration

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

Course Outcomes

The student will try to learn:

CO1. To understand the concepts Primary and Secondary standard, Errors in Analysis

CO2. To learn the concepts and importance of Acid Base and Non-aqueous Titration

CO3. To explain the importance Precipitation, Complexometry and Gravimetry

CO4. To understand the concept of Redox Titration

CO5. To know about the importance of Instrumental Analysis.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	1	3	3	3	2	2	2
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	2	3	2	3	3	3	3
CO-4	2	3	2	2	1	2	2	3	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP103T. PHARMACEUTICS- I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP103T	3	1	-	4 hours	25	75	100	4

Course Outcomes

The student will try to learn:

CO1. To Know the historical background and development of profession of pharmacy and introduction to dosage forms and handling of Prescription

CO2. To Understand/Know the pharmaceutical calculations and understand basics concepts of powders and liquid dosage forms

CO3. To understand formulation and evaluation of monophasic liquids and biphasic liquids

CO4. To Know the formulation requirement and evaluation of suppositories and understand pharmaceutical incompatibility

CO5. To Understand the formulation and evaluation of Semisolid dosage forms

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	3	1	3	1	2	2	2	2
CO-2	3	3	2	3	2	2	1	1	2	2	3
CO-3	2	2	3	2	3	3	2	3	3	3	3
CO-4	2	3	2	2	3	2	1	3	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP109P. PHARMACEUTICS-I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP109P	-	-	4	4 hours	15	35	50	2

45 Hours

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 this course the student should be able to:

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

Course Content:

UNIT – I

10 Hours

- **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

10 Hours

- **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

08 Hours

- **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

08 Hours

- **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.

UNIV – V

07 Hours

- **Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms

Recommended Books: (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. To Know the historical background and development of profession of pharmacy and introduction to dosage forms and handling of Prescription

CO2. To Understand/Know the pharmaceutical calculations and understand basics concepts of powders and liquid dosage forms

CO3. To understand formulation and evaluation of monophasic liquids and biphasic liquids

CO4. To Know the formulation requirement and evaluation of suppositories and understand pharmaceutical incompatibility

CO5. To Understand the formulation and evaluation of Semisolid dosage forms

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	2	3	3	3	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	3	3	3	3
CO-4	2	3	2	2	1	2	2	3	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP109P. PHARMACEUTICS-I (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP109P	-	-	4	4 hours	15	35	50	2

3 Hours / week

1. Syrups

- a) Syrup IP'66
- b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs

- a) Piperazine citrate elixir
- b) Paracetamol pediatric elixir

3. Linctus

- a) Terpin Hydrate Linctus IP'66
- b) Iodine Throat Paint (Mandles Paint)

4. Solutions

- a) Strong solution of ammonium acetate
- b) Cresol with soap solution
- c) Lugol's solution

5. Suspensions

- a) Calamine lotion
- b) Magnesium Hydroxide mixture
- c) Aluminium Hydroxide gel

6. Emulsions

- a) Turpentine Liniment
- b) Liquid paraffin emulsion

7. Powders and Granules

- a) ORS powder (WHO)

- b) Effervescent granules
- c) Dusting powder
- d) Divded powders

8. Suppositories

- a) Glycero gelatin suppository
- b) Coca butter suppository
- c) Zinc Oxide suppository

9. Semisolids

- a) Sulphur ointment
- b) Non staining-iodine ointment with methyl salicylate
- c) Carbopal gel
- d) Gargles and Mouthwashes
- e) Iodine gargle
- f) Chlorhexidine mouthwash

Course Outcomes

The student will try to learn:

CO1. To Know the historical background and development of profession of pharmacy and introduction to dosage forms and handling of Prescription

CO2. To Understand/Know the pharmaceutical calculations and understand basics concepts of powders and liquid dosage forms

CO3. To understand formulation and evaluation of monophasic liquids and biphasic liquids

CO4. To Know the formulation requirement and evaluation of suppositories and understand pharmaceutical incompatibility

CO5. To Understand the formulation and evaluation of Semisolid dosage forms

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	1	1	1	1	1	2	2	1	2	2	1
CO-2	1	1	2	1	1	2	2	2	2	2	2
CO-3	2	1	2	1	1	2	2	2	3	2	2
CO-4	2	1	2	1	2	2	2	2	3	2	2
CO-5	2	1	2	1	1	3	2	2	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP104T	3	1	-	4 hours	25	75	100	4

45 Hours

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

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

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

Course Content:

UNIT I

10 Hours

- **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

10 Hours

- **Acids, Bases and Buffers:** Buffer equations and buffers in buffer capacity in general buffer in pharmaceutical systems, preparation, stability, buffer isotonic solution, 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

10 Hours

- **Gastrointestinal agents**

Acidifiers: Ammonium chloride* and Dil. HCl

Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations

UNIT IV

08 Hours

- **Miscellaneous compounds**

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

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

Astringents: Zinc Sulphate, Potash Alum

UNIT V

07 Hours

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

Recommended Books (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. To list the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals

CO2. To understand the preparation, properties, assay and uses of acid base, buffers, electrolytes, and dental products.

CO3. To understand the preparation, properties, assay and uses of gastrointestinal agents

CO4. To understand the preparation, properties, assay and uses of poison, antidots, expectorants, emetics, hemanatics and astringents

CO5. To understand the medicinal and pharmaceutical importance of radiopharmaceuticals

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	3	3	3	3	2	2	2
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	3	3	2	3	3	3	3
CO-4	2	3	2	2	3	2	2	3	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP105T. COMMUNICATION SKILLS (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP105P	2	-	-	2 hours	15	35	50	2

30 Hours

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 student 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

07 Hours

- **Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
- **Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers
- **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT – II

07 Hours

- **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

07 Hours

- **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

05 Hours

- **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

04 Hours

- **Group Discussion:** Introduction, Communication skills in group discussion, Do's and Don't's of group discussion

Recommended Books: (Latest Edition)

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

Course Outcomes

The student will try to learn:

- CO1.** Developing all dimensions of personality in terms of communication skills to express, understand and convey the thoughts impressively in a given situation
- CO2.** Construct an understanding of verbal and nonverbal communication and various styles.
- CO3.** Develop better listening skills and written communication.
- CO4.** Develop interview skills and the art of presentation.
- CO5.** Build the ability for group discussion and leadership skills.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	1	2	2	1	2	2	2
CO-3	2	2	3	2	2	3	2	2	3	3	3
CO-4	2	3	2	2	1	2	2	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP 106RBT.REMEDIAL BIOLOGY (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 106RBT	2	-	-	2 hours	15	35	50	2

30 Hours

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 student shall be able to

- know the classification and salient features of five kingdoms of life
- understand the basic components of anatomy & physiology of plant
- know understand the basic components of anatomy & physiology animal with special reference to human

UNIT I

07 Hours

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, Protista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants

- Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
- General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledones.

UNIT II

07 Hours

Body fluids and circulation

- Composition of blood, blood groups, coagulation of blood
- Composition and functions of lymph
- Human circulatory system
- Structure of human heart and blood vessels
- Cardiac cycle, cardiac output and ECG

Digestion and Absorption

- Human alimentary canal and digestive glands
- Role of digestive enzymes
- Digestion, absorption and assimilation of digested food

Breathing and respiration

- Human respiratory system
- Mechanism of breathing and its regulation
- Exchange of gases, transport of gases and regulation of respiration
- Respiratory volumes

UNIT III

07 Hours

Excretory products and their elimination

- Modes of excretion
- Human excretory system- structure and function
- Urine formation
- Renin 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

05 Hours

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

04 Hours

Plant respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant growth and development

- Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators

Cell - The unit of life

- Structure and functions of cell and cell organelles. Cell division

Tissues

- Definition, types of tissues, location and functions.

Text Books

- a. Text book of Biology by S. B. Gokhale
- b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference Books

- a. A Text book of Biology by B.V. Sreenivasa Naidu
- b. A Text book of Biology by Naidu and Murthy
- c. Botany for Degree students By A.C.Dutta.
- d. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
- e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

Course Outcomes

The student will try to learn:

CO1. To know the classification and salient features of five kingdoms of life

CO2. To understand the basic components of anatomy & physiology of plant

CO3. To understand the basic components of anatomy & physiology of human

CO4. Demonstrate the scientific concepts of human anatomy related to blood circulation respiration and digestion

CO5. Demonstrate the scientific concepts of human biology related to CNS, Excretion and hormonal regulation

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	1	1	1	1	1	2	2	1	2	2	1
CO-2	1	1	2	1	1	2	2	2	2	2	2
CO-3	2	1	2	1	1	2	2	2	3	2	2
CO-4	2	1	2	1	2	2	2	2	3	2	2
CO-5	2	1	2	1	1	3	2	2	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 106RMT. REMEDIAL MATHEMATICS (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 106RMT	2	-	-	2 hours	15	35	50	2

30 Hours

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 student 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

06 Hours

- **Partial fraction**

Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics

- **Logarithms**

Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

- **Function:**

Real Valued function, Classification of real valued functions,

- Limits and continuity:

Introduction , Limit of a function, Definition of limit of a function ($\epsilon - \delta$

definition) , $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$, $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$,

UNIT –II

06 Hours

- **Matrices and Determinant:**

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

UNIT – III

06 Hours

- **Calculus**

Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n w.r.tx, where n is any rational number, Derivative of e^x , Derivative of $\log_e x$, 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

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

06 Hours

- 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)

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

Course Outcomes

The student will try to learn:

CO1. Know the introduction of partial fraction, logarithm, function and limits, and continuity.

CO2. Solve the different types of problems by applying matrices and determinants.

CO3. Appreciate and understand the principles and solve the problem related to calculus.

CO4. Summarize the principle and application of Analytical Geometry.

CO5. Explain the theory and application of differential equation, and Laplace transform.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	1	3	3	1	2	2	2
CO-2	3	3	2	2	1	2	2	1	2	2	2
CO-3	2	2	3	2	2	3	2	2	3	3	3
CO-4	2	3	2	2	1	2	2	1	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP110P	-	-	4	4 hours	15	35	50	2

4 Hours / Week

II 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

III Identification test

Magnesium hydroxide
Ferrous sulphate
Sodium bicarbonate
Calcium gluconate
Copper sulphate

IV Test for purity

Swelling power of Bentonite
Neutralizing capacity of aluminum hydroxide gel
Determination of potassium iodate and iodine in potassium Iodide

V Preparation of inorganic pharmaceuticals

Boric acid
Potash alum
Ferrous sulphate

Course Outcomes

The student will try to learn:

CO1. To list the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals

CO2. To understand the preparation, properties, assay and uses of acid base, buffers, electrolytes, and dental products.

CO3. To understand the preparation, properties, assay and uses of gastrointestinal agents

CO4. To understand the preparation, properties, assay and uses of poison, antidotes, expectorants, emetics, hemanatics and astringents

CO5. To understand the medicinal and pharmaceutical importance of radiopharmaceuticals

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	3	2	3	1	3	3	1	2	2	3
CO-2	3	3	2	2	1	2	2	1	2	2	3
CO-3	2	2	3	3	2	3	2	2	2	3	3
CO-4	2	3	2	2	1	2	2	1	2	2	2
CO-5	2	3	2	2	1	3	2	2	2	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP111P.COMMUNICATION SKILLS (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP111P	2	-	-	2 hours	10	15	25	1

2 Hours / week

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

Basic communication covering the following topics

Meeting People
Asking Questions
Making Friends
What did you do?
Do's and Dont's

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)
Pronunciation and Nouns
Pronunciation (Vowel Sounds)

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

Course Outcomes

The student will try to learn:

- CO1.** Developing all dimensions of personality in terms of communication skills to express, understand and convey the thoughts impressively in a given situation
- CO2.** Construct an understanding of verbal and nonverbal communication and various styles.
- CO3.** Develop better listening skills and written communication.
- CO4.** Develop interview skills and the art of presentation.
- CO5.** Build the ability for group discussion and leadership skills.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	3	1	3	3	1	3	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	3
CO-3	2	2	3	2	2	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	2	2	3	2	2
CO-5	2	3	2	2	2	3	2	2	3	2	3

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP112RBP. REMEDIAL BIOLOGY (Practical)

Sub Code	L	T	P	Duration	IA	ESE		Total	Credits
BP112 RBP	-	-	2	2 hours	10	15		25	1

30 Hours

1. Introduction to experiments in biology

- Study of Microscope
- Section cutting techniques
- Mounting and staining
- Permanent slide preparation

2. Study of cell and its inclusions

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

4. Detailed study of frog by using computer models

5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower

6. Identification of bones

7. Determination of blood group

8. Determination of blood pressure

9. Determination of tidal volume

Reference Books

- Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
- A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
- Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi

Course Outcomes

The student will try to learn:

CO1. To know the classification and salient features of five kingdoms of life

CO2. To understand the basic components of anatomy & physiology of plant

CO3. To understand the basic components of anatomy & physiology of human

CO4. Demonstrate the scientific concepts of human anatomy related to blood circulation respiration and digestion

CO5. Demonstrate the scientific concepts of human biology related to CNS, Excretion and hormonal regulation

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	2	2	2	2	1	2	2	3
CO-5	2	3	2	2	1	3	2	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

Second Semester

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP201T	3	1	-	4 hours	25	75	100	4

45 Hours

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 this course the student should 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
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Content:

Unit I

10 hours

- **Nervous system**

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

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

Unit II

06 hours

- **Digestive system**

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

- **Energetics**

Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III

10 hours

- **Respiratory system**

Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration

Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

- **Urinary system**

Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Unit IV

10 hours

- **Endocrine system**

Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

Unit V

09 hours

- **Reproductive system**

Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition

- **Introduction to genetics**

Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance

Recommended Books (Latest Editions)

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

Reference Books:

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

Course Outcomes

The student will try to learn:

CO1. To explain the organization of nervous system, structure and functions of nervous system.

CO2. Illustrate the anatomy, regulation, and disorders of the digestive system and energetics.

CO3. Make use of knowledge related to the anatomy of the respiratory system and urinary system

CO4. Relate the interlinked classification, mechanism, and functions of the endocrine system

CO5. Explain the anatomy, physiology, and functions of the reproductive system and aspects of genetics.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	3
CO-3	2	2	3	2	1	3	2	2	3	3	2
CO-4	2	3	2	2	1	2	2	1	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 207 P	-	-	4	4	15	35	50	2

4 Hours/week

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

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

Course Outcomes

The student will try to learn:

CO1. To explain the organization of nervous system, structure and functions of nervous system.

CO2. Illustrate the anatomy, regulation, and disorders of the digestive system and energetics.

CO3. Make use of knowledge related to the anatomy of the respiratory system and urinary system

CO4. Relate the interlinked classification, mechanism, and functions of the endocrine system

CO5. Explain the anatomy, physiology, and functions of the reproductive system and aspects of genetics.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	3	1	3	3	1	2	2	3
CO-2	3	3	2	2	1	2	2	1	2	2	2
CO-3	2	2	3	3	2	3	2	2	3	3	3
CO-4	2	3	2	2	1	2	2	2	2	2	2
CO-5	2	3	2	3	2	3	2	1	2	2	3

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP202T	3	1	-	4 hours	25	75	100	4

45 Hours

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.

Objectives: Upon completion of the course the student 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

07 Hours

- **Classification, nomenclature and isomerism**

Classification of Organic Compounds

Common and IUPAC systems of nomenclature of organic compounds

(Up to 10 Carbons open chain and carbocyclic compounds)

Structural isomerism's in organic compounds

UNIT-II

10 Hours

- Alkanes*, Alkenes* and Conjugated dienes*

SP³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

Stabilities of alkenes, SP hybridization in alkenes

E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 versus 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

10 Hours

- **Alkyl halides***

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

SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions

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

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

UNIT-IV

10 Hours

- **Carbonyl compounds* (Aldehydes and ketones)**

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

UNIT-V

08 Hours

- **Carboxylic acids***

Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amide and ester

Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

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

Recommended Books (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. To understand the classification, nomenclature and isomerism of simple organic compounds

CO2. Explaining the basic concepts of reaction involving in alkanes, alkenes and conjugated dienes

CO3. To understand the Structure, reactions and uses involve in alkyl halides and alcohols

CO4. To exploring the reactions, involve in carbonyl compounds there uses and structures

CO5. Evaluating the acidity and basicity, structure, uses and effects of substitutions on carboxylic acid and aliphatic amines

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	3	1	3	3	1	2	2	2
CO-2	3	3	3	2	2	2	2	1	2	2	2
CO-3	2	2	3	1	2	3	2	2	3	3	3
CO-4	2	3	2	2	1	2	2	2	2	2	3
CO-5	2	3	2	3	2	3	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 208 P	-	-	4	4	15	35	50	2

4 Hours / week

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

Course Outcomes

The student will try to learn:

CO1. To understand the classification, nomenclature and isomerism of simple organic compounds

CO2. Explaining the basic concepts of reaction involving in alkanes, alkenes and conjugated dienes

CO3. To understand the Structure, reactions and uses involve in alkyl halides and alcohols

CO4. To exploring the reactions, involve in carbonyl compounds there uses and structures

CO5. Evaluating the acidity and basicity, structure, uses and effects of substitutions on carboxylic acid and aliphatic amines

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP203 T. BIOCHEMISTRY (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP203T	3	1	-	4 hours	25	75	100	4

45 Hours

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.

Objectives: Upon completion of course student 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:

UNIT I

08 Hours

- **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

10 Hours

- **Carbohydrate metabolism**

Glycolysis – Pathway, energetics and significance

Citric acid cycle- Pathway, energetics and significance

HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency

Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance

Hormonal regulation of blood glucose level and Diabetes mellitus

- **Biological oxidation**

Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation

Inhibitors ETC and oxidative phosphorylation/Uncouplers

UNIT III

10 Hours

- **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 (Phenylketonuria, Albinism, alkaptonuria, tyrosinemia)

Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline

Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV

10 Hours

- **Nucleic acid metabolism and genetic information transfer**

Biosynthesis of purine and pyrimidine nucleotides

Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome

Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis

Genetic code, Translation or Protein synthesis and inhibitors

UNIT V

07 Hours

- **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.

Course Outcomes

The student will try to learn:

CO1. Demonstrate and define fundamental principles and nature of biomolecules

CO2. Outline and relate carbohydrate metabolic pathways and biological oxidation.

CO3. Understanding the metabolism of lipids and amino acids.

CO4. Understand the genetic organization of the mammalian genome and structure, functions of DNA and RNA.

CO5. Discuss the catalytic role and therapeutic and diagnostic applications of enzymes.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	3	2	3	3	3
CO-4	3	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 209 P. BIOCHEMISTRY (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 209 P	-	-	4	4	15	35	50	2

4 Hours / Week

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

Course Outcomes

The student will try to learn:

CO1. Demonstrate and define fundamental principles and nature of biomolecules

CO2. Outline and relate carbohydrate metabolic pathways and biological oxidation.

CO3. Understanding the metabolism of lipids and amino acids.

CO4. Understand the genetic organization of the mammalian genome and structure, functions of DNA and RNA.

CO5. Discuss the catalytic role and therapeutic and diagnostic applications of enzymes.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	3
CO-2	3	3	2	3	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP 204T. PATHOPHYSIOLOGY (THEORY)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP204T	3	1	-	4 hours	25	75	100	4

45Hours

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.

Objectives: Upon completion of the subject student shall be able to –

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

Course content:

Unit I

10Hours

- **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

10Hours

- **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 II

10Hours

- **Hematological Diseases:**

Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, 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

8 Hours

- 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

7 Hours

- **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.
- 6.

Course Outcomes

The student will try to learn:

CO1. Outline principles of cell injury adaptation and explain the basic mechanism involved in the process of inflammation and repair

CO2. The student will be able to understand the pathophysiology of cardiovascular, respiratory, and renal system

CO3. Classify and understand salient features related to the pathophysiology of hematological diseases, endocrine, nervous and gastrointestinal system

CO4. Define the etiology and pathophysiological mechanism of cancer and diseases of bone and joints

CO5. Understand the basic pathophysiological mechanisms of infectious and sexually transmitted diseases.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP205 T	2	1	-	2 hours	10	15	25	1

30 Hrs (2 Hrs/Week)

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

Objectives: Upon completion of the course the student 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

06 hours

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

06 hours

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

06 hours

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

06 hours

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

UNIT – V

06 hours

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

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Wiley 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

Course Outcomes

The student will try to learn:

- CO1.** Outline the basics of Number sysand explain the Concept of Information Systems and Software.
- CO2.** Define the web technologies and Introduction to databases
- CO3.** Explain the application of computers in pharmacy
- CO4.** Outline the Introduction, Objective, Databases and Concept of Bioinformatics.
- CO5.** To Understand the computers as data analysis in preclinical development

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	3	2	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	3	1	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP205 T	2	1	-	2 hours	10	15	25	1

30 Hrs (2 Hrs/Week)

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

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

4. know the various types of application of computers in pharmacy
5. know the various types of databases
6. know the various applications of databases in pharmacy

Course content:

UNIT – I

06 hours

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

06 hours

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

06 hours

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

06 hours

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

UNIT – V

06 hours

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

Recommended books (Latest edition):

5. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
6. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Wiley and Sons, INC., Publication, USA
7. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
8. 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

Course Outcomes

The student will try to learn:

- CO1.** Outline the basics of Number sysand explain the Concept of Information Systems and Software.
- CO2.** Define the web technologies and Introduction to databases
- CO3.** Explain the application of computers in pharmacy
- CO4.** Outline the Introduction, Objective, Databases and Concept of Bioinformatics.
- CO5.** To Understand the computers as data analysis in preclinical development

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	2	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	1	3	3	3
CO-4	2	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 210P	-	-	2	2	10	15	25	1

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

6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages

Course Outcomes

The student will try to learn:

CO1. Outline the basics of Number sysand explain the Concept of Information Systems and Software.

CO2. Define the web technologies and Introduction to databases

CO3. Explain the application of computers in pharmacy

CO4. Outline the Introduction, Objective, Databases and Concept of Bioinformatics.

CO5. To Understand the computers as data analysis in preclinical development

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	2	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	3	2	2	3	1	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP206T	3	-	-	3 hours	25	50	75	3

30 hours

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.

Objectives: Upon completion of the course the student 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

10hours

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

10hours

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

10hours

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

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

Course Outcomes

The student will try to learn:

CO1. To understand the multidisciplinary nature of environmental studies.

CO2. To understand the role of an individual in concern of natural sources.

CO3. To understand the Concept, Structure and function of an ecosystem.

CO4. To understand Introduction, types and characteristic features of the ecosystems.

CO5. To learn the concept of environmental pollution and create awareness about pollution.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

THIRD SEMESTER

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP301T	3	1	-	4 hours	25	75	100	4

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 student 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

10 Hours

- **Benzene and its derivatives**

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

UNIT II **10**
Hours

- **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 **10 Hours**

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

UNIT IV **08**
Hours

- **Polynuclear hydrocarbons**
 - a. Synthesis, reactions
 - b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT V **07**
Hours

- **Cyclo alkanes***
Stabilities – Baeyer’s strain theory, limitation of Baeyer’s strain theory, Coulson and Moffitt’s modification, Sachse Mohr’s theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.

Recommended Books (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. Interpret the structure, reactions and substituents of benzene and its derivative

CO2. Explain the methods of preparation, reactions and the type of isomerism of the phenol, aromatic amines and aromatic acids.

CO3. Elaborate various reactions and properties of fats and oils.

CO4. Explain synthesis and uses of polynuclear hydrocarbons.

CO5. Label general methods of preparation and reactions of different cyclo alkanes.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	1	3	3	1	3	2	2	2	3	3
CO-2	3	1	3	3	1	3	2	1	3	3	3
CO-3	3	1	3	3	1	3	2	1	3	3	3
CO-4	3	1	3	3	1	3	2	1	3	3	3
CO-5	3	1	3	3	1	3	2	1	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP305P	-	-	4	4 hours	15	35	50	2

- I. Experiments involving laboratory techniques
 - Recrystallization
 - Steam distillation
- II. Determination of following oil values (including standardization of reagents)
 - Acid value
 - Saponification value
 - Iodine value
- III. Preparation of compounds
 - Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
 - 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
 - Acetanilide by halogenation (Bromination) reaction.
 - 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
 - Benzoic acid from Benzyl chloride by oxidation reaction.
 - Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
 - 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.
 - Benzil from Benzoin by oxidation reaction.
 - Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction
 - Cinnamic acid from Benzaldehyde by Perkin reaction
 - *P*-Iodo benzoic acid from *P*-amino benzoic acid

Course Outcomes

The student will try to learn:

CO1. Interpret the structure, reactions and substituents of benzene and its derivative

CO2. Explain the methods of preparation, reactions and the type of isomerism of the phenol, aromatic amines and aromatic acids.

CO3. Elaborate various reactions and properties of fats and oils.

CO4. Explain synthesis and uses of polynuclear hydrocarbons.

CO5. Label general methods of preparation and reactions of different cyclo alkanes.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	2
CO-2	3	3	2	2	2	2	2	1	2	2	3
CO-3	2	2	3	2	2	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	3	1	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP302T	3	1	-	4 hours	25	75	100	4

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 the completion of the course student shall be able to

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

Course Content:

UNIT-I

10 Hours

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

UNIT-II

10 Hours

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

08

Hours

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.

UNIT-IV

08 Hours

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

UNIT-V

07

Hours

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

Recommended Books: (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. To understand concept of solubility of drugs, solubility expression, factors affecting solubility, different types of solutions, diffusion principle and applications of distribution law.

CO2. To understand different States of Matter, properties of matter and physiochemical properties of drug molecules

CO3. To get knowledge of surface and interfacial phenomenon, surface active agents, HLB Scale, solubilisation detergency and adsorption at solid interfaces

CO4. To understand complexation and protein binding, classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

CO5. To understand the concept of pH, buffers and Isotonic solutions, pH determination, applications of buffers, buffer equation and isotonic solutions

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	3	1	2	3	2	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP306P	-	-	4	4 hours	15	35	50	2

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

Course Outcomes

The student will try to learn:

CO1. To understand concept of solubility of drugs, solubility expression, factors affecting solubility, different types of solutions, diffusion principle and applications of distribution law.

CO2. To understand different States of Matter, properties of matter and physiochemical properties of drug molecules

CO3. To get knowledge of surface and interfacial phenomenon, surface active agents, HLB Scale, solubilisation detergency and adsorption at solid interfaces

CO4. To understand complexation and protein binding, classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

CO5. To understand the concept of pH, buffers and Isotonic solutions, pH determination, applications of buffers, buffer equation and isotonic solutions

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	2	1	3	3	1	2	2	3
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	1	3	2	2	3	3	3
CO-4	2	3	2	3	2	2	3	1	2	2	3
CO-5	2	3	2	2	2	3	2	2	2	2	3

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP303T	3	1	-	4 hours	25	75	100	4

45 Hours

Scope:

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

Objectives: Upon completion of the subject student shall be able to;

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. To 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

10 Hours

- Introduction, history of microbiology, its branches, scope and its importance.
- Introduction to Prokaryotes and Eukaryotes
- Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).
- Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

Unit II

10 Hours

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

Unit III

10 Hours

- 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

08 Hours

- 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

07 Hours

- 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. Pepler: 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

Course Outcomes

The student will try to learn:

- CO1.** Explain microbiology, Prokaryotes, Eukaryotes, Bacteria and types of microscopy.
- CO2.** Interpret the importance and implementation of sterilization and aseptic conditions in pharmaceutical processing and industry
- CO3.** Define fungi and viruses and sterility testing of pharmaceutical products
- CO4.** Outline the cell culture technology, aseptic area, and methods of standardization.
- CO5.** Illustrate methods of identification, cultivation, subculturing, and preservation of various microorganisms, growth of animal cells, and application in the pharmaceutical Industry.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	1	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	2	2	2	1	2	3	2	3
CO-4	1	2	3	3	2	3	1	2	3	2	3
CO-5	1	2	2	3	1	2	2	3	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 307P. PHARMACEUTICAL MICROBIOLOGY (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 307P	-	-	4	4 hours	15	35	50	2

4 Hrs/week

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid-fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test.

Course Outcomes

The student will try to learn:

CO1. Explain microbiology, Prokaryotes, Eukaryotes, Bacteria and types of microscopy.

CO2. Interpret the importance and implementation of sterilization and aseptic conditions in pharmaceutical processing and industry

CO3. Define fungi and viruses and sterility testing of pharmaceutical products

CO4. Outline the cell culture technology, aseptic area, and methods of standardization.

CO5. Illustrate methods of identification, cultivation, subculturing, and preservation of various microorganisms, growth of animal cells, and application in the pharmaceutical Industry.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	1	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	2	2	2	1	2	3	2	2
CO-4	1	2	3	3	2	3	1	2	3	2	3
CO-5	1	2	2	3	1	2	2	3	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 304 T	3	1	-	4 hours	25	75	100	4

45 Hours

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 student shall be able:

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 Hours

10

- **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 Hours

10

- **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

08

Hours

- **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

08

Hours

- **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

07

Hours

- **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 their prevention. Ferrous and nonferrous metals, inorganic and organic non-metals, basic of material handling systems.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation of chemical engineering – McCabe 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 pharmaceuticals- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

Course Outcomes

The student will try to learn:

- CO1.** Explain various operations of the flow of fluids, size reduction & size separation.
- CO2.** Relate the principles and operations involved in heat transfer, Evaporation, and distillation.
- CO3.** Explain the concept of drying and mixing with the equipment used.
- CO4.** Outline the concept of filtration and centrifugation with the equipment used.
- CO5.** Explain the concept of material of pharmaceutical plant construction, corrosion, and its prevention.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	1	2	3	2	1	2	2	1	2	3	2
CO-3	2	3	3	2	2	2	1	2	3	2	3
CO-4	1	2	2	3	2	3	1	1	2	2	2
CO-5	1	2	2	3	1	2	2	2	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 308P	-	-	4	4 hours	15	35	50	2

4 Hours/week

1. Determination of radiation constant of brass, iron, unpainted and painted glass.
2. Steam distillation – To calculate the efficiency of steam distillation.
3. To determine the overall heat transfer coefficient by heat exchanger.
4. Construction of drying curves (for calcium carbonate and starch).
5. Determination of moisture content and loss on drying.
6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
7. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
8. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
9. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
11. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity)
12. To study the effect of time on the Rate of Crystallization.
13. To calculate the uniformity Index for given sample by using Double Cone Blender.

Course Outcomes

The student will try to learn:

CO1. Explain various operations of the flow of fluids, size reduction & size separation.

CO2. Relate the principles and operations involved in heat transfer, Evaporation, and distillation.

CO3. Explain the concept of drying and mixing with the equipment used.

CO4. Outline the concept of filtration and centrifugation with the equipment used.

CO5. Explain the concept of material of pharmaceutical plant construction, corrosion, and its prevention.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	2	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	2	2	2	1	2	3	2	2
CO-4	1	2	3	3	2	3	1	2	3	2	3
CO-5	3	2	2	3	1	2	2	1	2	2	3

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

Fourth Semester

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 401 T	3	1	-	4 hours	25	75	100	4

45 Hours

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.

Objectives: At the end of the course, the student 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

10 Hours

Stereo isomerism

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

UNIT-II

10 Hours

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

UNIT-III**10 Hours****Heterocyclic compounds:**

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

UNIT-IV**8 Hours**

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

UNIT-V**07 Hours****Reactions of synthetic importance**

- Metal hydride reduction (NaBH_4 and LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.
- Oppenauer-oxidation and Dakin reaction.
- Beckmanns rearrangement and Schmidt rearrangement.
- Claisen-Schmidt condensation

Recommended Books (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. To understand the stereo chemical aspects of organic compounds and stereo chemical reactions

CO2. To explain the geometrical isomerism, Conformational isomerism, stereospecific and stereoselective reactions in different type of organic compounds.

CO3. To study the nomenclature, synthesis and reactivity of heterocyclic compounds (five membered with one hetero atom).

CO4. To summarize the methods of preparation and properties of heterocyclic compounds.

CO5. To understand the reactions of synthetic importance.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	2	2	3	2	1	2	2	3	2	3	2
CO-3	2	3	3	2	2	2	1	2	3	2	3
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP402T. MEDICINAL CHEMISTRY – I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 402 T	3	1	-	4 hours	25	75	100	4

45 Hours

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 (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**10 Hours**

- **Introduction to Medicinal Chemistry**
- **History and development of medicinal chemistry**
- **Physicochemical properties in relation to biological action**
 - Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.
- **Drug metabolism**
 - Drug metabolism principles- Phase I and Phase II.
 - Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II**10 Hours**

- **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

10 Hours

- **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, Isofluorophate, 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

08 Hours

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

- a. **Benzodiazepines:** SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem
- b. **Barbiturates:** SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital
- c. **Miscellaneous:**
 - i. Amides & imides: Glutethimide.
 - ii. Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol.
 - iii. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

- a. **Phenothiazines:** SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.
- b. **Ring Analogues of Phenothiazines:** Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.
- c. **Fluorobutyrophenones:** Haloperidol, Droperidol, Risperidone.
- d. **Beta amino ketones:** Molindone hydrochloride.
- e. **Benzamides:** Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action

- a. **Barbiturates:** Phenobarbitone, Methobarbital.
- b. **Hydantoins:** Phenytoin*, Mephenytoin, Ethotoin
- c. **Oxazolidine diones:** Trimethadione, Paramethadione
- d. **Succinimides:** Phensuximide, Methsuximide, Ethosuximide*
- e. **Urea and monoacylureas:** Phenacemide, Carbamazepine*

- f. **Benzodiazepines:** Clonazepam
- g. **Miscellaneous:** Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V

07 Hours

Drugs acting on Central Nervous System

A. General anesthetics:

- a. **Inhalation anesthetics:** Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
- b. **Ultra-short acting barbiturates:** Methohexital sodium*, Thiopental sodium, Thiopental sodium.
- c. **Dissociative anesthetics:** Ketamine hydrochloride.*

B. Narcotic and non-narcotic analgesics

- a. **Morphine and related drugs:** SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.
- b. **Narcotic antagonists:** Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.
- c. **Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, 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. Martindale's extra pharmacopoeia
6. Organic Chemistry by I.L. Finar, Vol. II.
7. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
8. Indian Pharmacopoeia.
9. Text book of practical organic chemistry- A.I. Vogel.

Course Outcomes

The student will try to learn:

CO1. To understand the introduction, history and development of medicinal chemistry and drug metabolism.

CO2. To assess structural activity relationship, mechanism of action, classification, and uses of drugs acting on the Autonomic nervous system.

CO3. To understand the Cholinergic neurotransmitters and Parasympathomimetic agents.

CO4. To extend the knowledge of drugs acting on central nervous systems like sedatives, antipsychotics, anticonvulsants etc.

CO5. To extend the knowledge of Drugs acting on Central Nervous System like General anesthetics, Narcotic and non-narcotic analgesics and Anti-inflammatory agents.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	2	2	2	2	1	2	2	2
CO-2	2	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	3	2	2	1	3	3	2	3
CO-4	3	2	3	3	2	3	1	2	3	2	2
CO-5	2	2	2	3	1	2	2	1	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 403 T	3	1	-	4 hours	25	75	100	4

45 Hours

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 the completion of the course student shall be able to

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

Course Content:

UNIT-I

07 Hours

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

10 Hours

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

10 Hours

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

10 Hours

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

UNIT-V

10 Hours

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. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

Course Outcomes

The student will try to learn:

CO1. To understand the various physical and physicochemical properties, classification, and principles involved in Colloidal dispersions.

CO2. Explain rheology and Deformation of solids.

CO3. Examine the Coarse dispersion like suspension and emulsion.

CO4. Illustrate the concept of micromeritics.

CO5. Demonstrate the role of various physical and chemical factors in drug stability and reaction kinetics.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP406P. MEDICINAL CHEMISTRY – I (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 406P	-	-	4	4 hours	15	35	50	2

4 Hours/Week

II. Preparation of drugs/ intermediates

- 1,3-pyrazole
- 1,3-oxazole
- Benzimidazole
- Benztriazole
- 2,3- diphenyl quinoxaline
- Benzocaine
- Phenytoin
- Phenothiazine
- Barbiturate

III. Assay of drugs

- Chlorpromazine
- Phenobarbitone
- Atropine
- Ibuprofen
- Aspirin
- Furosemide

IV. Determination of Partition coefficient for any two drugs

Course Outcomes

The student will try to learn:

CO1. To understand the introduction, history and development of medicinal chemistry and drug metabolism.

CO2. To assess structural activity relationship, mechanism of action, classification, and uses of drugs acting on the Autonomic nervous system.

CO3. To understand the Cholinergic neurotransmitters and Parasympathomimetic agents.

CO4. To extend the knowledge of drugs acting on central nervous systems like sedatives, antipsychotics, anticonvulsants etc.

CO5. To extend the knowledge of Drugs acting on Central Nervous System like General anesthetics, Narcotic and non-narcotic analgesics and Anti-inflammatory agents.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	1	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	1	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	1	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 407P	-	-	4	4 hours	15	35	50	2

3 Hrs/week

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

Course Outcomes

The student will try to learn:

- CO1.** To understand the various physical and physicochemical properties, classification, and principles involved in Colloidal dispersions.
- CO2.** Explain rheology and Deformation of solids.
- CO3.** Examine the Coarse dispersion like suspension and emulsion.
- CO4.** Illustrate the concept of micromeritics.
- CO5.** Demonstrate the role of various physical and chemical factors in drug stability and reaction kinetics.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	3	2	2	2	3	2
CO-3	2	3	3	2	1	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 404 T. PHARMACOLOGY-I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 404 T	3	1	-	4 hours	25	75	100	4

45 Hrs

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.

Objectives: Upon completion of this course the student should 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

08 hours

General Pharmacology

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

UNIT-II

12 Hours

General Pharmacology

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

UNIT-III

10 Hours

Pharmacology of drugs acting on peripheral nervous system

- a. Organization and function of ANS.
- b. Neurohumoral transmission, co-transmission and classification of neurotransmitters.
- c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.
- d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
- e. Local anesthetic agents.
- f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV

08 Hours

Pharmacology of drugs acting on central nervous system

- 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

07 Hours

Pharmacology of drugs acting on central nervous system

- 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, Churchill 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,

Course Outcomes

The student will try to learn:

- CO1.** To know the basics of principle and concept of pharmacology, including pharmacokinetics
- CO2.** Relate and develop fundamentals of pharmacodynamics, Adverse drug reactions, Drug interactions and Drug discovery and clinical evaluation.
- CO3.** Explain the pharmacology of drugs acting on the peripheral nervous system
- CO4.** Explain the Pharmacology of drugs acting on central nervous system like anesthetics, Sedatives, hypnotics, Anti-epileptics etc.
- CO5.** Explain the Pharmacology of drugs acting on central nervous system like Psychopharmacological agent, drugs used in Parkinsons disease and Alzheimer's disease, CNS stimulants and nootropics, Opioid drugs etc..

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	1	2	3	3
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 408 P. PHARMACOLOGY-I (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 408P	-	-	4	4 hours	15	35	50	2

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

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

Course Outcomes

The student will try to learn:

- CO1.** To know the basics of principle and concept of pharmacology, including pharmacokinetics
- CO2.** Relate and develop fundamentals of pharmacodynamics, Adverse drug reactions, Drug interactions and Drug discovery and clinical evaluation.
- CO3.** Explain the pharmacology of drugs acting on the peripheral nervous system
- CO4.** Explain the Pharmacology of drugs acting on central nervous system like anesthetics, Sedatives, hypnotics, Anti-epileptics etc.
- CO5.** Explain the Pharmacology of drugs acting on central nervous system like Psychopharmacological agent, drugs used in Parkinsons disease and Alzheimer's disease, CNS stimulants and nootropics, Opioid drugs etc..

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP 405 T. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP 405 T	3	1	-	4 hours	25	75	100	4

45 Hours

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.

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

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

Course Content:

UNIT-I

10 Hours

Introduction to Pharmacognosy:

- (a) Definition, history, scope and development of Pharmacognosy
- (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture
- (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

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

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II

10 Hours

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

07 Hours

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

10 Hours

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**08 Hours**

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. Saunders & 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), 1st Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, 2nd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iyenga

Course Outcomes

The student will try to learn:

CO1. To Summarize general introduction of pharmacognosy, classification of crude drugs, and quality control of drugs of natural origin

CO2. To understand the cultivation, collection, processing, and storage of drugs of natural origin

CO3. To acquire knowledge on the concept of plant tissue culture

CO4. Illustrate different systems of medicines and classification of secondary metabolites

CO5. To know about pharmacogenetic parameters of primary metabolites, plant products enzymes, proteins, enzymes, and marine drugs

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	3	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

Fifth Semester

MEDICINAL CHEMISTRY – II (BP501T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP501T	3	1	-	4 hours	25	75	100	4

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

10 Hours

Antihistaminic agents: Histamine, receptors and their distribution in the human body **H₁-antagonists:** Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H₂-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents:

Alkylating agents: Meclorothamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepe

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

10 Hours

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

10 Hours

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

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

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

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

UNIT- IV

08 Hours

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT – V

07 Hours

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acarbose, 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, Dipreron, Dibucaine.

Recommended Books (Latest Editions)

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

7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1 to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vog

Course Outcomes

The student will try to learn:

CO1. To understand the classification, mechanism of action, uses, Structure activity relationship and synthesis of selective class of Antihistaminic agents and Anti-neoplastic agents.

CO2. Understand classification, mechanism of action, uses, Structure activity relationship and synthesis of selective class of Diuretic, Anti-anginal and Anti-hypertensive.

CO3. To understand the classification, mechanism of action, uses, Structure activity relationship and synthesis of selective class of Anti-arrhythmic, Anti-hyperlipidemic, Congestive Heart Failure and Anticoagulants drugs.

CO4. To understand the classification, mechanism of action, uses, Structure activity relationship and synthesis of selective class of acting on Endocrine System.

CO5. Understand classification, mechanism of action, uses, Structure activity relationship and synthesis of selective class of Antidiabetics and Local Anesthetics.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	1	3	1	1	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

INDUSTRIAL PHARMACY-I (BP 502 T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP502T	3	1	-	4 hours	25	75	100	4

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

07 Hours

Preformulation Studies: 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

10 Hours

Tablets:

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

08

Hours

Capsules:

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

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

Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

UNIT-IV

10 Hours

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

10 Hours

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

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

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

Recommended Books: (Latest Editions)

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

8. Introduction to Pharmaceutical Dosage Forms by H. C. Ansel, Lea & Febiger, Philadelphia, 5th edition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 10

Course Outcomes

The student will try to learn:

CO1. To get Knowledge of preformulation, its goals and objectives, study of physicochemical characteristics of drug substances.

CO2. To describe in detail tablets and oral liquid dosage forms

CO3. To explain the importance and strategies of Capsule and pellets

CO4. To understand the parenteral and ophthalmic preparations

CO5. To know about the cosmetics, pharmaceutical aerosols, and packaging material sciences

Course Outcomes and their mapping with Programme Outcomes:

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	1	3	3	1	2	2	1	3	2	3
CO-2	3	2	3	3	3	2	2	1	2	3	2
CO-3	3	3	3	2	3	3	2	3	2	2	2
CO-4	3	2	2	3	3	2	3	2	3	2	2
CO-5	3	3	2	1	2	2	2	2	3	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

Industrial Pharmacy-I (Practical) (BP506P)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP506P	-	-	4	4 hours	15	35	50	2

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

Course Outcomes

The student will try to learn:

CO1. To get Knowledge of preformulation, it's goals and objectives, study of physicochemical characteristics of drug substances.

CO2. To describe in detail tablets and oral liquid dosage forms

CO3. To explain the importance and strategies of Capsule and pellets

CO4. To understand the parenteral and ophthalmic preparations

CO5. To know about the cosmetics, pharmaceutical aerosols, and packaging material sciences

Course Outcomes and their mapping with Programme Outcomes:

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PHARMACOLOGY-II (BP503T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP503T	3	1	-	4 hours	25	75	100	4

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 this course the student should 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

10hours

1. Pharmacology of drugs acting on cardio vascular system

- 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

10hours

2. Pharmacology of drugs acting on cardio vascular system

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

3. Pharmacology of drugs acting on urinary system

- a. Diuretics
- b. Anti-diuretics.

UNIT-III

10hours

PHARMACOLOGY-II (Practical) (BP 507P)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP507P	-	-	4	4 hours	15	35	50	2

1. Introduction to in-vitro pharmacology and physiological salt solutions.
 2. Effect of drugs on isolated frog heart.
 3. Effect of drugs on blood pressure and heart rate of dog.
 4. Study of diuretic activity of drugs using rats/mice.
 5. DRC of acetylcholine using frog rectus abdominis muscle.
 6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
 7. Bioassay of histamine using guinea pig ileum by matching method.
 8. Bioassay of oxytocin using rat uterine horn by interpolation method.
 9. Bioassay of serotonin using rat fundus strip by three point bioassay.
 10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
 11. Determination of PA₂ value of prazosin using rat anococcygeus muscle (by Schilds plot method).
 12. Determination of PD₂ value using guinea pig ileum.
 13. Effect of spasmogens and spasmolytics using rabbit jejunum.
 14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
 15. Analgesic activity of drug using central and peripheral methods
- Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos.

Course Outcomes

The student will try to learn:

CO1. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs acting on cardio vascular system.

CO2. To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of the drugs acting on blood and kidney.

CO3. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs related to autotoxins.

CO4. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs acting on endocrine system.

CO5. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs acting on endocrine system and Principle, types and applications of bioassay.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	1	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	2	1	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

PHARMACOGNOSY AND PHYTOCHEMISTRY II (BP504 T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP504T	3	1	-	4 hours	25	75	100	4

Scope: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites is 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

7

Hours

Metabolic pathways in higher plants and their determination

- 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

14 Hours

4. Autocoids and related drugs

- 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

08hours

5. Pharmacology of drugs acting on endocrine system

- a. Basic concepts in endocrine pharmacology.
- b. Anterior Pituitary hormones- analogues and their inhibitors.
- c. Thyroid hormones- analogues and their inhibitors.
- d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and VitaminD.
- d. Insulin, Oral Hypoglycemic agents and glucagon.
- e. ACTH and corticosteroids.

UNIT-V

07hours

6. Pharmacology of drugs acting on endocrine system

- a. Androgens and Anabolic steroids.
- b. Estrogens, progesterone and oral contraceptives.
- c. Drugs acting on the uterus.

7. Bioassay

- a. Principles and applications of bioassay.
- b. Types of bioassays
- c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's

Pharmacology, Churchill Livingstone Elsevier

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

Course Outcomes

The student will try to learn:

CO1. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs acting on cardio vascular system.

CO2. To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of the drugs acting on blood and kidney.

CO3. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs related to autotoxins.

CO4. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs acting on endocrine system.

CO5. To classify and describe the mechanisms, adverse effects and along with pharmacological uses of drugs acting on endocrine system and Principle, types and applications of bioassay.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	1	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	2	2	3	2	3
CO-5	2	2	2	3	1	2	3	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following

Secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III

06

Hours

Isolation, Identification and Analysis of Phytoconstituents

a) **Terpenoids:** Menthol, Citral, Artemisin

b) **Glycosides:** Glycyrrhetic acid & Rutin

c) **Alkaloids:** Atropine, Quinine, Reserpine, Caffeine

d) **Resins:** Podophyllotoxin, Curcumin

UNIT-IV

10

Hours

Industrial production, estimation and utilization of the following phytoconstituents:

Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine,

Taxol, Vincristine and Vinblastine

UNIT V

8 Hours

Basics of Phytochemistry

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

Recommended Books: (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. To get Knowledge of various Metabolic pathways in higher plants and their determination.

CO2. To get Knowledge about General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of different secondary metabolites

CO3. To Comprehend the concepts of Isolation, Identification and Analysis of Phytoconstituents.

CO4. To get Knowledge of Industrial production, estimation and utilization of the phytoconstituents like Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin etc.

CO5. To Create/ establish and summarise the correlation between chemistry, phytochemical classification, extraction, isolation and identification by means of pertinent analytical techniques.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical) (BP 508 P)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP508P	-	-	4	4 hours	15	35	50	2

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
 - a. Caffeine - from tea dust.
 - b. Diosgenin from Dioscorea
 - c. Atropine from Belladonna
 - d. Sennosides from Senna
3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstituents by TLC
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Course Outcomes

The student will try to learn:

CO1. To get Knowledge of various Metabolic pathways in higher plants and their determination.

CO2. To get Knowledge about General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of different secondary metabolites

CO3. To Comprehend the concepts of Isolation, Identification and Analysis of Phytoconstituents.

CO4. To get Knowledge of Industrial production, estimation and utilization of the phytoconstituents like Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin etc.

CO5. To Create/ establish and summarise the correlation between chemistry, phytochemical classification, extraction, isolation and identification by means of pertinent analytical techniques.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

PHARMACEUTICAL JURISPRUDENCE (BP 505 T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP505T	3	1	-	4 hours	25	75	100	4

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

Course Content:

UNIT-I

10 Hours

- **Drugs and Cosmetics Act, 1940** and its rules 1945: Objectives, Definitions, Legal definitions of schedules to the Act and Rules
Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.
- **Manufacture of drugs** – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II

Hours

10

- **Drugs and Cosmetics Act, 1940** and its rules 1945.
- **Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA)** Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties
- **Labeling & Packing of drugs-** General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.
- **Administration of the Act and Rules** – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III

10 Hours

- **Pharmacy Act –1948:** Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties
- **Medicinal and Toilet Preparation Act –1955:** Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.
- **Narcotic Drugs and Psychotropic substances Act-1985** and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Co nsultative 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

08

Hours

- **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

07 Hours

- **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)

Course Outcomes

The student will try to learn:

CO1. To acquire knowledge of Drugs and Cosmetics Act, 1940 and its rules 1945 particularly Objectives, schedules, Import of drugs, Manufacture of drugs, Conditions for grant of license etc.

CO2. To acquire knowledge of Drugs and Cosmetics Act, 1940 and its rules 1945 particularly schedules, Sale of Drugs, Labeling & Packing of drugs and Administration of the Act and Rules.

CO3. To acquire knowledge of Pharmacy Act –1948, Medicinal and Toilet Preparation Act –1955 and Narcotic Drugs and Psychotropic substances Act-1985 and Rules.

CO4. To acquire knowledge of Drugs and Magic Remedies Act and its rules, Prevention of Cruelty to animals Act-1960 and National Pharmaceutical Pricing Authority.

CO5. To acquire knowledge of Pharmaceutical Legislations, Code of Pharmaceutical ethics, Medical Termination of Pregnancy Act, RTI and IPR.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	1	3	3	2	2
CO-2	3	2	2	3	1	3	3	2	3	2	3
CO-3	1	2	2	1	3	3	3	2	2	3	2
CO-4	2	2	1	3	3	2	2	3	3	3	3
CO-5	3	3	3	2	2	2	3	1	3	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Sixth Semester

MEDICINAL CHEMISTRY – III (BP601T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP601T	3	1	-	4 hours	25	75	100	4

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 student 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

10 Hours

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

β-Lactam antibiotics: Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II

10 Hours

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

Macrolide: Erythromycin, Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone.

UNIT – III

10 Hours

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

08 Hours

Antifungal agents:

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

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole

Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

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

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

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides:

Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine,

Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V

07

Hours

Introduction to Drug Design

Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications of combinatorial chemistry: solid phase and solution phase synthesis.

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

Course Outcomes

The student will try to learn:

CO1. To get Knowledge of Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation, classification and uses of Antibiotics like β -Lactam, Aminoglycosides and Tetracyclines.

CO2. To get Knowledge of Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation, classification and uses of Antibiotics like Macrolide, miscellaneous; Antimalarial drugs and Basic concepts and application of prodrugs.

CO3. To explain chemistry, mechanism of action, metabolism, adverse effects, structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs like Anti-tubercular Agents, Urinary tract anti-infective agents and Antiviral agents.

CO4. To explain chemistry, mechanism of action, metabolism, adverse effects, structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs like Antifungal agents, Anti-protozoal Agents, Anthelmintics and Sulphonamides.

CO5. To Explain Introduction to Drug Design and Combinatorial Chemistry.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	3	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

MEDICINAL CHEMISTRY- III (Practical) (BP607P)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP607P	-	-	4	4 hours	15	35	50	2

I. Preparation of drugs and intermediates

- 1 Sulphanilamide
- 2 7-Hydroxy, 4-methyl coumarin
- 3 Chlorobutanol
- 4 Triphenyl imidazole
- 5 Tolbutamide
- 6 Hexamine

II. Assay of drugs

- 1 Isonicotinic acid hydrazide
- 2 Chloroquine
- 3 Metronidazole
- 4 Dapsone
- 5 Chlorpheniramine maleate
- 6 Benzyl penicillin

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

IV. Drawing structures and reactions using chem draw®

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

Course Outcomes

The student will try to learn:

CO1. To get Knowledge of Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation, classification and uses of Antibiotics like β -Lactam, Aminoglycosides and Tetracyclines.

CO2. To get Knowledge of Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation, classification and uses of Antibiotics like Macrolide, miscellaneous; Antimalarial drugs and Basic concepts and application of prodrugs.

CO3. To explain chemistry, mechanism of action, metabolism, adverse effects, structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs like Anti-tubercular Agents, Urinary tract anti-infective agents and Antiviral agents.

CO4. To explain chemistry, mechanism of action, metabolism, adverse effects, structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs like Antifungal agents, Anti-protozoal Agents, Anthelmintics and Sulphonamides.

CO5. To Explain Introduction to Drug Design and Combinatorial Chemistry.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	1	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PHARMACOLOGY-III (BP602 T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP602T	3	1	-	4 hours	25	75	100	4

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, immuno-pharmacology and in addition, emphasis on the principles of toxicology and chronopharmacology.

Objectives: Upon completion of this course the student should 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 poisoning
3. Appreciate correlation of pharmacology with related medical sciences.

Course Content:

UNIT-I

10hours

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

10hours

3. Chemotherapy
 - a. General principles of chemotherapy.
 - b. Sulfonamides and cotrimoxazole.
 - c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT-III

10hours

3. Chemotherapy
 - a. Antitubercular agents
 - b. Antileprotic agents
 - c. Antifungal agents
 - d. Antiviral drugs
 - e. Anthelmintics
 - f. Antimalarial drugs
 - g. Antiamoebic agents

UNIT-IV

08hours

3. Chemotherapy

- l. Urinary tract infections and sexually transmitted diseases.
- m. Chemotherapy of malignancy.
- 4. Immunopharmacology
 - a. Immunostimulants
 - b. Immunosuppressant

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

UNIT-V

07hours

- 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, organophosphorus 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 Editions)

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

Course Outcomes

The student will try to learn:

- CO1.** To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of drugs acting on respiratory and gastrointestinal system.
- CO2.** To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of chemotherapeutic agents like Sulfonamides and antibiotics.
- CO3.** To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of chemotherapeutic agents like Antitubercular agents, Antileprotic agents, Antifungal agents etc.
- CO4.** To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of chemotherapeutic agents used in Urinary tract infections, STD and malignancy; Immunopharmacology
- CO5.** To Explain Principles of toxicology and Chronopharmacology.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	1	3	2	2
CO-4	3	2	2	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

PHARMACOLOGY-III (Practical) (BP 608 P)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP608P	-	-	4	4 hours	15	35	50	2

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi- autoanalyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data

14. Biostatistics methods in experimental pharmacology(student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

*Experiments are demonstrated by simulated experiments/video

Course Outcomes

The student will try to learn:

CO1. To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of drugs acting on respiratory and gastrointestinal system.

CO2. To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of chemotherapeutic agents like Sulfonamides and antibiotics.

CO3. To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of chemotherapeutic agents like Antitubercular agents, Antileprotic agents, Antifungal agents etc.

CO4. To acquire Knowledge of classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications of chemotherapeutic agents used in Urinary tract infections, STD and malignancy; Immunopharmacology

CO5. To Explain Principles of toxicology and Chronopharmacology.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	2	2	2	3	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

HERBAL DRUG TECHNOLOGY (BP 603 T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP603T	3	1	-	4 hours	25	75	100	4

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 this course the student should 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 Hours

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 Hours

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III

10 Hours

Herbal Cosmetics source and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

Herbal excipients:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations:

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

UNIT- IV

10 Hours

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

UNIT-V

07 Hours

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 equipments, standard operating procedures, health and hygiene, documentation and records.

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy 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. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002

Course Outcomes

The student will try to learn:

- CO1.** To acquire knowledge of basic understanding of Herbs as raw material, Biodynamic Agriculture and Indian Systems of Medicine.
- CO2.** To acquire knowledge of basic understanding of Nutraceuticals and Herbal-Drug and herb -Food Interactions.
- CO3.** To acquire knowledge of basic understanding of Herbal Cosmetics, Herbal excipients and Herbal formulations.
- CO4.** To Explain Evaluation of Drugs, Patenting and Regulatory requirements of natural products and Regulatory Issues.
- CO5.** To Explain General Introduction to Herbal Industry and Schedule T – Good Manufacturing Practice of Indian systems of medicine.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	2	2	2	2	1	2	2	3
CO-2	3	2	3	3	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

HERBAL DRUG TECHNOLOGY (Practical) (BP 609 P)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP609P	-	-	4	4 hours	15	35	50	2

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

Course Outcomes

The student will try to learn:

CO1. To acquire knowledge of basic understanding of Herbs as raw material, Biodynamic Agriculture and Indian Systems of Medicine.

CO2. To acquire knowledge of basic understanding of Nutraceuticals and Herbal-Drug and Herb-Food Interactions.

CO3. To acquire knowledge of basic understanding of Herbal Cosmetics, Herbal excipients and Herbal formulations.

CO4. To Explain Evaluation of Drugs, Patenting and Regulatory requirements of natural products and Regulatory Issues.

CO5. To Explain General Introduction to Herbal Industry and Schedule T – Good Manufacturing Practice of Indian systems of medicine.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	3
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BIOPHARMACEUTICS AND PHARMACOKINETICS (BP 604 T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP604T	3	1	-	4 hours	25	75	100	4

45 Hours

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 arising therein.

Objectives: Upon completion of the course student 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 & applications.

Course Content

UNIT-I

10 Hours

Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non per oral extra-vascular routes, Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT- II

10 Hours

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

10 Hours

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - KE , $t_{1/2}$, V_d , AUC , K_a , Cl_t and CL_R - definitions methods of eliminations, understanding of their significance and applications.

UNIT- IV

08 Hours

Multicompartment models: Two compartment open model. IV bolus

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

UNIT- V

07 Hours

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity.

Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari

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

Course Outcomes

The student will try to learn:

CO1. To understand the concepts and mechanisms of ADME.

CO2. To study the methods of measurement of bioavailability and bioequivalence.

CO3. To study various linear pharmacokinetic models and their calculations to assess pharmacokinetic parameters.

CO4. To gain knowledge of methods and mechanisms of Dissolution as well as in vitro-in vivo correlation .

CO5. To study non linearity in pharmacokinetics and calculation of various parameters using Michaelis Menton method.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	1	1	2	1	3	2	1	2	2	3
CO-2	2	2	2	2	1	2	1	1	1	2	1
CO-3	2	2	3	3	1	2	1	1	2	1	2
CO-4	3	2	2	3	1	2	1	1	2	2	2
CO-5	3	2	2	2	1	2	2	2	2	1	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

Pharmaceutical Biotechnology (BP 605 T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP605T	3	1	-	4 hours	25	75	100	4

45 Hours

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 subject student 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

Unit I

10 Hours

- 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

10 Hours

- a) Study of cloning vectors, restriction endonucleases and DNA ligase.
- b) Recombinant DNA technology. Application of genetic engineering in medicine.
- c) Application of r DNA technology and genetic engineering in the production of:
 - i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.
- d) Brief introduction to PCR

Unit III

10 Hours

Types of immunity- humoral immunity, cellular immunity

- 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
- g) Blood products and Plasma Substitutes.

Unit IV

08Hours

- 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: Types of mutation/mutants.

Unit V

07 Hours

- a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
- b) Large scale production fermenter design and its various controls.

- c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
 d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: 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, Degrand, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitaker A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

Course Outcomes

The student will try to learn:

CO1. To gain Knowledge of Biotechnology, Biosensors, Protein Engineering, Use of microbes and genetic engineering.

CO2. To understand Recombinant DNA technology and PCR.

CO3. To study Types of immunity- humoral immunity, cellular immunity.

CO4. To gain knowledge of Immuno blotting techniques, Microbial genetics, Microbial biotransformation and Mutation.

CO5. To study Fermentation methods, production of - penicillins, citric acid, Vitamin B12 and Blood Products.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	1	3	2	2	3	2	2	3
CO-2	1	2	3	3	2	3	2	3	2	2	3
CO-3	1	2	3	3	2	3	2	3	2	2	3
CO-4	2	1	2	1	3	2	3	2	2	2	2
CO-5	1	2	2	3	3	2	3	2	3	3	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

PHARMACEUTICAL QUALITY ASSURANCE (BP606T1)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP606T1	3	1	-	4 hours	25	75	100	4

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

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

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

Course content:

UNIT – I

10 Hours

- Quality Assurance and Quality Management concepts: Definition and concept of Quality
- control, Quality assurance and GMP
- Total Quality Management (TQM): Definition, elements, philosophies
- ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines
- Quality by design (QbD): Definition, overview, elements of QbD program, tools
- ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration
- NABL accreditation: Principles and procedures

UNIT - II

10 Hours

Organization and personnel: Personnel responsibilities, training, hygiene and personal records. Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

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

Quality control: quality control test for containers, rubber closures and secondary packaging material.

UNIT – III

10 Hour

Quality Control: Quality control test for containers, rubber closures and secondary packaging 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

08 Hours

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

07 Hours

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 Dekker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

Course Outcomes

The student will try to learn:

CO1. To gain Knowledge of Quality Assurance and Quality Management aspects of pharmaceutical industries.

CO2. To Understand Organization and personnel, Premises and Equipments and raw materials.

CO3. To study about Quality Control and Good Laboratory Practices.

CO4. To Examine Complaints and Document maintenance in pharmaceutical industry.

CO5. To gain Knowledge of Calibration and Validation and Warehousing.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	1	3	2	3
CO-4	3	2	3	3	1	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Seventh Semester

INSTRUMENTAL METHOD OF ANALYSIS (BP701T)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP701T	3	1	-	4 hours	25	75	100	4

45Hours

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

10 Hours

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

10 Hours

IR spectroscopy

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

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

Flame Photometry-Principle, interferences, instrumentation, and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation, and applications

Nepheloturbidometry- Principle, instrumentation, and applications

UNIT –III

10 Hours

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

Hours

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

07

Hours

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 Editions)

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

Course Outcomes

The student will try to learn:

CO1. To get fundamental knowledge on the principle, instrumentation and Applications of UV Visible spectroscopy and Fluorimetry.

CO2. To get fundamental knowledge on the principle, instrumentation and Applications of IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy and Nepheloturbidometry.

CO3. To get fundamental knowledge on the principle, instrumentation and Applications of Adsorption, partition column chromatography and Electrophoresis.

CO4. To get fundamental knowledge on the principle, instrumentation and Applications of Gas chromatography and High performance liquid chromatography (HPLC).

CO5. To get fundamental knowledge on the principle, instrumentation and Applications of Ion exchange chromatography, Gel chromatography and Affinity chromatography.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	1	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

703T. PHARMACY PRACTICE (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP703T	3	1	-	4 hours	25	75	100	4

45hours

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 counselling in community pharmacy;
10. appreciate the concept of Rational drug therapy.

Unit I:

10 Hour

a) Hospital and its organization

BP705P. INSTRUMENTAL NSTRUMENTAL METHODS OF ANALYSIS (Practical)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP705P	-	-	4	4 hours	15	35	50	2

4 Hours/Week

- 1 Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
- 2 Estimation of dextrose by colorimetry
- 3 Estimation of sulfanilamide by colorimetry
- 4 Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
- 5 Assay of paracetamol by UV- Spectrophotometry
- 6 Estimation of quinine sulfate by fluorimetry
- 7 Study of quenching of fluorescence
- 8 Determination of sodium by flame photometry
- 9 Determination of potassium by flame photometry
- 10 Determination of chlorides and sulphates by nephelo turbidometry
- 11 Separation of amino acids by paper chromatography
- 12 Separation of sugars by thin layer chromatography
- 13 Separation of plant pigments by column chromatography
- 14 Demonstration experiment on HPLC
- 15 Demonstration experiment on Gas Chromatography

Course Outcomes

The student will try to learn:

CO1. To get fundamental knowledge on the principle, instrumentation and Applications of UV Visible spectroscopy and Fluorimetry.

CO2. To get fundamental knowledge on the principle, instrumentation and Applications of IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy and Nepheloturbidometry.

CO3. To get fundamental knowledge on the principle, instrumentation and Applications of Adsorption, partition column chromatography and Electrophoresis.

CO4. To get fundamental knowledge on the principle, instrumentation and Applications of Gas chromatography and High performance liquid chromatography (HPLC).

CO5. To get fundamental knowledge on the principle, instrumentation and Applications of Ion exchange chromatography, Gel chromatography and Affinity chromatography.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	1	3	2	3
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 702 T. INDUSTRIAL PHARMACYII (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP702T	3	1	-	4 hours	25	75	100	4

45 hours

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

10 Hours

Pilot plant scale up techniques: General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology

UNIT-II

10 Hours

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

UNIT-III

10 Hour

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

08 Hours

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP

UNIT-V

07

Hours

Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April

- available 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>.

Course Outcomes

The student will try to learn:

CO1. To acquire the knowledge of the process of pilot plant and scale up of pharmaceutical dosage forms

CO2. To Understand the process of Technology Transfer (TT) from lab scale to commercial batch. To Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India.

CO3. To acquire the knowledge of important acts & Laws that govern processes of pharmaceutical industry, regulatory affairs, quality management system and its applications in safety and efficacy of pharmaceutical product.

CO4. To know Evaluation of QMS-quality management system, process of drug approval and scale up of process.

CO5. To understand the approval process and regulatory requirements for drug products (CDCSO, COPP).

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	2	1	2	2	2	1	2	2	3
CO-2	3	2	3	2	1	2	2	2	2	3	2
CO-3	2	3	3	2	2	2	2	2	3	2	2
CO-4	3	2	3	3	2	3	1	2	3	2	3
CO-5	2	2	2	3	1	2	2	1	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

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.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) 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.

d) 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:

10 Hours

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:

10 Hours

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.

a) Drug information services

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

b) Patient counselling

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

c) 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.

d) Prescribed medication order and communication skills

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

Unit IV

8

Hours

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

7 Hours

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)

Course Outcomes

The student will try to learn:

CO1. To get the knowledge of Hospital, Hospital Pharmacy and their organization, Adverse drug reactions and Community Pharmacy.

CO2. To understand various drug supply and distribution/circulation systems in Hospital.

CO3. To gain a knowledge of Pharmacy and therapeutic committee, information services, Patient counseling, Education and training program in the hospital and Prescribed medication order and communication skills.

CO4. To get the knowledge of Budget preparation and implementation, Clinical Pharmacy and Over the counter (OTC) sales.

CO5. To get the knowledge of Drug store management and inventory control, Investigational use of drugs and Interpretation of Clinical Laboratory Tests.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	3	3	3	3	2	2	2
CO-2	3	3	2	2	2	2	2	1	2	2	2
CO-3	2	2	3	2	3	3	2	3	3	3	3
CO-4	2	3	2	2	3	2	2	3	2	2	2
CO-5	2	3	2	2	2	3	2	2	2	2	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP704T	3	1	-	4 hours	25	75	100	4

45 Hours

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

10 Hours

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

10 Hours

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 implants and osmotic pump

Unit-III

10 Hours

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

08 Hours

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

Unit-V

07 Hours

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 Editions)

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

Course Outcomes

The student will try to learn:

CO1. To understand the concepts of controlled release technology and applications of polymers in controlled release technology

CO2. To learn about microencapsulation, mucosal and implantable drug delivery approaches

CO3. To understand the strategies and applications of Transdermal, gastroretentive, ocular and nasopulmonary drug delivery approaches

CO4. To know the concepts of targeted drug delivery and applications of liposomes, niosomes, nanoparticles, monoclonal antibodies for the targeted delivery.

CO5. To learn about Explain the development and applications of ocular and intra uterine devices (IUDs)

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	3	3	2	3	2	1	2	2	3
CO-2	3	2	3	3	2	3	2	1	2	2	3
CO-3	2	3	2	3	2	1	2	2	3	2	3
CO-4	2	3	2	3	2	1	2	2	3	2	3
CO-5	2	3	2	3	2	1	2	2	3	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Eighth Semester

BP801T. BIOSTATISTICS AND RESEARCH METHODOLOGY (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP801T	3	1	-	4 hours	25	75	100	4

45hours

Scope: To understand the applications of Biostatistics 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 student shall be able to

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

Course content:

Unit-I

10 Hours

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 - Pharmaceutical examples

Unit-II

10 Hours

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

10 Hours

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test

Introduction to Research: Need for research, Need for design of Experiments, Experimental Design Technique, plagiarism.

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph

Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

Unit-IV

8 Hours

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

7Hours

Design and Analysis of experiments:

Factorial Design: Definition, 2^2 , 2^3 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. New York.
2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
3. Design and Analysis of Experiments – PHI Learning Private Limited, R.Pannerselvam,
4. .Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

Course Outcomes

The student will try to learn:

CO1. To gain knowledge about basics of statistics, Measures of central tendency, Measures of dispersion and Correlation.

CO2. To understand the basic principles of research design, methodology, hypothesis testing, sampling techniques, regression, probability, parametric test.

CO3. To acquire the knowledge of nonparametric test. To understand the basic principles of research design, methodology, graphs, designing the methodology.

CO4. To gain knowledge about hypothesis testing in Simple and Multiple regression models. To know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)

CO5. To understand the Design and Analysis of experiments: Factorial Design, Response Surface methodology

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	2	3	3	1	1	2	3	3	1	3	1
CO-2	2	2	3	1	2	3	2	2	2	2	2
CO-3	2	2	3	1	1	3	2	3	2	2	2
CO-4	2	3	3	2	2	2	3	3	1	3	1
CO-5	2	3	2	2	1	2	3	3	1	3	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 802T SOCIAL AND PREVENTIVE PHARMACY

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP802T	3	1	-	4 hours	25	75	100	4

45 hours

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

Course content:

Unit I:

10 Hours

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:

10 Hour

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:

10

Hours

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:

08

Hours

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:

07

Hours

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

Recommended Journals:

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

Course Outcomes

The student will try to learn:

CO1. To Understand the basics of public health, issues related to it with emphasis on Social and health education, Hygiene and health.

CO2. To Understand the General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, etc.

CO3. To Assess the observations of national program on community diseases & management of related lifestyle diseases.

CO4. To Understand the National health intervention programme for mother and child, National family welfare programme, National tobacco control programme etc.

CO5. To know about the Community services in rural, urban and school health.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	2	2	2	2	3	3	2	3	2	2
CO-2	2	2	3	2	2	3	3	2	3	1	1
CO-3	3	2	2	1	2	3	3	1	3	2	2
CO-4	2	2	3	2	1	2	3	2	3	2	2
CO-5	3	2	2	1	2	2	3	2	3	2	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP803ET. PHARMA MARKETING MANAGEMENT (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP803T	3	1	-	4 hours	25	75	100	4

45 hours

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.

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

Unit I

10

Hours

Marketing:

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market:

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation & targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.

Unit II

10 Hours

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

10 Hours

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

10

Hours

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

10

Hours

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; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.

Recommended Books: (Latest Editions)

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

Course Outcomes

The student will try to learn:

CO1. To understand the concepts and role of pharmaceutical marketing strategies

CO2. To learn the concepts and functions of product management

CO3. To explain the importance and strategies of online promotional techniques for OTC products.

CO4. To understand the functions of pharmaceutical marketing channels

CO5. To know about the functions of Drug Price Control Order and National Pharmaceutical Pricing Authority

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	3	3	3	1	3	3	1	3	3	3
CO-2	2	2	2	2	2	2	2	2	2	2	2
CO-3	2	2	2	2	2	2	2	2	2	2	2
CO-4	3	3	3	3	1	3	3	1	3	3	3
CO-5	3	3	3	3	2	3	3	2	3	3	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

BP 807 ET. COMPUTER AIDED DRUG DESIGN (Theory)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP807T	3	1	-	4 hours	25	75	100	4

45 hours

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 10 Hours

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 10 Hours

Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammett's substituent constant and Taft's steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III 10 Hours

Molecular Modeling and virtual screening techniques

Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore-based Screening,

Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design

UNIT-IV

Informatics & Methods in drug design

Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical, and pharmaceutical databases.

UNIT-V 07 Hours

Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Park Press

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

Course Outcomes

The student will try to learn:

CO1. To gain Knowledge of Drug Discovery, Development and Analog Based Drug Design.

CO2. To Understand the fundamentals of Quantitative Structure Activity Relationship (QSAR), in terms of history, types and attributes responsible of drug action.

CO3. To Apply information gained from Molecular Modeling and virtual screening techniques in drug design and discovery.

CO4. To Analyze the Bioinformatics, chemoinformatics in terms of drug design and discovery.

CO5. To Evaluate the Molecular Modeling in terms of molecular mechanics and quantum mechanics for drug design and discovery

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	3	3	3	1	3	3	1	3	3	3
CO-2	2	2	2	2	2	2	2	2	2	2	2
CO-3	2	2	2	2	2	2	2	2	2	2	2
CO-4	3	3	3	3	2	3	3	1	3	3	3
CO-5	3	3	3	3	2	3	3	1	3	3	3

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

BP810 ET. PHARMACOLOGICAL SCREENING METHODS

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
BP810T	3	1	-	4 hours	25	75	100	4

45 hours

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.

Unit –I

08 Hours

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

10 Hours

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

Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaesthetics

Unit –IV

05

Hours

Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslipidemic, anti-aggregatory, coagulants, and anticoagulants

Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

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

Recommended Books (latest edition):

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

Course Outcomes

The student will try to learn:

CO1. To learn about experimental animals used in pharmacological research for screening of various categories of drugs, guidelines for use and maintenance of experimental animals.

CO2. To Learn about statistical handling of preclinical data.Design and execute a research hypothesis independently.

CO3.

CO4.

CO5.

Course Outcomes and their mapping with Programme Outcomes

CO	PO										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	3	3	3	3	1	3	3	1	3	3	3
CO-2	2	2	2	2	2	2	2	2	2	2	2
CO-3	2	2	2	2	2	2	2	2	2	2	2
CO-4	3	3	3	3	2	3	3	2	3	3	3
CO-5	3	3	3	3	1	3	3	1	3	3	3

sWeightage: 1-Sightly; 2-Moderately; 3-Strongly

