Program Syllabus Booklet

Bachelor of Pharmacy
(B. Pharmacy- 1502)

Session: 2021-22

University College of Pharmacy
Guru Kashi University, Talwandi Sabo

GURU KASHI UNIVERSITY
PUNJAB - INDIA

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GURU KASHI UNIVERSITY
PUNJAB - INDIA

Annexure -1

Program: Bachelor of Pharmacy (B. Pharmacy)Program Code: 1502
Program Outcomes (PO): The PO for the Bachelor of Pharmacy (B. Pharmacy)is as follows:

PO	Statements
PO1	**Pharmacy Knowledge:** To acquire comprehensive knowledge and basic principles of Pharmaceutical agents and devices along with other associated sciences.
PO2	**Problem Analysis:** Todevelop an ability to identify, formulate and solve complex problems of Pharmaceutical Industry, Community & Hospital Pharmacy.
PO3	**Design/Development of solutions:** To design solutions for complex pharmacy problems that meet the specified needs with appropriate concern for the public health and safety and the cultural and environmental considerations.
PO4	**Conduct investigations of complex problems**: Touse research-based knowledge and research methods including design of experiments, analysis and interpretation of dataand synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Toapply appropriate methods, procedures, resourcesand modern pharmacy-related computing tools.
PO6	**Pharmacy and Society:** Toapply contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
PO7	**Environment and Sustainability:** Tounderstand the impact of the professional pharmacy solutions in community and environmental contexts, and demonstrate the knowledge and need for sustainable development.
PO8	**Ethics:** Topossess personal & universal values and apply ethical principles in professional and social contexts.
PO9	**Individual and Team work:** Tounderstand the responsibility as an individual and as a member, or leader in professional team or multidisciplinary settings.
PO10	**Communication:** Tocommunicate effectively in the professional settings and with society at large.
PO11	**Project Management and finance:** Toapply and demonstrate their professional skills and comprehensive knowledge to manage projects, to carry out research in the core and applied areas of Pharmaceutical sciences.
PO12	**Life-long learning:**Torecognize the need for self-assessment and effectively use the feedback from others to identify learning needs to compete globally.

Program Specific Outcomes (PSO): The PSO for the Bachelor of Pharmacy (B.Pharmacy) are as follows:

PSO	Statements
PSO1	To identify, formulate and solve problems related to Pharmaceutical industry, community & hospital pharmacy.
PSO2	To conduct, analyze and interpret data of pharmaceutical experiments in production, Quality Control & Quality Assurance.
PSO3	To design the formulation & Synthetic process as per needs and specifications in Pharmaceutical Industry& Marketing.

Annexure-2

Semester: 1st										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP101T	Human Anatomy and Physiology I– Theory	T	3	1	0	4	25	75	100
2	BP102T	Pharmaceutical Analysis I – Theory	T	3	1	0	4	25	75	100
3	BP103T	Pharmaceutics I – Theory	T	3	1	0	4	25	75	100
4	BP104T	Pharmaceutical Inorganic Chemistry – Theory	T	3	1	0	4	25	75	100
5	BP105T	Communication skills – Theory *	T	2	0	0	2	15	35	50
6		**Elective-I**								
7	BP107P	Human Anatomy and Physiology I– Practical	P	0	0	4	2	15	35	50
8	BP108P	Pharmaceutical Analysis I – Practical	P	0	0	4	2	15	35	50
9	BP109P	Pharmaceutics I – Practical	P	0	0	4	2	15	35	50
10	BP110P	Pharmaceutical Inorganic Chemistry – Practical	P	0	0	4	2	15	35	50
11	BP111P	Communication skills – Practical*	P	0	0	2	1	10	15	25
Total No. of Credits				27						

Elective-I (Select one of the following Subjects)										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP106RBT	Remedial Biology– Theory	T	2	0	0	2	15	35	50
	BP112RBP	Remedial Biology – Practical*	P	0	0	2	1	10	15	25
2	BP106RMT	Remedial Mathematics – Theory*	T	2	0	0	2	15	35	50
Note:										

• Applicable ONLY for the students studied Mathematics/Physics/Chemistry at HSC and appearing for **Remedial Biology(RB)** course.
• Applicable ONLY for the students studied Botany/Zoology/Physics/Chemistry at HSC and appearing for **Remedial Mathematics(RM)** course.
•Non University Examination (NUE)

Semester: 2nd										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP201T	Human Anatomy and Physiology II – Theory	T	3	1	0	4	25	75	100
2	BP202T	Pharmaceutical Organic Chemistry I – Theory	T	3	1	0	4	25	75	100
3	BP203T	Biochemistry – Theory	T	3	1	0	4	25	75	100
4	BP204T	Pathophysiology – Theory	T	3	1	0	4	25	75	100
5	BP205T	Computer Applications in Pharmacy – Theory *	T	3	0	0	3	25	50	75
6	BP206T	Environmental sciences – Theory *	T	3	0	0	3	25	50	75
7	BP207P	Human Anatomy and Physiology II –Practical	P	0	0	4	2	15	35	50
8	BP208P	Pharmaceutical Organic Chemistry I– Practical	P	0	0	4	2	15	35	50
9	BP209P	Biochemistry – Practical	P	0	0	4	2	15	35	50
10	BP210P	Computer Applications in Pharmacy – Practical*	P	0	0	2	1	10	15	25
Total No. of Credits				29						

•**Non University Examination (NUE)**

Semester: 3rd										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP301T	Pharmaceutical Organic Chemistry II – Theory	T	3	1	0	4	25	75	100
2	BP302T	Physical Pharmaceutics I – Theory	T	3	1	0	4	25	75	100
3	BP303T	Pharmaceutical Microbiology – Theory	T	3	1	0	4	25	75	100
4	BP304T	Pharmaceutical Engineering – Theory	T	3	1	0	4	25	75	100
5	BP305P	Pharmaceutical Organic Chemistry II – Practical	P	0	0	4	2	15	35	50
6	BP306P	Physical Pharmaceutics I – Practical	P	0	0	4	2	15	35	50
7	BP307P	Pharmaceutical Microbiology – Practical	P	0	0	4	2	15	35	50
8	BP308P	Pharmaceutical Engineering –Practical	P	0	0	4	2	15	35	50
Total No. of Credits				24						

Semester: 4th										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP401T	Pharmaceutical Organic Chemistry III– Theory	T	3	1	0	4	25	75	100
2	BP402T	Medicinal Chemistry I – Theory	T	3	1	0	4	25	75	100
3	BP403T	Physical Pharmaceutics II – Theory	T	3	1	0	4	25	75	100
4	BP404T	Pharmacology I – Theory	T	3	1	0	4	25	75	100
5	BP405T	Pharmacognosy and Phytochemistry I– Theory	T	3	1	0	4	25	75	100
6	BP406P	Medicinal Chemistry I – Practical	P	0	0	4	2	15	35	50
7	BP407P	Physical Pharmaceutics II – Practical	P	0	0	4	2	15	35	50
8	BP408P	Pharmacology I – Practical	P	0	0	4	2	15	35	50
9	BP409P	Pharmacognosy and Phytochemistry I – Practical	P	0	0	4	2	15	35	50
Total No. of Credits				28						

Semester: 5th										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP501T	Medicinal Chemistry II – Theory	T	3	1	0	4	25	75	100
2	BP502T	Industrial Pharmacy I– Theory	T	3	1	0	4	25	75	100
3	BP503T	Pharmacology II – Theory	T	3	1	0	4	25	75	100
4	BP504T	Pharmacognosy and Phytochemistry II– Theory	T	3	1	0	4	25	75	100
5	BP505T	Pharmaceutical Jurisprudence – Theory	T	3	1	0	4	25	75	100
6	BP506P	Industrial Pharmacy I – Practical	P	0	0	4	2	15	35	50
7	BP507P	Pharmacology II – Practical	P	0	0	4	2	15	35	50
8	BP508P	Pharmacognosy and Phytochemistry II – Practical	P	0	0	4	2	15	35	50
Total No. of Credits				26						

Semester: 6th										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP601T	Medicinal Chemistry III – Theory	T	3	1	0	4	25	75	100
2	BP602T	Pharmacology III – Theory	T	3	1	0	4	25	75	100
3	BP603T	Herbal Drug Technology – Theory	T	3	1	0	4	25	75	100
4	BP604T	Biopharmaceutics and Pharmacokinetics – Theory	T	3	1	0	4	25	75	100
5	BP605T	Pharmaceutical Biotechnology – Theory	T	3	1	0	4	25	75	100
6	BP606T	Quality Assurance – Theory	T	3	1	0	4	25	75	100
7	BP607P	Medicinal chemistry III – Practical	P	0	0	4	2	15	35	50
8	BP608P	Pharmacology III – Practical	P	0	0	4	2	15	35	50
9	BP609P	Herbal Drug Technology – Practical	P	0	0	4	2	15	35	50
Total No. of Credits				30						

Semester: 7th										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP701T	Instrumental Methods of Analysis – Theory	T	3	1	0	4	25	75	100
2	BP702T	Industrial Pharmacy II – Theory	T	3	1	0	4	25	75	100
3	BP703T	Pharmacy Practice – Theory	T	3	1	0	4	25	75	100
4	BP704T	Novel Drug Delivery System – Theory	T	3	1	0	4	25	75	100
5	BP705P	Instrumental Methods of Analysis – Practical	P	0	0	4	2	15	35	50
6	BP706PS	Practice School*	P	0	0	12	6	25	125	150
Total No. of Credits				24						
•**Non University Examination (NUE)**										

Semester: 8th										
Sr. No	Subject Code	Subject Name	Type of Subject T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	BP801T	Biostatistics and Research Methodology	T	3	1	0	4	25	75	100
2	BP802T	Social and Preventive Pharmacy	T	3	1	0	4	25	75	100
3		**Elective-II/I**	T	3	1	0	4	25	75	100
4		**Elective-II/II**	T	3	1	0	4	25	75	100
5	BP813PW	Project Work	P	0	0	12	6	NA	150	150
Total No. of Credits							22			

Elective-II/I , Elective- II/II (Select any two from a following list)

Sr. No	Subject Code	Subject Name
1	BP803ET	Pharma Marketing Management
2	BP804ET	Pharmaceutical Regulatory Science
3	BP805ET	Pharmacovigilance
4	BP806ET	Quality Control and Standardization of Herbals
5	BP807ET	Computer Aided Drug Design
6	BP808ET	Cell and Molecular Biology
7	BP809ET	Cosmetic Science
8	BP810ET	Experimental Pharmacology
9	BP811ET	Advanced Instrumentation Techniques
10	BP812ET	Dietary Supplements and Nutraceuticals

Annexure-3

Course Name: Human Anatomy and Physiology I

Course Code: BP101T

Semester: 1st

Credits 4

L	T	P
3	1	0

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statement
CO1	Understand anatomical terms to recognize and characterize positions of major organs of human body systems
CO2	Apply medical terminology and functionality of body systems in health education and health promotion.
CO3	Analyze disorders of skeletal muscle, smooth muscle, cardiovascular system, lymphatic system and digestive system.
CO4	Evaluate Bleeding time, clotting time, Blood group of various individuals
CO5	Develop advanced physiological and health-related tests using their skills

Course Content

Unit I

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

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

Body fluids and blood

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

Lymphatic system

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

Unit IV

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

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:

1. K. Sembulingam and P. Sembulingam (2012). Essentials of Medical Physiology, Jaypee brothers Medical Publishers, New Delhi.
2. Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1,2, Academic Publishers Kolkata

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	1	1	1	1	1	2	1	1	3	1	2
CO2	3	1	2	1	1	3	2	3	2	3	2	2	2	3	2
CO3	3	3	2	1	2	2	1	2	3	1	3	1	3	3	2
CO4	2	3	2	1	3	2	3	1	2	3	2	2	2	2	1
CO5	1	1	3	1	3	2	1	3	3	1	3	3	1	2	3
Average	**2.2**	**2**	**2**	**1.2**	**2**	**2**	**1.6**	**2**	**2.2**	**2**	**2.2**	**1.8**	**2.2**	**2.2**	**2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Human Anatomy and Physiology I Lab
Course Code: BP107P
Semester: 1st

Credits 04

L	T	P
0	0	4

Course Outcomes:

On completion of this course, the successful students will be able to:

CO	Statement
CO1	Understand the construction, working, care and handling of instruments, glassware and equipment required for practical
CO2	Apply body fluids and blood knowledge in Hemoglobin detection and measurement of blood pressure.
CO3	Analyze working pattern of different organs of each system.
CO4	Evaluate pulse rate, heart rate, erythrocyte sedimentation rate
CO5	Develop reports of white blood cells and red blood cells count

Course Content

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

Recommended Books (Latest Editions)

1. K. Sembulingam and P. Sembulingam (2012). Essentials of Medical Physiology, Jaypee Brothers Medical Publishers, New Delhi.
2. Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1,2, Academic Publishers Kolkata

The mapping of PO/PSO/COattainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	3	1	1	1	1	3	1	1	3	2
CO2	2	1	2	1	2	2	3	2	2	3	2	2	2	1	2
CO3	1	2	3	2	2	1	3	2	2	2	1	2	1	1	2
CO4	1	1	2	1	1	2	2	1	1	1	2	1	2	2	3
CO5	2	3	1	3	3	3	2	2	3	2	1	3	3	2	1
Average	**1.8**	**1.8**	**2.2**	**1.8**	**1.8**	**2.2**	**2.2**	**1.6**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Pharmaceutical Analysis I

Course Code: BP102T

Semester: 1st **L T P**

Credits: 04 **3 1 0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand qualitative, quantitative and semi-quantitative estimation.
CO2	Comprehend the principles of volumetric and electro chemical analysis.
CO3	Develop analytical skills.
CO4	Check the purity and strength of the drug formulations.
CO5	Cognize the different separation techniques and their applications in analysis of drugs

Course Content

Unit-I

(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
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
Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.
Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.
Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.
Basic Principles, methods and application of diazotisation titration.

UNIT-IV
Redox titrations
(a) Concepts of oxidation and reduction
(b) Types of redox titrations (Principles and applications)
Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate.

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

Recommended Books: (Latest Editions)

1. A.I. Vogel(1978), Text Book of Quantitative Inorganic Analysis,J.Bassett et.al London.
2. Indian Pharmacopoeia (2018)

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	3	2	3	2	2	3	2	2	1	3	1
CO2	2	1	2	1	1	2	2	1	3	2	3	1	2	1	1
CO3	3	2	3	2	2	2	2	2	2	3	1	2	2	1	2
CO4	2	1	1	1	2	1	1	1	1	1	2	1	1	2	1
CO5	1	2	3	3	2	3	1	2	3	2	3	1	3	2	1
Average	**1.8**	**1.4**	**2.2**	**1.8**	**2**	**2**	**1.8**	**1.6**	**2.2**	**2.2**	**2.2**	**1.8**	**1.8**	**1.8**	**1.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Pharmaceutical Analysis-I (lab)

Course Code: BP108P

Semester: 1st

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Perform limit test, preparation, standardization and determination of Normality.
CO2	Carryout various volumetric and electrochemical titrations.
CO3	Develop analytical skills.
CO4	Perform analysis of drugs using Fluorimetry, nepheloturbidimetry and flame photometry
CO5	Cognize the different separation techniques and their applications in analysis of drugs

Course Content

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 complexometry
(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

Recommended Books: (Latest Editions)
1. A.I. Vogel(1978), Text Book of Quantitative Inorganic Analysis,J.Bassett et.al London.
2. Indian Pharmacopoeia (2018)

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	1	3	3	2	1	3	1	1	1
CO2	1	1	1	1	1	2	3	1	2	1	2	2	2	3	2
CO3	2	3	2	2	3	1	2	2	3	2	2	3	2	3	2
CO4	2	2	2	3	2	3	2	1	2	3	2	2	3	2	2
CO5	1	1	3	3	1	2	2	2	3	3	3	1	1	2	2
Average	**1.8**	**1.8**	**2**	**2.2**	**1.8**	**2**	**2**	**1.8**	**2.6**	**2.2**	**2**	**2.2**	**1.8**	**2.2**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICS- I

Course Code: BP103T

Semester: 1st

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the professional way of handling the prescription
CO2	Apply various additives and technical terms commonly used in the field of Pharmacy.
CO3	Analyze the Knowledge about the Pharmacopoeias and the role of Pharmacist
CO4	Evaluate the methods of preparation of extracts and principle of infusion, decoction
CO5	Create the formulation, sterilization and stability of various conventional different dosage forms

Course Content:

Unit – I

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

Dosage forms: Introduction to dosage forms, classification and definitions

Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription.

Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

Unit – II

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

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

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

Unit – III

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

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

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

Unit – V

S**emisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semisolid dosage forms. Evaluation of semisolid dosages forms.

Recommended Books:

1. Lachmann(2020). Theory and Practice of Industrial Pharmacy, Lea&Febiger Publisher, The University of Michigan.
2. Indian Pharmacopoeia (2018).
3. British Pharmacopoeia (2019).
4. Alfonso R. Gennaro Remington(2006). The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2	1	2	1	2	3	2	3	1	2	2	1	2
CO2	3	2	1	2	2	3	1	2	3	1	2	3	2	2	3
CO3	1	2	3	1	3	1	2	2	2	1	1	1	1	3	1
CO4	2	3	1	2	3	2	3	3	3	2	2	2	1	2	2
CO5	2	1	3	1	3	1	2	3	3	1	1	3	2	3	3
Average	**1.8**	**2.2**	**2**	**1.4**	**2.6**	**1.6**	**2**	**2.6**	**2.6**	**1.6**	**1.4**	**2.2**	**1.6**	**2.2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Pharmaceutics-I (Practical)

Course Code: BP109P

Semester: 1st

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes: On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the Formulation of dosage forms
CO2	Apply the methods of preparation of extracts and principle of infusion, decoction etc.
CO3	Analyze Resolve the problems through the application of fundamental principles of pharmaceutical metrology and conclude the decision.
CO4	Evaluate the Pharmacopeial standards for the preparation of various dosages forms.
CO5	Create the mouthwashes, syrups

Course Content

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) Aluminum 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)Divided powders

8. Suppositories

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

8. Semisolids

a) Sulphur ointment
b) Non staining-iodine ointment with methyl salicylate
c) Carbopal gel

9. Gargles and Mouthwashes

a) Iodine gargle
b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. Lachmann(2020). Theory and Practice of Industrial Pharmacy, Lea&Febiger Publisher, The University of Michigan.
2. Indian Pharmacopoeia (2018).
3. British Pharmacopoeia (2019).
4. Alfonso R. Gennaro Remington(2006). The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	3	2	3	3	3	3	2	2	3	2
CO2	2	1	1	2	2	3	1	2	-	1	2	2	2	-	3
CO3	3	2	3	1	3	1	2	2	2	2	1	3	1	1	2
CO4	1	2	1	2	3	2	3	-	3	2	-	1	2	2	2
CO5	3	1	3	2	-	1	3	3	1	1	3	3	1	3	1
Average	**2.2**	**1.8**	**2.2**	**1.8**	**2**	**2**	**2.2**	**2**	**1.8**	**1.8**	**1.8**	**2.2**	**1.6**	**1.8**	**2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Pharmaceutical Inorganic Chemistry

Course Code: BP104T

Semester: 1st

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Deals with monograph of inorganic drug and pharmaceutics.
CO2	Recognize acid base and buffers.
CO3	Familiarize with a variety of inorganic drug classes
CO4	Clarify topical agents, gases and vapors, dental products and radio pharmaceuticals
CO5	Get Awareness about the sources of impurities

Course Content

Unit I

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate

General methods of preparation, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes.

Unit II

Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Unit III

Gastrointestinal agents

Acidifiers: Ammonium chloride* and Dil. HCl

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

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin andBentonite

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

Unit IV
Miscellaneous compounds
Expectorants: Potassium iodide, Ammonium chloride*.
Emetics: Copper sulphate*, Sodium potassium tartarate
Haematinics: Ferrous sulphate*, Ferrous gluconate
Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite
Astringents: Zinc Sulphate, Potash Alum

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

Recommended Books (Latest Editions)
1. Anand & Chatwal (2018). Inorganic Pharmaceutical Chemistry, Himalaya Publishing House.
2. A.H. Beckett & J.B. Stenlake's (2005). Practical Pharmaceutical Chemistry Vol 1,2. Stahlone Press of University of London
3. A.I. Vogel (1989). Text Book of Quantitative Inorganic Analysis
4. Indian Pharmacopoeia (2018).

The mapping of the PO/PSO/COattainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	2	1	1	3	2	1	2	2
CO2	1	1	3	2	2	1	3	2	2	-	2	2	2	1	1
CO3	1	2	1	-	2	-	2	2	2	2	-	1	3	1	-
CO4	2	2	-	2	-	2	1	1	1	2	2	-	2	2	2
CO5	1	1	2	3	1	2	2	1	1	3	2	1	-	1	2
Average	**1.4**	**1.6**	**1.6**	**1.8**	**1.6**	**1.2**	**2**	**1.6**	**1.4**	**1.6**	**1.8**	**1.4**	**1.8**	**1.2**	**1.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL INORGANIC CHEMISTRY

Course Code: BP110P

Semester: 1st

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Know about identification, purity and limit tests.
CO2	Develop information of preparation of inorganic pharmaceuticals
CO3	Get Awareness about the sources of impurities
CO4	Acquire Knowledge about methods of determination of the impurities in inorganic drugs and pharmaceuticals
CO5	Familiarize with a variety of inorganic drug classes

Course Content

I. 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 Heavymetals
Limit test for Lead
Limit test for Arsenic

II. Identification test

Magnesium hydroxide
Ferrous sulphate
Sodium bicarbonate
Calcium gluconate
Copper sulphate

III. Test for purity

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

IV. Preparation of inorganic pharmaceuticals

Boric acid

Potash alum
Ferrous sulphate

Recommended Books (Latest Editions)

1. Anand & Chatwal (2018). Inorganic Pharmaceutical Chemistry, Himalaya Publishing House.
2. A.H. Beckett & J.B. Stenlake's (2005). Practical Pharmaceutical Chemistry Vol 1,2. Stahlone Press of University of London
3. A.I. Vogel (1989). Text Book of Quantitative Inorganic analysis
4. Indian Pharmacopoeia (2018).

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	1	2	1	1	2	2	2	1	3	2
CO2	-	1	-	2	2	1	-	-	2	-	2	2	2	1	1
CO3	1	2	1	-	1	-	2	2	2	2	-	1	-	1	2
CO4	2	2	2	2	-	2	1	1	1	2	2	-	2	2	2
CO5	1	-	1	-	2	2	2	2	2	3	2	1	3	1	1
Average	**1.2**	**1.2**	**1.2**	**1.2**	**1.4**	**1.2**	**1.4**	**1.2**	**1.6**	**1.8**	**1.6**	**1.2**	**1.6**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: COMMUNICATION SKILLS

Course Code: BP105T

Semester: 1st

L	T	P
2	0	0

Credits: 02

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Improve proof-reading skills and language awareness so that one can spot mistakes and correct their own work
CO2	Comprehend the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation.
CO3	Develop interview skills
CO4	Communicate effectively (Verbal and Non-Verbal)
CO5	Improve writing skills

Course content:

Unit – I

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

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

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

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

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

Recommended Books

1. Andreja. J. Ruther Ford (2011). Basic communication skills for Technology, Pearson Education.
2. Communication skills (2011). Sanjay Kumar, Pushpalata, Oxford Press,
3. Stephen .P. Robbins (2013).Organizational Behaviour, 1stEdition, Pearson.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	1	2	1	1	2	2	2	1	3	2
CO2	1	1	2	2	2	1	-	2	2	-	2	-	-	1	1
CO3	1	-	1	-	1	-	3	2	1	2	-	1	2	1	2
CO4	2	2	-	2	3	2	1	1	1	-	2	3	2	2	2
CO5	1	2	1	-	-	2	2	1	2	3	2	1	3	1	1
Average	**1.4**	**1.2**	**1.2**	**1.2**	**1.6**	**1.2**	**1.6**	**1.4**	**1.4**	**2.4**	**2.2**	**1.8**	**2**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: COMMUNICATION SKILLS (lab)

Course Code: BP111P

Semester: 1st

L T P

Credits: 01 **0 0 2**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Acquire modules that are to be conducted using English language lab software.
CO2	Comprehend the behavioral needs for a Pharmacist to function efficiently.
CO3	Establish the team as an effective team player

Course Content

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

Recommended Books

1. Andreja. J. Ruther Ford (2011). Basic communication skills for Technology, Pearson Education,.
2. Communication skills (2011). Sanjay Kumar, Pushpalata, Oxford Press,
3. Stephen .P. Robbins (2013).Organizational Behaviour, 1stEdition, Pearson.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	2	1	2	2	2	1	3	2
CO2	1	-	1	-	1	1	2	-	2	-	3	2	2	1	1
CO3	1	2	1	3	1	3	-	2	2	2	-	1	3	1	2
Average	**1.3**	**1.3**	**1.3**	**1.6**	**1.3**	**1.6**	**1.3**	**1.3**	**1.6**	**1.3**	**1.6**	**1.6**	**2**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: REMEDIAL BIOLOGY

Course Code: BP106RBT

Semester: 1st

	L	T	P
Credits: 02	**2**	**0**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the basic concept of plant morphology.
CO2	Study the morphology of flowering plant.
CO3	Be familiar with Theory of evolution
CO4	Understand Cell biology (Basic Nature of Plant cell and Animal cell)

Course Content

Unit I

Living world:

Definition and characters of living organisms
Diversity in the living world
Binomial nomenclature
Five kingdoms of life and basis of classification. Salient features of Monera, 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 &Dicotylidones.

Unit II

Body fluids and circulation

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

Digestion and Absorption

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

Breathing and respiration

Human respiratory system
Mechanism of breathing and its regulation

Exchange of gases, transport of gases and regulation of respiration
Respiratory volumes

Unit III
Modes of excretion
Human excretory system- structure and function
Urine formation
Rennin angiotensin system

Neural control and coordination
Definition and classification of nervous system
Structure of a neuron
Generation and conduction of nerve impulse
Structure of brain and spinal cord
Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation
Endocrine glands and their secretions
Functions of hormones secreted by endocrine glands

Human reproduction
Parts of female reproductive system
Parts of male reproductive system
Spermatogenesis and Oogenesis
Menstrual cycle

Unit IV
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
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.

Reference books:
1. S. B. Gokhale (2008). Text book of Biology.Pragtai Books Pvt. Ltd.
2. Dr. Thulajappa and Dr. Seetaram (2015). A Text book of Biology. Cengage Learning India Private Ltd.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	2	3	1	3	2	1	2	2
CO2	1	1	3	2	-	1	-	2	2	-	2	-	2	1	1
CO3	2	2	1	-	2	3	2	-	-	2	-	1	3	1	2
CO4	-	2	-	2	3	2	1	1	1	2	2	3	2	2	2
Average	**1.2**	**1.7**	**1.5**	**1.5**	**1.7**	**1.7**	**1.2**	**1.2**	**1.5**	**1.2**	**1.7**	**1.5**	**2**	**1.5**	**1.7**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: REMEDIAL BIOLOGY (lab)

Course Code: BP112RBP

Semester: 1st

L T P

Credits: 01 **0 0 2**

Course Outcomes

On successful completion of this course, the students will be able to:

CO	STATEMENT
CO1	Understand microscopic study and identification of tissues Study of cell, Stem, Root, Leaf, seed, fruit, and flower.
CO2	Carry out detailed study of frog by using computer models
CO3	Perform determination of blood group and check blood pressure and tidal volume.
CO4	Solve different type of problems by applying theory

Course Content

1. Introduction to experiments in biology
a) Study of Microscope
b) Section cutting techniques
c) Mounting and staining

d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using 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

1. S.B.Gokhale, C.K.Kokate and S.P.Shriwastava *(2007)*.A Manual of Pharmaceutical Biology Practical. NiraliPrakashan.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	1	2	1	1	1	2	2	2	2	1
CO2	2	1	2	2	-	1	-	2	2	1	2	2	2	1	1
CO3	1	2	-	1	1	2	2	1	2	2	-	1	1	1	2
CO4	1	2	3	-	3	2	1	1	1	2	2	1	2	2	2
Average	**1.5**	**1.5**	**1.7**	**1.2**	**1.2**	**1.5**	**1.2**	**1.2**	**1.5**	**1.5**	**1.5**	**1.5**	**1.7**	**1.5**	**1.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: REMEDIAL MATHEMATICS

Course Code: BP106RMT

Semester: 1st

L T P

Credits: 02

2 0 0

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Deal with introduction of partial fraction, logarithm, matrix, Calculus.
CO2	Apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.
CO3	Create, use and analyze mathematical representations and mathematical relationships
CO4	Communicate mathematical knowledge and understanding to help in the field of Clinical Pharmacy

Course Content

Unit – I

Partial fraction

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

Logarithms

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

- **Function***:*

Real Valued function, Classification of real valued functions,

Limits and continuity:

Introduction, Limit of a function, Definition of limit of a function (□□- □□definition)

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

Unit –II

Matrices and Determinant:

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

Unit – III

Differentiation : Introductions, Derivative of a function, Derivative of aconstant, Derivative of a product of a constant and a function , Derivativeof the sum or difference of two functions, Derivative of the product of twofunctions (product formula), Derivative of the quotient of two functions(Quotient formula) – **Without Proof**, Derivative of *xnw.r.t*x,where*n*is anyrational number, Derivative of *ex*,, Derivative of loge *x* , Derivative of*ax*,Derivative of trigonometric functions from first principles **(withoutProof)**, Successive

Differentiation, Conditions for a function to be amaximum 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

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 Chemicalkineticsand Pharmacokinetics equations.
Recommended Books (Latest Edition)

1. Panchaksharappa Gowda D.H (2014). Pharmaceutical Mathematics with application to Pharmacy

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	2	2	2	1	1	1	3	1	2	1	1	1	2	1	1
CO3	-	2	2	3	1	2	-	3	1	2	3	1	1	1	2
CO4	1	-	-	2	3	2	1	-	1	2	1	3	2	2	2
Average	**1.2**	**1.2**	**1.5**	**1.5**	**1.5**	**1.5**	**1.7**	**1.2**	**1.5**	**1.5**	**1.7**	**1.7**	**15.**	**1.5**	**1.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: HUMAN ANATOMY AND PHYSIOLOGY-II

Course Code: BP 201T

Semester: 2nd

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Know about the various tissues and organs of different systems of human body.
CO2	Analyze the relevance and significance of Human Anatomy and Physiology to Pharmaceutical Sciences
CO3	Perform the hematological tests like blood cell counts, hemoglobin estimationetc and also record blood pressure, heart rate, pulse andrespiratory volume
CO4	Inspect Homeostatic mechanisms and their imbalances in the human body
CO5	Determine the proper care for each individual patient and their specific symptoms.

Course Content

Unit I

Nervous system

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

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

Unit II

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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

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

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

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:

1.K. Sembulingam and P. Sembulingam (2012). Essentials of Medical Physiology, Jaypee brothers medical publishers, New Delhi.
2. Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1,2, Academic Publishers Kolkata

The mapping of the PO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	2	2	2	1	2	2	2	1	3	3	1
CO2	2	2	1	1	2	1	2	1	2	2	-	2	2	2	1
CO3	1	1	2	2	1	2	2	3	3	2	3	2	2	2	2
CO4	1	2	3	1	3	-	3	1	2	3	1	3	2	1	2
CO5	1	3	2	3	1	3	1	2	2	1	1	1	1	3	3
Average	**1.4**	**1.8**	**1.8**	**2**	**1.8**	**1.6**	**2**	**1.6**	**2.2**	**2.2**	**1.4**	**1.8**	**2**	**2.2**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: HUMAN ANATOMY AND PHYSIOLOGY

Course Code: BP207P

Semester: 2nd

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the construction, working, care and handling of instruments, glassware and equipment required for practical
CO2	Apply body fluids and blood knowledge in Hemoglobin detection and measurement of blood pressure.
CO3	Analyze working pattern of different organs of each system.
CO4	Evaluate pulse rate, heart rate, erythrocyte sedimentation rate
CO5	Develop reports of white blood cells and red blood cells count

Course Content

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

Recommended Books:

1.K. Sembulingam and P. Sembulingam (2012). Essentials of Medical Physiology, Jaypee BrothersMedical Publishers, New Delhi.

2. Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1,2, Academic Publishers Kolkata

The mapping of the PO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	1	2	2	2	2	1	1	1
CO2	1	2	2	1	2	2	1	1	1	2	2	2	2	2	3
CO3	1	3	2	3	2	-	2	3	3	2	1	-	2	2	2
CO4	1	3	3	3	3	3	3	1	2	3	3	3	2	3	2
CO5	1	3	3	3	3	3	3	2	3	3	3	3	1	1	3
Average	**1.4**	**2.6**	**2.4**	**2.4**	**2.4**	**2**	**2.2**	**1.6**	**2**	**2.4**	**2.2**	**2**	**1.6**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL ORGANIC CHEMISTRY –I

Course Code: BP202T

Semester:2nd

L T P

Credits: 04 **3 1 0**

Course Outcomes: On successful completion of this course, the students will be able to:

CO	Statement
CO1	Learn the classification of organic compounds on the basis of functional group and IUPAC nomenclature of different organic compounds.
CO2	Apply concepts of organic chemistry related to hybridization, types of bonds and isomerism , Methods of preparation ,elimination and addition reactions of different compounds
CO3	Identify/confirm the identification of organic compound
CO4	Examine various techniques of purification of the synthesized compounds using precipitation or recrystallization
CO5	Explore molecules and compounds.

Course Content:

UNIT-I

Classification, nomenclature and isomerism

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

UNIT-II

Alkanes*, Alkenes* and Conjugated dienes*

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

Stabilities of alkenes, SP2 hybridization in alkenes

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

Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

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

UNIT-III

Alkyl halides*

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

SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions

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

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

UNIT-IV

Carbonyl compounds* (Aldehydes and ketones)

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

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. Morrison and Boyd (2010). Organic Chemistry.Pearson.
2. Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry. Pearson

The mapping of the PO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	2	2	2	1	2	2	2	1	1	2	1
CO2	2	3	1	1	2	1	3	1	1	1	2	2	2	1	1
CO3	1	1	-	1	1	2	2	3	2	2	1	1	1	2	2
CO4	1	2	3	2	1	-	1	1	1	1	1	2	2	1	-
CO5	1	1	2	-	1	3	2	2	1	2	2	1	1	1	3
Average	**1.6**	**1.6**	**1.4**	**1.6**	**1.6**	**1.6**	**1.8**	**1.6**	**1.4**	**1.6**	**1.6**	**1.4**	**1.4**	**1.4**	**1.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: PHARMACEUTICAL ORGANIC CHEMISTRY –I

Course Code: BP208P

Semester: 2nd

	L	**T**	**P**
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the principle behind various qualitative tests and analyze the given unknown organic compound having different functional groups
CO2	Apply various laboratory techniques for the synthesis of organic compounds, purification of the synthesized compounds using precipitation or recrystallization.
CO3	Analyze organic compounds qualitatively, synthesis of derivatives.
CO4	Evaluate correct use of various equipment& Safety measures in Pharmaceutical Chemistry laboratory.
CO5	Understand creation of polymers, like plastics and nylons

Course Content

I. Systematic qualitative analysis of unknown organic compounds like
1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation.
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 bymelting point/ boiling point.
8. Minimum 5 unknown organic compounds to be analysed systematically.
II. Preparation of suitable solid derivatives from organic compounds
III. Construction of molecular models

Recommended Books (Latest Editions)

1. Morrison and Boyd (2010).OrganicChemistry.Pearson.
2. Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry. Pearson

The mapping of the PO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	2	1	2	2	1	2	1	1	2	1	1
CO2	3	2	1	2	1	3	3	1	2	2	2	1	3	2	1
CO3	2	2	2	3	3	3	2	3	3	3	2	3	2	3	2
CO4	3	3	3	2	2	2	2	2	2	2	3	2	2	2	2
CO5	1	3	2	3	2	3	3	2	3	3	3	3	3	3	3
Average	**2.2**	**2.4**	**1.8**	**2.6**	**2**	**2.4**	**2.4**	**2**	**2.2**	**2.4**	**2.2**	**2**	**2.4**	**2.2**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: BIOCHEMISTRY

Course Code: BP203 T

Semester: 2nd

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Recognize role of biochemical processes and cell metabolism.
CO2	Implement basics like chemistry, function, classification, biological importance, qualitative tests & applications of various biomolecules. e.g. proteins, carbohydrates and lipids, etc
CO3	Detect and identify proteins, amino acids and carbohydrates by various qualitative as well as quantitative tests.
CO4	Estimate the fundamentals of metabolism, process, steps involved in metabolism of carbohydrates, lipids, protein and nucleic acid.
CO5	Construct tests used to detect infections, genetic disorders, and other diseases

Course Content

UNIT I

Biomolecules

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

Bioenergetics

Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.

Energy rich compounds; classification; biological significances of ATP and cyclic AMP

UNIT II

Carbohydrate metabolism

Glycolysis – Pathway, energetics and significance

Citric acid cycle- Pathway, energetics and significance

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

Glycogen metabolism Pathways and glycogen storage diseases (GSD)

Gluconeogenesis- Pathway and its significance
Hormonal regulation of blood glucose level and Diabetes mellitus

Biological oxidation
Electron transport chain (ETC) and its mechanism.
Oxidative phosphorylation & its mechanism and substrate phosphorylation
Inhibitors ETC and oxidative phosphorylation/Uncouplers level

UNIT III
Lipid metabolism
β-Oxidation of saturated fatty acid (Palmitic acid)
Formation and utilization of ketone bodies; ketoacidosis
De novo synthesis of fatty acids (Palmitic acid)
Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D
Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

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

UNIT IV
Nucleic acid metabolism and genetic information transfer
Biosynthesis of purine and pyrimidine nucleotides
Catabolism of purine nucleotides and Hyperuricemia and Gout disease
Organization of mammalian genome
Structure of DNA and RNA and their functions
DNA replication (semi conservative model)
Transcription or RNA synthesis
Genetic code, Translation or Protein synthesis and inhibitors

UNIT V
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. Lehninger (2021). Principles of Biochemistry. W H Freeman & CO.
2. Robert K. Murry, Daryl K. Granner and Victor W. Rodwell(2020). Harper's Biochemistry. Vitae Gen Biotech.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	2	3	2	3	2	3	2	2	3	1	3
CO2	2	1	2	2	1	1	1	1	2	1	2	2	2	1	1
CO3	2	-	1	3	1	1	2	2	2	2	1	1	1	1	2
CO4	1	2	1	1	2	2	-	1	1	1	1	3	-	2	2
CO5	1	1	1	-	3	2	2	-	1	2	2	1	1	3	1
Average	**1.4**	**1.2**	**1.4**	**1.6**	**1.8**	**1.6**	**1.6**	**1.6**	**1.6**	**1.8**	**1.6**	**1.8**	**1.6**	**1.6**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: BIOCHEMISTRY

Course Code: BP 209P

Semester: 2nd

	L	**T**	**P**
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Develop skill for qualitative analysis of carbohydrates, Proteins, urine analysis, enzymes
CO2	Apply the skills for physiological and pathological condition of chemicals.
CO3	Analyze the interpretation of data emanating from a Clinical Test Lab.
CO4	Evaluate physiological conditions, influence the structures and re-activities of biomolecules
CO5	Construct tests used to detect infections, genetic disorders, and other diseases

Course Content

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

Recommended Books (Latest Editions)

1. Lehninger (2021).Principles of Biochemistry. W H Freeman & CO.
2. Robert K. Murry, Daryl K. Granner and Victor W. Rodwell(2020).Harper's Biochemistry. Vitae Gen Biotech.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	1	2	3	1	1	2	2	3	1	3
CO2	3	1	2	3	2	3	1	2	3	2	1	2	1	2	1
CO3	2	2	1	1	1	1	2	2	2	-	1	1	2	3	2
CO4	1	1	-	1	2	1	1	1	1	2	2	-	2	2	1
CO5	1	1	3	1	3	2	2	1	2	2	2	3	1	1	2
Average	**1.8**	**1.6**	**1.6**	**1.6**	**2**	**1.6**	**1.6**	**1.8**	**1.8**	**1.4**	**1.6**	**1.6**	**1.8**	**1.8**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PATHOPHYSIOLOGY

Course Code: BP 204T

Semester: 2nd

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the etiology and pathogenesis of the selected disease states
CO2	Learn the signs and symptoms of the diseases
CO3	Define the etiology and pathogenesis of the selected disease states
CO4	Recognize the complications of the diseases

Course Content:

Unit I

Basic principles of Cell injury and Adaptation:

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

Basic mechanism involved in the process of inflammation and repair:

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

Unit II

Cardiovascular System:

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

Respiratory system: Asthma, Chronic obstructive airways diseases.

Renal system: Acute and chronic renal failure .

Unit III

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

Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones
Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
Gastrointestinal system: Peptic Ulcer

Unit IV
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
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 (2014).Pathologic Basis of Disease; South Asia edition; India; Elsevier.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	3	3	1	3	2	2	3	2	3
CO2	2	3	2	2	2	3	1	2	2	1	2	2	2	3	3
CO3	2	2	2	1	3	2	2	2	2	2	1	3	3	3	1
CO4	3	2	1	1	2	2	3	1	3	2	2	1	2	2	2
CO5	1	1	3	1	3	2	2	3	2	1	2	3	3	3	2
Average	**2.2**	**2.2**	**2**	**1.4**	**2.4**	**2.4**	**2.2**	**2.2**	**2**	**1.8**	**1.8**	**2.2**	**2.6**	**2.6**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: COMPUTER APPLICATIONS IN PHARMACY

Course Code: BP205 T

Semester:2nd

	L	T	P
Credits: 03	**3**	**0**	**0**

Course Outcomes: On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand Database, Database Management system, Computer application in clinical studies and use of databases.
CO2	Practice drug interactions, drug information services and patient counseling.
CO3	Understand that using automated technology can also improve patient care safety by reducing medication errors, maintaining patient's medication records.
CO4	Evaluate abnormal changes in patients faster and with more accuracy
CO5	Design Automated Dispensing Units and Medication Reminder Devices

Course Content:

UNIT – I

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement,Two's complement method, binarymultiplication, 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

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

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

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

UNIT-V

Computers as data analysis in Preclinical development:

Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS

Recommended books

1. William E.Fassett Lea and Febiger (1986).Computer Application in Pharmacy, 600 South Washington Square, USA, (215) 922-1330.
2. Sean Ekins, Wiley-Interscience(2006). Computer Application in Pharmaceutical Research and Development, A John Willey and Sons, INC., Publication, USA
3.S.C.Rastogi (2007). Bioinformatics (Concept, Skills and Applications)CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	2	3	3	3	1	3	2	2	3	2	3
CO2	2	1	2	2	1	1	1	-	2	1	2	1	2	1	1
CO3	1	2	-	1	2	1	2	2	2	2	1	3	1	3	1
CO4	1	1	1	1	2	2	1	1	2	2	2	-	1	2	2
CO5	3	1	2	1	-	2	2	3	1	1	2	3	3	1	2
Average	**1.6**	**1.4**	**1.6**	**1.6**	**1.4**	**1.8**	**1.8**	**1.8**	**1.6**	**1.8**	**1.8**	**1.8**	**2**	**1.8**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: COMPUTER APPLICATIONS IN PHARMACY

Course Code: BP210P

Semester: 2nd

	L	**T**	**P**
Credits: 01	**0**	**0**	**2**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Know the various types of databases
CO2	Generate report and printing the report from patient database
CO3	Design a questionnaire using a word processing package to gather informationabout a particular disease.
CO4	Retrieve the information of a drug and its adverse effects using online tools
CO5	Create and work with queries in MS Access

Course Content

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

Recommended books

1. William E.Fassett Lea and Febiger (1986).Computer Application in Pharmacy, 600 South Washington Square, USA, (215) 922-1330.
2. Sean Ekins, Wiley-Interscience(2006).Computer Application in Pharmaceutical Research and Development, A John Willey and Sons, INC., Publication, USA
3. S.C.Rastogi (2007). Bioinformatics (Concept, Skills and Applications),CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	1	2	1	2	1	2	2	1	2	1
CO2	2	1	1	2	2	1	3	2	1	1	1	2	2	1	1
CO3	-	2	2	1	1	2	-	2	2	2	3	1	3	1	2
CO4	1	-	1	2	1	-	1	-	1	2	2	1	2	2	2
CO5	1	2	3	3	1	2	2	3	2	3	1	1	2	1	2
Average	**1.2**	**1.2**	**1.8**	**2**	**1.2**	**1.2**	**1.6**	**1.6**	**1.6**	**1.8**	**1.8**	**1.6**	**2**	**1.4**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: ENVIRONMENTAL SCIENCES

Course Code: BP 206 T

Semester: 2nd

	L	T	P
Credits: 03	**3**	**0**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Generate the awareness about environmental problems in the society
CO2	Develop an attitude of concern for the environment
CO3	Attain harmony with Nature.
CO4	Develop knowledge about natural resources.

Course Content:

Unit-I
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
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

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Y.K. Sing,(2006). Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C (2001). Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Brunner R.C. (1989). Hazardous Waste Incineration, McGraw Hill Inc. 480p

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	3	3	2	1	2	1	2	1	2	2	1	2	1
CO2	2	1	2	2	2	1	3	2	1	1	1	2	2	1	1
CO3	1	2	-	1	1	2	2	1	1	2	1	1	-	1	2
CO4	1	2	1	2	1	2	1	1	2	3	2	1	2	2	2
Average	**1.2**	**1.5**	**1.2**	**2**	**1.5**	**1.5**	**2**	**1.2**	**1.5**	**1.7**	**1.5**	**1.5**	**1.2**	**1.5**	**1.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: -Pharmaceutical Organic Chemistry-II

Course code: - BP301T

Semester: 3rd

L T P

Credits: 04 **3 1 0**

Course Outcomes:

CO	Statement
CO1	Understand methods of preparation and reactions of organic compounds
CO2	Apply on heterocyclic compounds
CO3	Analyze the Chemistry of fats and oils
CO4	Evaluate reactions, reactivity, mechanisms, and orientation of organic compounds
CO5	Create electrophilic and nucleophilic reactions.

On successful completion of this course, the students will be able to:

Course Content

Unit I

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, halogenationreactivity,Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.

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

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

UNIT II

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitativetests, 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 andimportant reactions of benzoic acid.

UNIT III

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

Polynuclear hydrocarbons:

a. Synthesis, reactions

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

UNIT V

Cyclo alkanes*

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

Recommended Books (Latest Editions)

1. Morrison and Boyd (2010). Organic Chemistry.Pearson.
2. Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry. Pearson

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	1	2	1	2	1	2	2	1	3	1
CO2	2	1	2	1	2	1	2	2	1	3	2	2	2	2	1
CO3	2	2	2	1	1	3	2	2	2	-	1	3	1	1	2
CO4	1	2	1	1	2	2	1	3	1	2	1	2	2	2	2
CO5	3	3	1	3	1	2	2	1	2	2	2	1	3	1	2
Average	**1.8**	**1.8**	**1.6**	**1.6**	**1.6**	**1.8**	**1.8**	**1.8**	**1.6**	**1.6**	**1.6**	**2**	**1.8**	**1.8**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:- Pharmaceutical Organic Chemistry-II Lab

Course Code:- BP305P

	L	**T**	**P**
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the laboratory techniques for Recrystallization, and Steam distillation.
CO2	Determine oil values.
CO3	Analyze and prepare compounds
CO4	Evaluate the reactivity of organic compounds
CO5	Create steam distillation techniques

Course Content

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-napthol from Aniline by diazotization and coupling reactions.
Benzil from Benzoin by oxidation reaction.
Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
Cinnammic acid from Benzaldehyde by Perkin reaction
P-Iodo benzoic acid from *P*-amino benzoic acid

Recommended Books (Latest Editions)

1. Morrison and Boyd (2010). Organic Chemistry.Pearson.
2. Fumiss S. Brian (2005).Vogel'sText book of Practical Organic Chemistry. Pearson

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	1	2	1	2	1	2	2	1	3	2
CO2	2	1	2	1	2	1	2	2	1	3	1	2	2	1	1
CO3	2	2	2	1	1	3	2	2	2	2	-	1	1	1	2
CO4	1	2	1	-	2	2	1	1	1	2	2	2	2	2	2
CO5	1	3	1	3	1	2	2	1	2	2	2	1	3	1	2
Average	**1.6**	**1.8**	**1.4**	**1.4**	**1.4**	**1.8**	**1.8**	**1.4**	**1.6**	**2**	**1.4**	**1.6**	**1.8**	**1.6**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHYSICAL PHARMACEUTICS-I

Course Code: BP302T

Semester: 3rd

L T P

Credits: 04 **3 1 0**

Course Outcomes: On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the various physicochemical properties of drug molecules in the designing the dosage forms.
CO2	Apply the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
CO3	Analyze use of physicochemical properties in the formulation development and evaluation of dosage forms.
CO4	Evaluate the role of surfactants, interfacial phenomenon and thermodynamics.
CO5	Create physicochemical properties of drug molecules in formulation and research development.

Course Content:

UNIT-I

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

UNIT-II

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT-III

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

UNIT-IV

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

UNIT-V

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:

1. Cooper and Gunn (2008).Tutorial Pharmacy, S J Carter.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	3	2	3	2	1	2	1	3	2	2	3	2
CO2	2	3	1	2	2	1	3	2	1	3	1	1	2	2	1
CO3	1	1	1	2	1	-	2	2	2	1	3	1	3	1	2
CO4	3	2	3	1	1	2	1	1	1	2	2	2	1	2	2
CO5	2	3	1	1	1	3	1	1	1	1	1	1	2	1	1
Average	**1.8**	**2**	**1.6**	**1.8**	**1.4**	**1.8**	**1.8**	**1.4**	**1.4**	**1.6**	**2**	**1.4**	**2**	**1.8**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:- Physical Pharmaceutics-I (Practical)

Course Code:- BP306P

Semester: 3rd

L T P

Credits: 02 **0 0 4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the determination of solubility of drug, pKa value, Partition co-efficient, % composition, surface tension, HLB number, Freundlich and Langmuir constants, critical micellar concentration, stability constant and donor acceptor ratio
CO2	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.
CO3	Analyze the determination of expiry date of formulations.
CO4	Evaluate the chemical stability tests of various drug products.
CO5	Create the pH titration method.

Course Content

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 solubilitymethod
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

Recommended Books: (Latest Editions)

1. Cooper and Gunn (2008).Tutorial Pharmacy, S J Carter.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	2	2	3	2	3	3	3	2	2	3	3	2
CO2	2	1	2	2	2	2	1	2	2	1	2	2	2	1	3
CO3	3	2	1	1	1	1	2	2	2	2	1	3	1	1	2
CO4	1	2	1	2	1	2	3	1	1	2	2	1	2	2	2
CO5	3	1	-	2	2	1	2	1	1	1	2	3	1	3	2
Average	**2**	**1.8**	**1.4**	**1.8**	**1.6**	**1.8**	**2**	**1.8**	**1.8**	**1.8**	**1.8**	**2.2**	**1.8**	**2**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL MICROBIOLOGY

Course Code: BP 303T

Semester: 3rd

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand methods of identification, cultivation and preservation of various microorganisms
CO2	Performsterilization in pharmaceutical processing and industry
CO3	Analyze microbiological standardization of Pharmaceuticals
CO4	Evaluate sterility testing of pharmaceutical products
CO5	Develop cell cultures for pharmaceutical industry and research

Course content:

Unit I

Introduction, history of microbiology, its branches, scope and its importance.

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

Unit II

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

Equipment employed in large scale sterilization.

Sterility indicators.

Unit III

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

Unit IV

Designing of aseptic area, laminar flow equipment's; 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

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 (2013).Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn (2002). Industrial Microbiology, CBS Publishers &Distributors,Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	2	1	1	2	3	1	3	2	1
CO2	2	1	1	1	1	2	1	2	1	-	1	1	2	1	2
CO3	1	-	2	2	2	1	2	1	2	2	2	2	1	1	2
CO4	2	2	2	1	-	3	1	1	2	1	2	-	2	2	1
CO5	1	1	2	1	2	1	2	1	-	1	1	3	1	1	1
Average	**1.8**	**1.2**	**1.6**	**1.4**	**1.2**	**1.6**	**1.6**	**1.2**	**1.2**	**1.2**	**1.8**	**1.4**	**1.8**	**1.4**	**1.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL MICROBIOLOGY

Course Code: BP 307P

Semester: 3rd

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand Introduction and study of different equipment and processing.
CO2	Apply importance of microbial limit tests, preservative efficacy test & standardization processes
CO3	Analyze sterilization status of glassware, culture media
CO4	Evaluate various structural features, biology & characteristics of microbes
CO5	Develop new antibiotics and pure cultures of microorganisms for vaccine production

Course Content

1. Introduction and study of different equipment 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.

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel (2013).Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.

2. Prescott and Dunn (2002).Industrial Microbiology, CBS Publishers &Distributors,Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	3	1	1	1	1	1	2	1	2	1	1
CO2	2	-	1	2	2	2	2	2	1	1	2	2	2	1	2
CO3	1	2	1	1	2	-	2	1	2	2	-	1	1	2	2
CO4	1	1	2	-	1	1	1	2	2	2	1	1	2	2	1
CO5	2	1	2	1	1	2	2	1	1	2	1	2	1	1	1
Average	**1.2**	**1.2**	**1.6**	**1.2**	**1.8**	**1.2**	**1.6**	**1.4**	**1.4**	**1.6**	**1.2**	**1.4**	**1.6**	**1.4**	**1.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:-PHARMACEUTICAL ENGINEERING

Course code: -BP304T

Semester: 3rd

L T P

Credits: 04 **3 1 0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand various unit operations used in Pharmaceutical industry.
CO2	Apply various processes involved in pharmaceutical manufacturing.
CO3	Analyse various tests to prevent environmental pollution.

CO4	Evaluate appreciate and comprehend significance of plant layout design for optimum use of resources
CO5	Create the various preventive methods used for corrosion control in pharmaceutical industry

Course Content:

UNIT-I

Flow of fluids: Types of manometers, Reynolds number and its significance,Bernoulli's theorem and its applications, Energy losses, Orifice meter,Venturimeter, Pitot tube and Rotometer

Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

Size Separation: Objectives, applications &mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank

.

UNIT-II

Heat Transfer: Objectives, applications &Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

Distillation: Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT- III

Drying: Objectives, applications &mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, 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, ribbonblender, Sigma blade mixer,planetarymixers, Propellers, Turbines, Paddles &Silverson Emulsifier,

UNIT-IV

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V

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:

1. Martin, (2005).Remington Practice of Pharmacy.
2. Lachmann (2018).Theory and Practice of Industrial Pharmacy.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	3	2	3	2	3	1	2	3	1	3
CO2	2	3	2	1	1	1	1	-	1	1	2	1	1	3	1
CO3	2	1	-	3	2	1	2	2	2	2	1	1	-	2	2
CO4	1	2	1	1	1	2	1	1	1	1	2	2	2	1	2
CO5	1	1	2	1	1	2	2	1	2	2	2	1	1	2	1
Average	**1.8**	**1.8**	**1.4**	**1.6**	**1.4**	**1.8**	**1.6**	**1.4**	**1.6**	**1.6**	**1.6**	**1.4**	**1.4**	**1.8**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course name:- Pharmaceutical Engineering (Lab)

Course code:- BP308P

Semester: 3rd

	L	**T**	**P**
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the determination of radiation constant, overall heat transfer coefficient, moisture content and loss on drying, humidity of air.
CO2	Apply Construction working and application of Pharmaceutical Machinery
CO3	Analyze Size analysis by sieving.
CO4	Evaluate size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
CO5	Create steam distillation

COURSE CONTENT

I. Determination of radiation constant of brass, iron, unpainted and painted glass.
II. Steam distillation – To calculate the efficiency of steam distillation.
III. To determine the overall heat transfer coefficient by heat exchanger.
IV. Construction of drying curves (for calcium carbonate nd starch).
V. Determination of moisture content and loss on drying.
VI. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic
Andlogarithmic probability plots.
IX. 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.
X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajor equipment.
XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
XII. To study the effect of time on the Rate of Crystallization.
XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.

Recommended Books:

1. Martin, (2005).Remington practice of pharmacy.
2.Lachmann (2018).Theory and practice of industrial pharmacy

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	3	2	3	2	3	2	2	2	1	3
CO2	3	-	2	3	2	1	2	2	1	1	2	2	2	2	1
CO3	2	2	2	1	-	1	1	2	2	2	1	1	1	1	2
CO4	1	2	1	1	2	2	-	1	1	1	1	2	2	2	1
CO5	1	1	1	1	1	2	2	1	2	2	2	-	1	1	2
Average	**1.8**	**1.6**	**1.6**	**1.6**	**1.4**	**1.8**	**1.4**	**1.8**	**1.6**	**1.8**	**1.6**	**1.4**	**1.6**	**1.4**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL ORGANIC CHEMISTRY –III

Course Code: BP401T

Semester: 4th

L T P

Credits: 04 **3 1 0**

Course Outcomes:

On successful completion of this course, the students will be able to:

Course Content:

CO	Statement
CO1	Understand anatomical terminology to identify and describe locations of majororgans of human body systems.
CO2	Analyze the advanced concepts of cardiovascular physiology.
CO3	Identify the major components of the lymphatic system and describe their functions.
CO4	Evaluate coordinated working pattern of different organs of each system.
CO5	Develop isomers

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

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

UNIT-II
Geometrical isomerism
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 reaction

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

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

UNIT-V
Reactions of synthetic importance
Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birchmreduction, Wolff Kishner reduction.
Oppenauer-oxidation and Dakin reaction.
Beckmanns rearrangement and Schmidt rearrangement.
Claisen-Schmidt condensation

Recommended Books (Latest Editions)
1. Morrison and Boyd (2010). Organic Chemistry.Pearson.
2. Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry. Pearson

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	3	1	2	1	1	2	2	1	1	1	2
CO2	1	1	1	2	2	1	1	1	2	1	2	1	1	2	1
CO3	2	1	2	1	1	2	2	2	2	1	-	2	2	1	1
CO4	2	2	2	-	1	2	1	1	1	2	2	2	1	1	2
CO5	-	1	1	1	2	1	1	2	1	2	1	1	2	3	1
Average	**1.2**	**1.4**	**1.6**	**1.4**	**1.8**	**1.4**	**1.4**	**1.4**	**1.4**	**1.6**	**1.4**	**1.4**	**1.4**	**1.6**	**1.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: MEDICINAL CHEMISTRY–I

Course Code: BP402T

Semester: 4th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Correlate between pharmacology of a disease and its mitigation or cure.
CO2	Analyze the structural activity relationship of different class of drugs.
CO3	Compose the chemical synthesis of some drugs.
CO4	Evaluate the Structural Activity Relationship (SAR) of different class of drugs.
CO5	Develop advancements in the Structural Activity Relationship (SAR) of different class of drugs.

Course Content:

UNIT- I

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects

UNIT- II

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline,Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine,Propylhexedrine.

Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*,Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol,Labetolol, Carvedilol.

UNIT-III

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol,Methacholine, Pilocarpine

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):
Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride,Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophateiodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyaminesulphate, Scopolamine hydrobromide, Homatropine hydrobromide,Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT- IV
Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:
Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital,Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Trifluprомazine, Thioridazinehydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate,Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene,Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsantAction

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin

Oxazolidine diones: Trimethadione, Paramethadione

Succinimides Phensuximide, Methsuximide, Ethosuximide*

Urea andmonoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V
Drugs acting on Central Nervous System

General anesthetics:
Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane,Sevoflurane, Isoflurane, Desflurane.
Ultra short acting barbitutrates: Methohexital sodium*, Thiamylalsodium, Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride

Narcotic and non-narcotic analgesics
Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*,Methadone hydrochloride*, Propoxyphene hydrochloride,Pentazocine,Levorphanoltartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphantartarate, Naloxone hydrochloride.

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

Recommended Books

1. Foye's Principles of Medicinal Chemistry (2019). Wolters Kluwer.
2. Burger's Medicinal Chemistry, Vol I to IV.
3. Remington's Pharmaceutical Sciences (2008).
4. Indian Pharmacopoeia (2018).

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	1	2	1	1	1	2	2	1	3	2
CO2	2	1	2	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	2	1	-	1	3	2	2	2	2	3	1	-	1	2
CO4	2	2	3	2	3	2	1	1	1	2	2	3	2	2	2
CO5	1	3	1	2	1	2	2	1	2	1	-	1	3	1	2
Average	**1.6**	**1.8**	**1.8**	**1.6**	**1.8**	**1.8**	**2**	**1.4**	**1.6**	**1.8**	**1.8**	**1.8**	**1.6**	**1.6**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: MEDICINAL CHEMISTRY – I (lab)

Course Code: BP406P

Semester: 4th

L T P

Credits: 04 **0 0 4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Get well acquainted with the synthesis of some important classes of drugs.
CO2	Analyze the chemistry of drugs with respect to their pharmacological activity.
CO3	Evaluate the synthesis of some important classes of drugs.
CO4	Examine mechanism pathways of different classes of medicinal. compounds
CO5	Develop skills involved in thin layer chromatography techniques and purification of synthesized compounds by column chromatography

Course Content

1 1, 3-pyrazole
2 1, 3-oxazole
3 Benzimidazole
4 Benztriazole
5 2, 3- diphenyl quinoxaline
6 Benzocaine
7 Phenytoin
8 Phenothiazine
9 Barbiturate

II Assay of drugs

1 Chlorpromazine
2 Phenobarbitone
3 Atropine
4 Ibuprofen
5 Aspirin
6 Furosemide

III Determination of Partition coefficient for any two drugs

Recommended Books

1. Foye's Principles of Medicinal Chemistry (2019). Wolters Kluwer.
2. Burger's Medicinal Chemistry, Vol I to IV.
3. Remington's Pharmaceutical Sciences (2008).
4. Indian Pharmacopoeia (2018).

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	1	2	1	1	1	2	2	1	3	2
CO2	1	1	2	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	2	1	-	1	2	2	2	2	2	1	1	3	1	2
CO4	3	2	3	2	3	2	1	1	1	2	2	3	2	2	2
CO5	1	3	1	3	1	2	2	1	2	3	2	1	3	1	2
Average	**1.6**	**1.8**	**1.6**	**1.8**	**1.6**	**1.6**	**2**	**1.4**	**1.6**	**2.2**	**1.8**	**1.8**	**2.2**	**1.6**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Physical Pharmaceutics-II

Course Code: BP403T

Semester: 4th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes: On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the physicochemical properties of drug molecules, pH, and solubility.
CO2	Determine use of physicochemical properties in the formulation development and evaluation of dosage forms.
CO3	Differentiate disperse system in different pharmaceutical preparation.
CO4	Evaluate half-life.
CO5	Formulate pure drug substance into a dosage form

Course Content:

UNIT-I

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

UNIT-II

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain,Elastic Modulus

UNIT-III

Coarse dispersion: Suspension, interfacial properties of suspended particles, settlinsuspensions, 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

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

UNIT-V

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. Cooper and Gunn (2008).Tutorial Pharmacy, S J Carter.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	2	1	1	3	2	1	2	2
CO2	1	1	3	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	2	1	-	2	3	2	2	2	2	1	1	3	1	2
CO4	2	2	3	2	3	2	1	1	1	2	-	3	2	2	2
CO5	1	1	2	3	1	2	2	1	1	3	2	1	-	1	2
Average	**1.4**	**1.6**	**2.2**	**1.8**	**2**	**1.8**	**2**	**1.6**	**1.4**	**2.2**	**1.6**	**1.8**	**1.6**	**1.4**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Physical Pharmaceutics-II (Lab)

Course Code: BP 407P

Semester: 4th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
CO2	Analyze the pharmaceutical applications of various physical.
CO3	Examine the chemical stability tests of various drug products
CO4	Evaluaterheological parameters of pharmaceutical suspensions and colloids
CO5	Develop new techniques for the evaluation of parameters of dosage forms

Course Content

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

Recommended Books: (Latest Editions)

1. Cooper and Gunn (2008).Tutorial Pharmacy, S J Carter.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	1	2	1	1	2	2	2	1	3	2
CO2	2	1	2	2	2	1	3	2	2	-	2	2	2	1	1
CO3	1	2	1	-	1	3	2	2	2	2	3	1	3	1	2
CO4	2	2	2	2	3	2	1	1	1	2	2	3	2	2	2
CO5	1	3	1	3	1	2	2	1	2	3	2	1	3	1	1
Average	**1.4**	**1.8**	**1.6**	**1.6**	**1.8**	**1.8**	**2**	**1.4**	**1.6**	**1.8**	**2.2**	**1.8**	**2.2**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Pharmacology-I

Course Code: BP404 T

Semester: 4th

L T P

Credits: 04 **3 1 0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the application of basic pharmacological knowledge in the prevention and treatment of various diseases.

CO2	Analyze the signal transduction mechanism of various receptors.
CO3	Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
CO4	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
CO5	Modify mechanism of action of different drugs

Course Content:

UNIT-I

1. General Pharmacology

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

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

UNIT-II

General Pharmacology

a. Pharmacodynamics-Principles and mechanisms of drug action. Receptor theoriesand classification of receptors, regulation of receptors. drug receptors interactionssignal transduction mechanisms, G-protein–coupled receptors, ion channel receptor,transmembrane enzyme linked receptors, transmembrane JAK-STAT bindingreceptor and receptors that regulate transcription factors, dose responserelationship, 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

2. Pharmacology of drugs acting on peripheral nervous system

a. Organization and function of ANS.

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

c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

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

e. Local anesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV

3. Pharmacology of drugs acting on central nervous system

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

b. General anesthetics and pre-anesthetics**.**

c. Sedatives, hypnotics and centrally acting muscle relaxants.

d. Anti-epileptics
e. Alcohols and disulfiram

UNIT-V

3. Pharmacology of drugs acting on central nervous system

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 (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier

2. Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO3	1	2	1	-	1	3	2	2	2	2	3	1	3	1	2
CO4	2	2	2	2	3	2	1	1	1	2	2	3	2	2	2
CO5	1	3	1	3	1	2	2	1	2	3	2	1	3	1	1
Average	**1.4**	**1.8**	**1.6**	**1.8**	**1.8**	**1.8**	**2**	**1.4**	**1.6**	**1.8**	**2.2**	**1.8**	**2.2**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Pharmacology-I (Lab)

Course Code: BP408 P

Semester: 4th

	L	**T**	**P**
Credits: 04	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand what drugs do to the living organisms and how their effects can be applied to therapeutics
CO2	Analyze correlation of pharmacology with other bio medical sciences.
CO3	Apply laboratory techniques for animal studies
CO4	Observe the effect of drugs on animals by simulated experiments
CO5	Invent laboratory techniques for animal studies

Course Content

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 byMES and PTZ method.

13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.

14. Study of anxiolytic activity of drugs using rats/mice.

15. Study of local anesthetics by different methods

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

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier

3. Goodman and Gilman's (2017).The Pharmacological Basis of Therapeutics

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	1	2	1	2	1	2	2	2	3	2
CO2	2	1	2	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	3	1	3	1	3	2	2	2	2	3	1	3	1	2
CO4	2	2	3	2	1	2	1	1	1	2	2	3	2	2	1
CO5	2	3	1	3	1	2	2	1	2	3	2	1	3	1	2
Average	**1.6**	**2**	**1.8**	**2.4**	**1.4**	**1.8**	**2**	**1.4**	**1.8**	**2.2**	**2.2**	**1.8**	**2.4**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Pharmacognosy and Phytochemistry I

Course Code: BP405T

Semester: 4th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the recognition of medicinal plants, identification of adulteration and Contamination.
CO2	Analysis of organoleptic microscopic properties of herbal drugs
CO3	Apply chemical constituents of drug in commercial pharmaceutical aids
CO4	Understand evaluation techniques for the herbal drugs.
CO5	Develop plant tissue cultures

Course Content:

UNIT-I

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, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II

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

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.
Aplications of plant tissue culture in pharmacognosy.
Edible vaccines

UNIT IV

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

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primarymetabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes : Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs: Novel medicinal agents from marine sources

Recommended Books: (Latest Editions)

1. W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.
2. Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.
3. C.K. Kokate,Purohit,Gokhlae(2007), Text book of Pharmacognosy. NiraliPrakashan, New Delhi.
4.R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.
5.Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	1	2	1	2	1	2	2	2	3	2
CO2	2	1	2	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	3	1	-	1	3	2	2	2	2	3	1	3	1	2
CO4	2	2	3	2	1	2	1	1	1	2	2	3	2	2	1
CO5	2	3	1	3	1	2	2	1	2	3	2	1	-	1	2
Average	**1.6**	**2**	**1.8**	**1.8**	**1.4**	**1.8**	**2**	**1.4**	**1.8**	**2.2**	**2.2**	**1.8**	**1.8**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Pharmacognosy and Phytochemistry I (Lab)

Course Code: BP409 P

Semester: 4th

	L	T	P
Credits: 04	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand Phytotherapy and the Elderly, Phytotherapy and Children, Understanding Herbal Action.
CO2	Analyze the Material Medicine.
CO3	Conduct extractions/isolations & explain significance of use of various chemicals & physical conditions.
CO4	Identify unorganized crude drugs using morphological, chemical, physical & microscopical characteristics.
CO5	Develop plant tissue cultures

Course Content

1. Analysis of crude drugs by chemical tests: **(**i)Tragaccanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil

2. Determination of stomatal number and index

3. Determination of vein islet number, vein islet termination and paliside ratio.

4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer

5. Determination of Fiber length and width

6. Determination of number of starch grains by Lycopodium spore method

7. Determination of Ash value

8. Determination of Extractive values of crude drugs

9. Determination of moisture content of crude drugs

10. Determination of swelling index and foaming

Recommended Books: (Latest Editions)

1. W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.
2. Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.
3. C.K. Kokate,Purohit,Gokhlae(2007), Text book of Pharmacognosy. NiraliPrakashan, New Delhi.
4.R.D. Choudhary(1996) Herbal drug industry, Eastern Publisher, New Delhi.
5.Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.

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PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	3	2	3	2	3	2	2	3	2	2
CO2	1	1	2	2	2	3	1	2	2	1	2	2	2	3	1
CO3	3	2	2	1	3	1	2	2	2	2	1	2	1	-	2
CO4	1	2	2	2	1	2	3	1	3	2	2	1	2	2	2
CO5	2	1	1	1	1	2	2	-	2	1	2	3	1	3	2
Average	**2**	**1.8**	**1.8**	**1.6**	**2**	**2.2**	**2**	**1.6**	**2.2**	**1.8**	**1.8**	**2**	**1.8**	**2**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High correlation and "-" indicates there is no correlation.

Course name:- Medicinal Chemistry

Course code:- BP501T

Semester: 5th

	L	T	P
Credits: 02	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the chemical synthesis of drugs.
CO2	Apply on drug metabolic pathway, adverse effect and therapeutic value of drugs
CO3	Analyze structural activity relationship of different class of drugs.
CO4	Evaluate and acquire knowledge about the chemotherapy for cancer.
CO5	Create drug metabolic pathways

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
Antihistaminic agents: Histamine, receptors and their distribution in the humanbody

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

H2-antagonists: Cimetidine*, Famotidine, Ranitidin.

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

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II
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, Methyldopatehydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide,Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III
Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.
Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol
Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

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

UNIT- IV
Drugs acting on Endocrine system
Nomenclature, Stereochemistry and metabolism of steroids
Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.
Drugs for erectile dysfunction: Sildenafil, Tadalafil.
Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol
Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

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

UNIT – V
Antidiabetic agents:
Insulin and its preparations
Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.
Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.
Meglitinides: Repaglinide, Nateglinide.
Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics
Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Pierocaine.
Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.
Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.
Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

Recommended Books

1. Foye's Principles of Medicinal Chemistry (2019). Wolters Kluwer.
2. Burger's Medicinal Chemistry, Vol I to IV.
3. Remington's Pharmaceutical Sciences (2008).
4. Indian Pharmacopoeia (2018).

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	3	3	1	3	2	2	3	2	3
CO2	2	1	2	2	2	1	1	2	2		2	2	2	3	-
CO3	2	2	2	3	3	2	2	2	2	2	1	1	3	1	1
CO4	1	2	1	1	2	2	-	1	3	2	2	1	2	2	2
CO5	1	1	3	1	1	2	2	1	2	1	2	3	1	-	2
Average	**1.8**	**1.8**	**2**	**1.8**	**2**	**1.6**	**1.6**	**1.8**	**2**	**2**	**1.8**	**1.8**	**2.2**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: Industrial Pharmacy-I

Course Code: BP 502 T

Semester: 5th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Know the various pharmaceutical dosage forms and their manufacturing techniques.
CO2	Identify various considerations in development of pharmaceutical dosage forms.
CO3	Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality.
CO4	Understand the quality control of solid, liquid and semisolid dosage form

Course Content

UNIT-I

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

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

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 ofcapsules,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

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

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. H. C.Ansel, Lea &Febiger, Philadelphia (2005).Introduction to Pharmaceutical Dosage Forms.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	3	3	3	1	3	2	2	2	2	3
CO2	2	-	2	2	2	1	1	2	2	1	1	2	2	1	3
CO3	1	2	2	1	1	2	3	2	2	2	1	3	1	1	1
CO4	3	2	1	1	2	2	-	1	3	2	2	1	2	2	2
Average	**2**	**1.7**	**1.7**	**1.5**	**1.7**	**2**	**1.7**	**2**	**2**	**2**	**1.5**	**2**	**1.7**	**1.5**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: Industrial Pharmacy-I Lab

Course Code: BP 506P

Semester: 5th

	L	**T**	**P**
Credits: 02	**0**	**0**	**4**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Articulate solid, liquid and semisolid dosage forms and evaluate them for theirQuality.
CO2	Understand and appreciate the influence of pharmaceutical additives.
CO3	Know about Development of pharmaceutical dosage form.
CO4	Design and layout of various procedures in pharmaceutical industry.

Course Content

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

11. Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

1. H. C.Ansel, Lea &Febiger, Philadelphia (2005).*Introduction to Pharmaceutical Dosage Forms*.

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	2	1	2	3	2	3	1	2	2	1	2
CO2	2	1	3	2	2	3	1	2	3	1	2	1	2	2	3
CO3	-	1	2	2	1	1	2	1	2	1	1	3	1	3	2
CO4	1	2	1	3	2	2	3	-	1	2	2	2	3	2	2
Average	**1.5**	**1.7**	**2**	**2**	**1.7**	**1.7**	**2**	**1.5**	**2**	**1.7**	**1.5**	**2**	**2**	**2**	**1.7**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACOLOGY-II

Course Code: BP503 T

Semester: 5th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the effect of drugs on physiological system.
CO2	Acquire the knowledge of newer targets of several disease conditions for treatment.
CO3	Appreciate correlation of pharmacology with related medical sciences.
CO4	Understand the Assumption the mechanism of drug action and its relevance in the treatment of different diseases.

Course Content:

UNIT-I

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

1. Pharmacology of drugs acting on cardio vascular system

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

2. Pharmacology of drugs acting on urinary system

a. Diuretics
b. Anti-diuretics.

UNIT-III

3. 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

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 Vitamin-D.
d. Insulin, Oral Hypoglycemic agents and glucagon.
e. ACTH and corticosteroids.

UNIT-V

5. Pharmacology of drugs acting on endocrine system

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

6. Bioassay

a. Principles and applications of bioassay.
b.Types of bioassay

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

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics

The mapping of the PO/PSO/CO attainment is as follows:

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACOLOGY-II Lab

Course Code: BP 507 P

Semester: 5th

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Demonstrate the various receptor actions using isolated tissue preparation.
CO2	Establish isolation of different organs/tissues from the laboratory animals by simulated experiments
CO3	Perform various in-vitro experiments to demonstrate receptor action
CO4	Appreciate the correlation of pharmacology with related medical sciences

Course Content

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

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics

Course outcomes	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1	3	1	1	2	1	1	2	3	1	3	2	1
CO2	2	1	3	1	3	2	3	2	3	2	-	2	2	2	2
CO3	2	3	2	2	2	3	2	3	2	2	2	2	1	1	2
CO4	2	2	2	3	2	3	1	2	2	3	2	3	2	2	1
Average	**1.7**	**2**	**2**	**1.7**	**2**	**1.7**	**2**	**2**	**2**	**1.7**	**1.7**	**2**	**2**	**1.7**	**1.5**

The mapping of the PO/PSO/CO attainment is as follows:

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:-PHAMACOGNOSY AND PHYTOCHEMISTRY II

Course code: -BP504T

Semester: 5th

	L	T	P
Credits: 02	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the preparation and development of herbal formulation.
CO2	Apply and Carry-out isolation and identification of phytoconstituents
CO3	Analyze the preparation and development of herbal formulation.
CO4	Evaluate the isolation and identification of phytoconstituents
CO5	Create the modern extraction techniques

Course Content:

UNIT-I
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
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
Isolation, Identification and Analysis of Phytoconstituents
a) Terpenoids: Menthol, Citral, Artemisin
b) Glycosides: Glycyrhetinic acid &Rutin
c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d) Resins: Podophyllotoxin, Curcumin

UNIT-IV

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

UNIT V

Basics of Phytochemistry

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 (2009). Trease and Evans *Pharmacognosy*, 16th edition, W.B. Sounders & Co., London.
2. Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., *Pharmacognosy*, Lea and Febiger, Philadelphia.
3. C.K. Kokate,Purohit,Gokhlae(2007), *Text book of Pharmacognosy*. NiraliPrakashan, New Delhi.
4.R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.
5.Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	3	2	3	2	3	2	2	3	1	3
CO2	2	3	2	2	2	1	3	2	1	1	2	2	2	3	1
CO3	2	1	2	3	-	2	2	2	2	2	1	1	3	1	2
CO4	1	2	1	1	2	2	1	1	1	2	2	3	2	2	2
CO5	1	1	3	1	1	-	2	1	2	2	2	3	1	1	1
Average	**1.8**	**1.8**	**2**	**1.8**	**1.4**	**1.6**	**2**	**1.8**	**1.6**	**2**	**1.8**	**2.2**	**2.2**	**1.6**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:- Pharmacognosy and phytochemistry

Course code:- BP508P

Semester: 5th

L T P

Credits: 02 **0 0 4**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the preparation and development of herbal formulation.
CO2	Apply isolation and identification of phytoconstituents
CO3	Analyze the identification of phytoconstituents
CO4	Evaluate the development of herbal formulation.
CO5	Find out the separation of sugars by paper chromatography

Course Content

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 phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests:
(i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans (2009). Trease and Evans *Pharmacognosy*, 16th edition, W.B. Sounders & Co., London.
2. Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., *Pharmacognosy*, Lea and Febiger, Philadelphia.
3. C.K. Kokate,Purohit,Gokhlae(2007), *Text book of Pharmacognosy*. NiraliPrakashan, New Delhi.
4.R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.

5.Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	3	2	3	2	3	2	2	3	2	2
CO2	3	3	2	2	2	1	3	2	2	3	2	2	2	3	3
CO3	1	2	2	3	2	1	2	2	3	2	3	2	1	1	2
CO4	1	2	1	2	1	-	-	1	1	2	2	1	2	2	2
CO5	3	1	3	1	3	2	2	-	2	1	2	2	1	1	2
Average	**2**	**2**	**2.2**	**2**	**2.2**	**1.4**	**1.8**	**1.6**	**2**	**2.2**	**2.2**	**1.8**	**1.8**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name:-PHAMACEUTICAL JURISPRUDENCE

Course Code: -BP505T

Semester: 5th

	L	T	P
Credits: 02	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
CO2	Apply Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
CO3	Analyze the code of ethics during the pharmaceutical practice.
CO4	Evaluate the basic knowledge on important legislations related to the profession of Pharmacy in India
CO5	Create detailed study of Schedules

Course Content:

UNIT-I
Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.**

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs,

Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II
Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III
Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties
Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV
Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes ofExempted 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

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. B.M. Mithal (2017).Text book of Forensic Pharmacy, Nirali Publication.
2.N.K. Jain (2020). A text book of Forensic Pharmacy.
3. Drugs and Cosmetics Act/Rules by Govt. of India publications.
4. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
5. Narcotic drugs and psychotropic substances act by Govt. of India publications
6. Drugs and Magic Remedies act by Govt. of India publication
7.Bare Acts of the said laws published by Government. Reference books (Theory)

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	1	2	1	2	1	2	2	1	2	1
CO2	2	1	2	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	2	2	-	1	2	2	2	2	2	3	3	3	1	2
CO4	1	2	3	2	3	2	1	3	1	2	2	3	2	2	2
CO5	1	1	3	3	1	2	2	3	2	3	2	1	3	1	2
Average	**1.4**	**1.4**	**2.4**	**1.8**	**1.6**	**1.6**	**2**	**2.2**	**1.8**	**2.2**	**2.2**	**2.2**	**2.2**	**1.4**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: MEDICINAL CHEMISTRY – III

Course Code:BP601T

Semester: 6th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the importance of drug design and different techniques of drug design.
CO2	Assume drug metabolism, bioavailability, and pharmacokinetics.
CO3	Analyze the result of drug designing and relationship of SAR.
CO4	Evaluate the relationship between structure and biological activity of drug.
CO5	Discover and design the drug with modern techniques.

Course Content:

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

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

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

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

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.
Antimalarials: Etiology of malaria.
Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.**Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil.
Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III

Anti-tubercular Agents

Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

Anti-tubercular antibiotics: Rifampicin, Rifabutin, CycloserineStreptomycine, 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
Antifungal agents:

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

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

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

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

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides:

Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.
Sulfones: Dapsone*.

UNIT – V
Introduction to Drug Design
Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis.
Pharmacophore modeling and docking techniques.

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

Recommended Books

1. Foye's Principles of Medicinal Chemistry (2019). Wolters Kluwer.
2. Burger's Medicinal Chemistry, Vol I to IV.
3. Remington's Pharmaceutical Sciences (2008).
4. Indian Pharmacopoeia (2018).

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	1	2	2	3	2	3	2	2	3	2	2	1	3	1
CO2	2	1	2	1	1	2	2	1	3	2	3	1	2	1	1
CO3	3	2	3	2	2	2	2	2	2	3	1	2	2	1	2
CO4	2	1	1	1	2	1	1	1	1	1	2	1	1	2	1
CO5	1	2	3	3	2	3	1	2	3	2	3	1	3	2	1
Average	**1.8**	**1.4**	**2.2**	**1.8**	**2**	**2**	**1.8**	**1.6**	**2.2**	**2.2**	**2.2**	**1.4**	**1.8**	**1.8**	**1.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: MEDICINAL CHEMISTRY- III Lab

Course Code:BP607P

Semester: 6th

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to

CO	Statement
CO1	Understand the structure, chemistry and therapeutic value of drugs and
CO2	Apply synthesis and SAR of drug.
CO3	Analyze the chemistry of drug.
CO4	Evaluate the relationship between structure and biological activity of various drug molecules.
CO5	Create the structure and physical properties of drugs to their pharmacological activity.

Course Content

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)

Recommended Books

1. Foye's Principles of Medicinal Chemistry (2019). Wolters Kluwer.
2. Burger's Medicinal Chemistry, Vol I to IV.
3. Remington's Pharmaceutical Sciences (2008).
4. Indian Pharmacopoeia (2018).

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	2	2	2	1	3	3	2	1	3	1	1	1
CO2	1	1	1	1	1	2	3	1	2	1	2	2	2	3	2
CO3	2	3	2	2	3	1	2	2	3	2	2	3	2	3	2
CO4	2	2	2	3	2	3	2	1	2	3	2	2	3	2	2
CO5	1	1	3	3	1	2	2	2	3	3	3	1	1	2	2
Average	1.8	1.8	2	2.2	1.8	2	2	1.8	2.6	2.2	2	2.2	1.8	2.2	1.8

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACOLOGY-III

Course Code:BP602T

Semester: 6th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the pharmacological activity of drug.
CO2	Apply their assumption on drug metabolism, bioavailability, and pharmacokinetics.
CO3	Analyzethe result of drug designing and relationship of SAR.
CO4	Evaluatethe relationship between structure and biological activity of drug.
CO5	Create discover and design the drug with modern techniques.

Course Content:

UNIT-I

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

UNIT-IV
3. Chemotherapy
h. Urinary tract infections and sexually transmitted diseases.
i. Chemotherapy of malignancy.
4. Immunopharmacology
a. Immunostimulants
b. Immunosuppressant
Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V
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, organophosphosphorus 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 (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	2	3	3	1	2	3	1	2	2	1	1	1	2
CO2	3	1	3	2	2	3	3	1	2	2	2	2	2	2	2
CO3	2	1	2	1	2	2	2	2	2	1	3	2	2	1	1
CO4	2	2	3	3	1	2	3	3	1	3	2	3	1	1	2
CO5	3	3	1	1	2	1	1	2	3	2	1	3	3	3	1
Average	**2.2**	**1.8**	**2.2**	**2**	**2**	**1.8**	**2.2**	**2.2**	**1.8**	**2**	**2**	**2.2**	**1.8**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: PHARMACOLOGY-III Lab

Course Code:BP 608 P

Semester: 6th

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understandthe various Biostatistics methods in experimental pharmacology.
CO2	Apply drugs into animal and record response.
CO3	Analyze various in-vitro experiments to demonstrate receptor action using isolated tissue preparation.
CO4	Evaluatethe toxic effects of drugs.
CO5	Create record report of drugs therapeutic effects.

Course Content

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 andNSAIDS 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/videos

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO12	PSO 1	PS O2	PS O3
CO1	1	3	2	2	3	3	2	2	2	3	2	1	1	3	2
CO2	2	2	1	3	1	2	1	1	2	1	3	2	2	1	3
CO3	3	2	2	1	2	1	3	2	1	2	2	2	2	1	2
CO4	2	2	1	2	3	2	2	1	3	2	2	1	1	2	2
CO5	3	1	3	1	2	2	1	3	2	3	1	3	3	2	1
Average	**2.2**	**2**	**1.8**	**1.8**	**2.2**	**2**	**1.8**	**1.8**	**2**	**2.2**	**2**	**1.8**	**1.8**	**1.8**	**2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation

Course Name: HERBAL DRUG TECHNOLOGY

Course Code: BP603T

Semester: 6th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understandthe raw material as source of herbal drugs from cultivation to herbal drug product.
CO2	Apply their ideas on the WHO and ICH guidelines for evaluation of herbal drugs.
CO3	Analyzethe behavior herbal cosmetics, natural sweeteners, nutraceuticals .
CO4	Evaluate WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.
CO5	Follow the ideas on GMP GUIDELINES.

Course content:

UNIT-I
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
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
Herbal Cosmetics
Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gumscolours, perfumes, protective agents, bleaching agents, antioxidants in products such as skincare, 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
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 andBiopiracy

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

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

UNIT-V
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 – GoodManufacturing 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. W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.
2. Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.
3. C.K. Kokate,Purohit,Gokhlae(2007), Text book of Pharmacognosy. NiraliPrakashan, New Delhi.
4.R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.
5.Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	1	3	2	2	3	2	1	2	1	2	3
CO2	2	3	2	2	2	2	3	2	2	1	3	2	2	1	2
CO3	2	1	1	2	2	2	1	2	3	3	2	1	2	1	2
CO4	2	1	2	1	1	1	3	1	1	2	2	3	1	2	2
CO5	3	3	3	1	3	2	2	3	2	3	1	2	3	2	1
Average	**2**	**2**	**2**	**1.8**	**1.8**	**2**	**2.2**	**2**	**2.2**	**2.2**	**1.8**	**2**	**1.8**	**1.6**	**2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: HERBAL DRUG TECHNOLOGY Lab

Course Code: BP609 P

Semester: 6th

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the Management of quality of medicinal plant products and derivatives.
CO2	Apply raw material as source of herbal drugs from cultivation to herbal drug product.
CO3	AnalyzeQuality and Quantity Assurance of herbal drugs, cosmetics.
CO4	Evaluatetoxicological aspects of active ingredients and finished products, WHO & ICH guidelines for the assessment of herbal drugsStability testing of herbal drugs.
CO5	Create herbal formulations like syrups, mixtures and tablets and Novel dosage

Course Content

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

Recommended Books: (Latest Editions)

1. W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.
2. Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.
3. C.K. Kokate,Purohit,Gokhlae(2007), Text book of Pharmacognosy. NiraliPrakashan, New Delhi.
4.R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.
5.Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	3	2	2	2	2	3	1	3	2	1	1	2	3
CO2	3	1	2	2	3	3	2	2	3	1	3	2	2	1	3
CO3	2	2	1	2	1	1	1	2	2	3	1	2	2	1	2
CO4	2	2	2	3	2	2	3	2	2	2	2	3	1	2	2
CO5	3	3	3	1	3	3	2	1	3	2	1	3	3	2	1
Average	**2.2**	**2**	**2.2**	**2**	**2.2**	**2.2**	**2**	**2**	**2.2**	**2.2**	**1.8**	**2.2**	**1.8**	**1.6**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: BIOPHARMACEUTICS AND PHARMACOKINETICS

Course Code: BP 604 T

Semester: 6th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understandthe concepts of bioavailability and bioequivalence of drug products and their significance
CO2	Applythe concept of metabolism,elimination,bioavailability and bioequivalence.
CO3	Analyze the principles of pharmacokinetics that underline the absorption, distribution, metabolismand elimination of drug.
CO4	Evaluatethe effect of physiological factor and variability of pharmacokinetics parameters towards drug deposition within body.
CO5	Unsderstand the various causes of non- linear pharmacokinetics.

Course Content:

UNIT-I

Introduction Biopharmaceutics to Absorption;

Mechanisms of drug absorption through GIT, factors influencing drugabsorption though GIT, absorption of drug from Non per oral extra-vascularroutes,

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

Elimination:

Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence:

Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT- III

Pharmacokinetics:

Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model.

(a) Intravenous Injection (Bolus)

(b) Intravenous infusion and

(c) Extra vascular administrations.

Pharmacokinetics parameters - KE,t1/2,Vd,AUC,Ka, Clt and CLR- definitions methods of eliminations, understanding of their significance andApplication

UNIT- IV

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

Nonlinear Pharmacokinetics:

a. Introduction,

b. Factors causing Non-linearity.

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

Recommended Books: (Latest Editions)

1. Thomas (1995) .N. Tozen, Lea and Febrger, Philadelphia.

2.Dissolution, Bioavailability and Bioequivalence(1989) By Abdou H.M, Mack, Publishing Company,Pennsylvania.

3. Rebort F NotariMarcel 1987. Biopharmaceutics and Clinical Pharmacokinetics-An introduction , New York and Basel.

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	1	2	1	2	2	3	3	2	1	3	3
CO2	2	1	2	1	1	1	2	3	3	1	2	2	2	1	2
CO3	3	2	1	3	2	2	1	1	1	2	2	3	2	1	2
CO4	2	3	1	2	2	3	2	2	2	2	2	2	1	2	3
CO5	3	2	3	3	3	2	3	3	2	3	1	1	3	2	1
Average	**2.2**	**2**	**2**	**2.2**	**1.8**	**2**	**2.2**	**2**	**2**	**2.2**	**2**	**2**	**1.8**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL BIOTECHNOLOGY

Course Code: BP 605T

Semester: 6th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Design research strategy with step-by-step instructions to address a research problem.
CO2	Explain the concept and application of monoclonal antibody technology
CO3	Know about the Importance of Monoclonal antibodies in Industries
CO4	Appreciate the use of microorganisms in fermentation technology

Course Content

Unit I

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

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

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 Substituties.

Unit IV

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

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 Substituties.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak (2017).Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
2. RA Goldshy et. Al., :Kuby Immunology.
3. J.W.Goding: Monoclonal Antibodies.

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	2	2	2	1	2	3	2	2	3
CO2	1	3	1	3	2	2	3	1	1	2	2	1	2	2	1
CO3	3	3	2	2	2	1	1	2	3	2	3	2	1	2	2
CO4	1	2	2	2	2	1	2	3	3	3	1	2	3	1	1
CO5	1	2	1	3	1	1	3	3	2	1	2	2	1	2	1
Average	**1.8**	**2.4**	**1.6**	**2.6**	**2**	**1.2**	**2.2**	**2.2**	**2.2**	**1.8**	**2**	**2**	**1.8**	**1.8**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL QUALITY ASSURANCE

Course Code:BP606T

Semester: 6th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the responsibilities of QA & QC departments, cGMP aspects in a pharmaceutical industry
CO2	ApplyGMP overviews of ICH guidelines.
CO3	Analyze the scope of quality certifications applicable to pharmaceutical industries
CO4	Evaluatethe basic fundamental of quality concepts.
CO5	Acquirea thorough understanding of important QC,QA.

Course Content

UNIT – I

Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP

Total Quality Management (TQM): Definition, elements, philosophies

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testingguidelines

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

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.

UNIT – III

Quality Control: Quality control test for containers, rubber closures and secondary packing materials.

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities

UNIT – IV

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

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, SandyWeinberg Vol. 69.
3. ISO 9000 and Total QualityManagement – Sadhank G Ghosh
4. The International Pharmacopoeia (2018) Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
5. ICH guidelines, ISO 9000 and 14000 guidelines

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	1	2	1	2	2	2	3	2	1	2	3	2	1	1	2
CO2	2	3	2	3	2	1	1	2	2	1	2	2	2	2	1
CO3	2	2	1	3	1	3	2	3	2	2	2	1	1	2	2
CO4	2	1	3	2	3	2	1	2	3	1	2	2	3	2	3
CO5	3	2	2	1	2	1	2	2	2	3	1	3	3	2	1
Average	**2**	**2**	**1.8**	**2.2**	**2**	**1.8**	**1.8**	**2.2**	**2**	**1.8**	**2**	**2**	**2**	**1.8**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: INSTRUMENTAL METHODS OF ANALYSIS

Course Code: BP701T

Semester: 7th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Appreciate the interaction of matter with electromagnetic radiations and its applications in drug analysis.
CO2	Comprehend the chromatographic separation and analysis of drugs
CO3	Understand quantitative & qualitative analysis of drugs using various analytical instruments
CO4	Learn documentation and express the observations with clarity.

Course Content

UNIT –I
UV Visible spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.
Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.
Applications - Spectrophotometric titrations, Single component and multi component analysis
Fluorimetry
Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

UNIT –II
IR spectroscopy

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations
Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications
Flame Photometry-Principle, interferences, instrumentation and applications
Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications
Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III

Introduction to chromatography

Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications

Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications

UNIT –IV

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

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. B.K Sharma (2004). Instrumental Methods of Chemical Analysis, CBS publication.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	1	2	1	2	1	2	2	1	2	1
CO2	2	1	2	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	2	2	3	1	2	2	2	2	2	3	3	3	1	2
CO4	1	2	3	2	3	2	1	3	1	2	2	3	2	2	2
CO5	1	3	1	3	1	2	2	1	2	3	2	1	3	1	2
Average	**1.4**	**1.8**	**2**	**2.4**	**1.6**	**1.6**	**2**	**1.8**	**1.8**	**2.2**	**2.2**	**2.2**	**2.2**	**1.4**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: INSTRUMENTAL METHODS OF ANALYSIS Lab

Course Code: BP705P

Semester: 7th

	L	T	P
Credits: 02	**0**	**0**	**4**

Course Outcomes:
On successful completion of this course, the students will be able to

CO	Statement
CO1	Prepare accurate analysis and report the results in defined formats.
CO2	Develop practical skills for the analysis of drugs and excipients using various instrumentation techniques.
CO3	Perform quantitative and qualitative analysis of drugs using various analytical methods
CO4	Understand the chromatographic separation and analysis of drugs.

Course Content

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

Recommended Books (Latest Editions)

1. B.K Sharma (2004). Instrumental Methods of Chemical Analysis , CBS publication.

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	2	1	2	2	1	1	3	2	1	2	2
CO2	1	1	3	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	2	1	3	2	3	2	2	2	2	3	1	3	1	2
CO4	2	2	3	2	3	2	1	1	1	2	2	3	2	2	2
Average	**1.5**	**1.7**	**2.2**	**2.2**	**2.2**	**1.7**	**2**	**1.7**	**1.5**	**2**	**2.5**	**2**	**2**	**1.5**	**1.7**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: INDUSTRIAL PHARMACY II

Course Code: BP 702 T

Semester: 7th

	L	**T**	**P**
Credits:04	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Know the process of pilot plant and scale up of pharmaceutical dosage forms.
CO2	Understand the process of technology transfer from lab scale to commercial batch.
CO3	Recognize different Laws and Acts that regulate pharmaceutical industry
CO4	Comprehend the approval process and regulatory requirements for drug products.
CO5	Recognize different Laws and Acts that regulate pharmaceutical industry

Course Content:

UNIT-I

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

UNIT-II

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

UNIT-III

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory AffairsProfessionals

Regulatory requirements for drug approval: Drug Development Teams, Non-ClinicalDrug Development, Pharmacology, Drug Metabolism and Toxicology, Generalconsiderations of Investigational New Drug (IND) Application, Investigator's Brochure(IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical ResearchProtocols, Biostatistics in Pharmaceutical Product Development, Data Presentation forFDA Submissions, Management of Clinical Studies.

UNIT-IV

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

UNIT-V

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

Recommended Books: (Latest Editions)

1. H. C.Ansel, Lea &Febiger, Philadelphia (2005).Introduction to Pharmaceutical Dosage Forms.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	2	1	1	3	2	1	2	2
CO2	1	1	3	2	2	1	3	2	2	3	2	2	2	1	1
CO3	1	2	1	3	2	3	2	2	2	2	3	1	3	1	2
CO4	2	2	3	2	3	2	1	1	1	2	2	3	2	2	2
CO5	1	1	2	3	1	2	2	1	1	3	2	1	3	1	2
Average	**1.4**	**1.6**	**2.2**	**2.4**	**2**	**1.8**	**2**	**1.6**	**1.4**	**2.2**	**2.4**	**1.8**	**2.2**	**1.4**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACY PRACTICE

Course Code: BP703T

Semester: 7th

	L	**T**	**P**
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand drug distribution methods in hospital and apply it in the practice of pharmacy.
CO2	Apply and Interpret role of pharmacist in education and training program.
CO3	Analyze requirements essential for hospital, community and hospital pharmacy management.
CO4	Evaluate medication history, medication adherence and adverse effects of drugs
CO5	Develop clinical report, adverse reaction report of patients

Course Content

Unit I

a) Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.

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 detectingdrug 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

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 DrugMonitoring, 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

a) Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Drug information services

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

c) Patient counseling

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

d) Education and training program in the hospital

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

e) Prescribed medication order and communication skills

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

Unit IV

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, Medicationhistory 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

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.2001A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata.2004A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1st ed. Chennai: OrientLongman Private Limited.
3. William E. Hassan.1986Hospital pharmacy, 5th ed. Philadelphia: Lea &Febiger.
4. Tipnis Bajaj2008. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications.
5. Scott LT 2009. Basic skills in interpreting laboratory data, 4thed.American Society of Health System Pharmacists Inc

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)

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	3	2	3	2	1	2	1	3	2	2	3	2
CO2	2	3	1	2	2	1	3	2	1	3	2	1	2	2	1
CO3	1	1	1	2	1	3	2	2	2	3	3	1	3	1	2
CO4	3	2	3	1	1	2	1	1	1	2	2	2	1	2	2
CO5	2	3	1	3	1	3	1	1	1	3	3	1	2	1	1
Average	**1.8**	**2**	**1.6**	**2.2**	**1.4**	**2.4**	**1.8**	**1.4**	**1.4**	**2.4**	**2.6**	**1.4**	**2**	**1.8**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: NOVEL DRUG DELIVERY SYSTEMS

Course Code: BP 704T

Semester: 7th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand various properties of sustained and controlled drug delivery systems.
CO2	Apply formulation and evaluation of various controlled drug delivery system for oral and parenteral.
CO3	Analyze design of a drug delivery system.
CO4	Evaluate current development in drug delivery system.
CO5	Create selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation.

Course Content

Unit-I

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

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

Unit-II

Microencapsulation: Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump

Unit-III

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers

Unit-IV

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

Unit-V

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 1992. Novel Drug Delivery Systems, revised and expanded, Marcel Dekker, Inc., New York.
2. Robinson, J. R., Lee V. H. L (1992). Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York.

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)

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2	2	2	3	2	1	1	1	3	2	2	3	2
CO2	2	3	1	2	2	1	3	2	1	3	2	1	2	2	1
CO3	1	1	1	2	1	3	2	2	2	3	3	1	3	1	2
CO4	3	2	3	1	1	2	1	1	1	2	1	2	1	2	2
CO5	2	3	1	3	1	3	1	1	1	3	1	1	2	1	1
Average	**1.8**	**2**	**2.2**	**1.8**	**2**	**1.8**	**2.2**	**1.8**	**1.8**	**1.6**	**2**	**1.8**	**1.8**	**1.8**	**2.2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: BIOSTATISITCS AND RESEARCH METHODOLOGY

Course Code: BP801T

Semester: 8th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand about operation of M.S. Excel, SPSS, R and MINITAB, DoE (Design of Experiment).
CO2	Applydesign of Experiments, Experiential Design Technique, plagiarism**,** Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph
CO3	Analyze distinguish the application of statistical in clinical data management
CO4	Evaluate the 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
CO5	Create the appreciate statistical techniques in solving the problems

Course Content

Unit-I
Introduction: Statistics, Biostatistics, Frequency distribution
Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples
Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems
Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples

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

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties – problems Sample, Population, large sample, small sample, Null hypothesis, 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
Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism
Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph
Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

Unit-IV
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
Design and Analysis of experiments:
Factorial Design: Definition, 22, 23design. Advantage of factorial design
Response Surface methodology: Central composite design, Historical design, Optimization Techniques

Recommended Books (Latest edition):
1. S.C.Guptha (2018).Fundamental of Statistics – Himalaya Publishing House

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	2	3	3	1	2	3	1	2	2	1	1	1	2
CO2	3	1	3	2	2	3	3	1	2	2	2	2	2	2	2
CO3	2	1	2	1	2	2	2	2	2	1	3	2	2	1	1
CO4	2	2	3	3	1	2	3	3	1	3	2	3	1	1	2
CO5	3	3	1	1	2	1	1	2	3	2	1	3	3	3	1
Average	**2.2**	**1.8**	**2.2**	**2**	**2**	**1.8**	**2.2**	**2.2**	**1.8**	**2**	**2**	**2.2**	**1.8**	**1.6**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: SOCIAL AND PREVENTIVE PHARMACY

Course Code: BP 802T

Semester: 8th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
CO2	Apply a critical way of thinking based on current health care development
CO3	Analyze improvement in rural sanitation, national urban health mission, Health promotion and education in school
CO4	Evaluate alternative ways of solving problems related to health and pharmaceutical issues.
CO5	Create a better health care service system.

Course Content

Unit I

Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health

Hygiene and health: personal hygiene and health care; avoidable habits

Unit II

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

Unit III

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

Unit IV
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
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,2010 JAYPEE Publications
2. Mahajan and Gupta 2008.Textbook of Preventive and Social Medicine SahaIndranil,JAYPEE Publications
3. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:
1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	1	2	1	3	3	1	2	2	1	2	2	1	1	3	1
CO2	3	1	2	1	1	1	3	3	2	3	1	2	3	1	3
CO3	1	2	3	2	3	2	1	2	1	1	2	1	2	2	3
CO4	2	1	2	2	3	1	1	3	2	2	3	2	1	2	2
CO5	3	2	1	3	1	1	2	3	1	2	1	2	2	1	2
Average	**2.2**	**1.5**	**2**	**2**	**2**	**1.2**	**1.7**	**2.7**	**1.5**	**2**	**1.7**	**1.7**	**2**	**1.5**	**2.5**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMA MARKETING MANAGEMENT

Course Code: BP803ET

Semester: 8th

	L	T	P
Credits: 08	**6**	**2**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand know how of marketing management and grooming the people for taking a challenging role in Sales and Product management.
CO2	Apply new product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.
CO3	Analyze distinguish the methods, determinants of promotional mix, promotional budget. ; Analyzing consumer buying behavior; industrial buying behavior.
CO4	Evaluate of the various policies for drug inventory management.
CO5	Create retail and wholesale marketing.

Course Content

Unit I

Marketing:

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

Pharmaceutical market:

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

Unit II

Product decision:

Classification, product line and product mix decisions, product life cycle,product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

Unit III

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

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

Pricing:

Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing:

Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller(2017). Marketing Management, Prentice Hall of India, New Delhi

The mapping of the PO/PSO/CO attainment is as follows

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2	2	1	2	2	1	1	3	3	1	2	1	2
CO2	3	2	1	3	3	1	3	3	2	2	1	1	3	3	2
CO3	1	3	2	2	3	2	2	2	2	1	2	1	2	3	1
CO4	2	1	2	2	2	1	2	1	3	1	1	2	3	2	2
CO5	1	2	3	2	2	2	1	2	2	2	2	3	1	1	1
Average	**1.6**	**2.2**	**2**	**2.2**	**2.2**	**1.6**	**2**	**1.8**	**2**	**1.8**	**1.8**	**1.6**	**2.2**	**2**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACEUTICAL REGULATORY SCIENCE

Course Code: BP804 ET

Semester: 8th

	L	T	P
Credits: 08	**6**	**2**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand about the process of drug discovery and development.
CO2	Apply clinical studies, Innovator and generics, Concept of generics, Generic drug product development.
CO3	Analyze about legal aspects and quality polices for drug manufacturing
CO4	Evaluatethe regulatory approval process and their registration in Indian and international markets.
CO5	Identify the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.

Course Content

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

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

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

Unit III
Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD)research.

Unit IV
Clinical trials
Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance – safetymonitoring in clinical trials

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

Recommended books (Latest edition):
1. Dr. N.S. Vyawahare(1905). Drug Regulatory Affairs by SachinItkar, NiraliPrakashan.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	1	2	3	2	1	1	2	2	1	1	1	2
CO2	1	2	2	2	2	1	2	2	2	2	1	3	2	2	3
CO3	3	3	3	3	1	3	2	2	1	3	2	2	3	2	3
CO4	2	1	3	1	1	2	1	1	2	2	3	2	3	2	2
CO5	1	3	2	2	3	1	1	2	3	1	3	1	1	2	3
Average	**2**	**2**	**2.6**	**1.8**	**1.8**	**2**	**1.6**	**1.6**	**1.8**	**2**	**2.2**	**1.8**	**2**	**1.8**	**2.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACOVIGILANCE

Course Code: BP 805T

Semester: 8th

	L	T	P
Credits: 08	**6**	**2**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand about national and international scenario of pharmacovigilance
CO2	Apply the various methods that can be used to generate safety data and signal detection
CO3	Develop the skills of classifying drugs, diseases and adverse drug reactions.
CO4	Evaluate why drug safety monitoring is important.
CO5	Create differences in Indian and global pharmacovigilance requirements.

Course Content

Unit I

Introduction to Pharmacovigilance

- History and development of Pharmacovigilance
- Importance of safety monitoring of Medicine
- WHO international drug monitoring programme
- Pharmacovigilance Program of India(PvPI)

Introduction to adverse drug reactions

- Definitions and classification of ADRs
- Detection and reporting
- Methods in Causality assessment
- Severity and seriousness assessment
- Predictability and preventability assessment
- Management of adverse drug reactions

Basic terminologies used in pharmacovigilance

- Terminologies of adverse medication related events
- Regulatory terminologies

Unit II

Drug and disease classification

- Anatomical, therapeutic and chemical classification of drugs
- International classification of diseases
- Daily defined doses
- International Non-proprietary Names for drugs

Drug dictionaries and coding in pharmacovigilance

- WHO adverse reaction terminologies
- MedDRA and Standardised MedDRA queries

- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

- Basic drug information resources
- Specialised resources for ADRs

Establishing pharmacovigilance programme

- Establishing in a hospital
- Establishment & operation of drug safety department in industry
- Contract Research Organisations (CROs)
- Establishing a national programme

Unit III

Vaccine safety surveillance

- Vaccine Pharmacovigilance
- Vaccination failure
- Adverse events following immunization

Pharmacovigilance methods

- Passive surveillance – Spontaneous reports and case series
- Stimulated reporting
- Active surveillance – Sentinel sites, drug event monitoring and registries
- Comparative observational studies – Cross sectional study, case control study and cohort study
- Targeted clinical investigations

Communication in pharmacovigilance

- Effective communication in Pharmacovigilance
- Communication in Drug Safety Crisis management
- Communicating with Regulatory Agencies, Business Partners, Healthcare facilities &Media

Unit IV

Safety data generation

- Pre-clinical phase
- Clinical phase
- Post approval phase (PMS)

ICH Guidelines for Pharmacovigilance

- Organization and objectives of ICH
- Expedited reporting
- Individual case safety reports
- Periodic safety update reports
- Post approval expedited reporting
- Pharmacovigilance planning
- Good clinical practice in pharmacovigilance studies

Unit V

Pharmacogenomics of adverse drug reactions

- Genetics related ADR with example focusing PK parameters.

Drug safety evaluation in special population

- Paediatrics

- Pregnancy and lactation
- Geriatrics

CIOMS

- CIOMS Working Groups
- CIOMS Form

CDSCO (India) and Pharmacovigilance

- D&C Act and Schedule Y
- Differences in Indian and global pharmacovigilance requirements

Recommended Books (Latest edition):

1. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
2. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
3. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
4. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	2	1	2	3	1	1	1	2	3	3
CO2	1	3	2	1	3	2	2	1	2	2	3	1	2	1	1
CO3	2	1	1	2	1	1	2	3	1	2	1	2	3	3	2
CO4	1	2	2	1	3	3	2	2	3	2	2	3	2	1	1
CO5	1	1	3	2	1	2	3	1	3	1	3	1	1	2	2
Average	**1.6**	**1.8**	**2.2**	**1.8**	**1.8**	**2**	**2**	**1.8**	**2.4**	**1.6**	**2**	**1.6**	**2**	**2**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: QUALITY CONTROL AND STANDARDIZATION OF HERBALS

Course Code: BP 806 ET

Semester: 8th

	L	T	P
Credits: 08	**6**	**2**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the regulatory approval process and its registration in Indian and international markets.
CO2	Apply WHO guidelines for quality control of herbal drugs.
CO3	Analyze EU and ICH guidelines for quality control of herbal drugs.
CO4	Evaluate quality assurance in herbal drug industry
CO5	Create preparation of documents for new drug application and export registration .

Course Content

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

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

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

Unit IV
Stability testing of herbal medicines.Application of various chromatographic techniques in standardization of herbal products.
Preparation of documents for new drug application and export registration
GMP requirements and Drugs & Cosmetics Act provisions.

Unit V
Regulatory requirements for herbal medicines.
WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems
Comparison of various Herbal Pharmacopoeias.
Role of chemical and biological markers in standardization of herbal products

Recommended Books: (Latest Editions)

1. Rangari, V.D.(2006) Text book of Pharmacognosy and Phytochemistry Vol. I, Carrier Pub.
2. Mukherjee, P.W.(2002).Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	2	2	1	3	1	2	1	2	1	1
CO2	3	1	2	3	2	1	1	1	2	3	1	3	2	3	2
CO3	1	3	3	2	3	2	3	2	1	2	3	2	2	3	1
CO4	1	1	2	2	1	1	2	1	3	1	2	2	3	2	2
CO5	3	2	2	3	2	1	1	3	2	1	1	3	2	1	1
Average	**2**	**2**	**2.2**	**2.4**	**1.8**	**1.4**	**1.8**	**1.6**	**2.2**	**1.6**	**1.8**	**2.2**	**2.2**	**2**	**1.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: COMPUTER AIDED DRUG DESIGN

Course Code: BP 807 ET

Semester: 8th

	L	**T**	**P**
Credits: 08	**6**	**2**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand design and discovery of lead molecule .Stages of drug discovery and development
CO2	Apply 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.
CO3	Analyze the concept of QSAR and docking
CO4	Evaluate about various strategies to develop new drug.
CO5	Create design new drug molecules using molecular modeling software.

Course Content

UNIT-I

Introduction to Drug Discovery and Development

Stages of drug discovery and development

Lead discovery and Analog Based Drug Design

Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies

UNIT-II

Quantitative Structure Activity Relationship (QSAR)

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

UNIT-III

Molecular Modeling and virtual screening techniques

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

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

UNIT-IV

Informatics & Methods in drug design

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

UNIT-V

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

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	2	2	2	1	2	3	2	2	3
CO2	1	3	1	3	2	2	3	1	1	2	2	1	2	2	1
CO3	3	3	2	2	2	1	1	2	3	2	3		1	2	2
CO4	1	2	2	2	2	1	2	3	3	3	1	2	3	1	1
CO5	1	2	1	3	1	1	3	3	2	1	2	2	1	2	1
Average	**1.8**	**2.4**	**1.6**	**2.6**	**2**	**1.2**	**2.2**	**2.2**	**2.2**	**1.8**	**2**	**2**	**1.8**	**1.8**	**1.6**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: CELL AND MOLECULAR BIOLOGY

Course Code: BP808ET

Semester: 8th

	L	**T**	**P**
Credits: 08	**6**	**2**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the chemical foundation of cell biology know about the cellular functioning and composition
CO2	Apply ; DNA and the Flow of Molecular Information ,DNA Functioning, DNA and RNA,Types of RNA
CO3	Validate properties of cells and cell membrane.
CO4	Evaluate comprehend the DNA properties of cell biology.
CO5	Create recognize about the history of cell and molecular biology

Course Content

Unit I

a) Cell and Molecular Biology: Definitions theory and basics and Applications.

b) Cell and Molecular Biology: History and Summation.

c) Properties of cells and cell membrane.
d) Prokaryotic versus Eukaryotic
e) Cellular Reproduction
f) Chemical Foundations – an Introduction and Reactions (Types)

Unit II
a) DNA and the Flow of Molecular Information
b) DNA Functioning
c) DNA and RNA
d) Types of RNA
e) Transcription and Translation

Unit III
a) Proteins: Defined andAmino Acids
b) Protein Structure
c) Regularities in Protein Pathways
d) Cellular Processes
e) Positive Control and significance of Protein Synthesis

Unit IV
a) Science of Genetics
b) Transgenics and Genomic Analysis
c) Cell Cycle analysis
d) Mitosis and Meiosis
e) Cellular Activities and Checkpoints

Unit V
a) Cell Signals: Introduction
b) Receptors for Cell Signals
c) Signaling Pathways: Overview
d) Misregulation of Signaling Pathways
e) Protein-Kinases: Functioning

Recommended Books (latest edition):
1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. RA Goldshy et. al., :Kuby Immunology.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	2	1	3	3	1	2	3	1	2	2	1	1
CO2	2	2	3	3	2	3	1	3	1	1	2	1	2	3	3
CO3	1	2	3	3	2	2	2	2	3	3	1	2	3	3	1
CO4	3	1	2	2	1	1	2	1	1	2	3	1	3	2	1
CO5	1	1	2	3	2	1	3	2	2	1	3	1	2	1	3
Average	**1.6**	**1.6**	**2.6**	**2.6**	**1.6**	**2**	**2.2**	**1.8**	**1.8**	**2**	**2**	**1.4**	**2.4**	**2**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: COSMETIC SCIENCE

Course Code: BP809ET

Semester: 8th

	L	**T**	**P**
Credits: 08	**6**	**2**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the importance of biostatistics and research methodology. Definition of cosmetics as per Indian and EU regulations
CO2	Apply design and execute a research hypothesis independently
CO3	Validate the various screening methods used in preclinical research
CO4	Evaluate evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs
CO5	Create the application of various commonly used laboratory animals.

Course Content

UNIT I

Classification of cosmetic and cosmeceutical products.
Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheologymodifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums**.**

UNIT II

Principles of formulation and building blocks of skin care products:
Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages.Application of these products in formulation of cosmeceuticals.

Antiperspants& deodorants- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products:

Conditioning shampoo, Hair conditioner,anti-dandruff shampoo, Hair oils.

Chemistry and formulation of Para-phylenediamine-based hair dye.
Principles of formulation and building blocks of oral care products:
Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III

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

UNIT IV

Principles of Cosmetic Evaluation:Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps,and syndet bars. Evolution and skin benefits.

UNIT V

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.
Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes

Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.
Antiperspirants and Deodorants- Actives and mechanism of action

References

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3	2	1	3	3	2	1	2	2	3
CO2	2	1	2	2	1	1	2	2	3	1	3	3	1	2	1
CO3	2	1	3	3	2	2	1	1	1	3	2	3	3	2	2
CO4	1	3	2	1	1	3	3	2	3	2	3	3	2	2	1
CO5	3	2	3	1	3	1	3	2	1	3	3	1	3	1	2
Average	**2.2**	**1.8**	**2.4**	**2**	**1.8**	**2**	**2.2**	**1.6**	**2.2**	**2.4**	**2.6**	**2.2**	**2.2**	**1.8**	**1.8**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: PHARMACOLOGICAL SCREENING METHODS

Course Code: BP010T

Semester: 8th

	L	T	P
Credits: 08	**6**	**2**	**0**

Course Outcomes:
On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.
CO2	Apply the application of various commonly used laboratory animals.
CO3	Analyze topic, review of literature, research hypothesis and study design Pre-clinical data analysis
CO4	Evaluation of biostatistics and research methodology. Appreciate the application of various commonly used laboratory animals.
CO5	Create the various screening methods used in preclinical research.

Course Content

Unit –I

Laboratory Animals:

Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals.

Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

Unit –II

Preclinical screening models

a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals andimportance 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 anaethetics

Unit –IV

Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

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-byM.N.Ghosh

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	1	2	2	3	3	2	3	2	2	1	3
CO2	2	2	2	2	2	1	1	2		2	1	3	1	2	2
CO3	3	3	2	3	1	3	2	1	2		2	3	2	1	3
CO4	3	2	3	2	2	1	1	2	1	1	2	3	2	3	1
CO5	1	2	2	1	3	1	2	3	2	3	1	3	1	2	3
Average	**2.2**	**2.4**	**2.4**	**2**	**1.8**	**1.6**	**1.6**	**2.2**	**2**	**2**	**1.8**	**2.8**	**1.6**	**1.8**	**2.4**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High Correlation and "-" indicates there is no correlation.

Course Name: ADVANCED INSTRUMENTATION TECHNIQUES

Course Code: BP811 ET

Semester: 8th

	L	T	P
Credits: 08	**6**	**2**	**0**

Course Outcomes: On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the advanced instruments used and its applications in drug analysis.
CO2	Apply the chromatographic separation and analysis of drugs
CO3	Analyzethe subject that deals with the application of instrumental methods in qualitative and quantitative analysis of drugs
CO4	Evaluation comprehend the calibration of various analytical instruments
CO5	Create general principle and procedure involved in the solid phase extraction and liquid-liquid extraction

Course Content

UNIT-I

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques –Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

UNIT-II

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, Xray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT-III

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer,Fluorimeter, Flame Photometer, HPLC and GC

UNIT-IV

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

UNIT-V

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Spectrophotometric identification of Organic Compounds by Silverstein

The mapping of the PO/PSO/CO attainment is as follows:

PO/PSO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	1	2	1	3	1	3	2	1	2	3
CO2	3	3	2	3	3	1	2	1	2	3	1	1	1	2	2
CO3	2	1	2	3	2	1	1	2	1	3	2	2	2	1	1
CO4	2	2	2	3	2	1	3	3	2	1	3	1	1	2	1
CO5	1	3	2	2	3	1	1	1	3	1	2	1	2	2	3
Average	**2**	**2.4**	**2**	**2.6**	**2.2**	**1**	**1.8**	**1.6**	**2.2**	**1.8**	**2.2**	**1.4**	**1.4**	**1.8**	**2**

The correlation levels are: "1" – Low Correlation, "2" – Medium Correlation, "3" – High correlation and "-" indicates there is no correlation.

Course Name: DIETARY SUPPLEMENTS AND NUTRACEUTICALS
Course Code: BP 812 ET

Semester: 8th

	L	T	P
Credits: 08	**6**	**2**	**0**

Course Outcomes:

On successful completion of this course, the students will be able to:

CO	Statement
CO1	Understand the outcomes of deficiencies in dietary supplements.
CO2	Apply public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community. .
CO3	Study the various optimization techniques for pharmaceutical product development
CO4	Evaluate the regulatory and commercial aspects of dietary supplements including health claims.
CO5	Formulateadvanced study of Pharmaceutical Excipients.

Course Content

UNIT I

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

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

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

UNIT II

Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin
b) Sulfides: Diallyl sulfides, Allyl trisulfide.
c) Polyphenolics: Reservetrol
d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones
e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lactobacillum
f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans
g) Tocopherols
h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.

UNIT III

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.

b) Dietary fibres and complex carbohydrates as functional food ingredients.

UNIT IV

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders.Free radicals theory of ageing.
b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.
c) Functional foods for chronic disease prevention

UNIT V

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.
b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety.Adulteration of foods.
c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals

References:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.TAgusti and P.Faizal: BSPunblication.

The mapping of the PO/PSO/CO attainment is as follows:

Course outcomes	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO! 2	PS O1	PS O2	PS O3
CO1	3	2	2	3	2	3	2	1	3	3	2	1	2	2	3
CO2	2	1	2	2	1	1	2	2	3	1	3	3	1	2	1
CO3	2	1	3	3	2	2	1	1	1	3	2	3	3	2	2
CO4	1	3	2	1	1	3	3	2	3	2	3	3	2	2	1
CO5	3	2	3	1	3	1	3	2	1	3	3	1	3	1	2
Average	**2.2**	**1.8**	**2.4**	**2**	**1.8**	**2**	**2.2**	**1.6**	**2.2**	**2.4**	**2.6**	**2.2**	**2.2**	**1.8**	**1.8**

The correlation levels are: “1” – Low Correlation, “2” – Medium Correlation, “3” – High Correlation and “-” indicates there is no correlation.

Total Number of Course	76
Number of Theory Course	49
Number of Practical Course	27
Total Number of Credits	**212**

Annexure-4

ACADEMIC INSTURCTIONS

Attendance Requirements

A student shall have to attend 80% of the scheduled periods in each course in a semester; otherwise he / she shall not be allowed to appear in that course in the University examination and shall be detained in the course(s). The University may condone attendance shortage in special circumstances (as specified by the Guru Kashi University authorities). A student detained in the course(s) would be allowed to appear in the subsequent university examination(s) only on having completed the attendance in the program, when the program is offered in a regular semester(s) or otherwise as per the PCI guidelines.

Assessment of a course

Each course shall be assessed out of 100 marks. The distribution of these 100 marks is given in subsequent sub sections (as per PCI guidelines).

	Internal (25)			External (75)	Total
Components	**Continuous Assessment**	**MST1**	**MST2**	**ETE**	
Weightage	10	15	15	75	
Average Weightage	10	15		75	100

Passing Criteria

The students have to pass both in internal and external examinations. The minimum passing marks to clear in examination is 50% of the total marks as per PCI guidelines.

Note:

Lateral entry students have to appear for

- BP105T Communication Skill (Theory)
- BP111P Communication Skill (Practical)
- BP205T Computer application in Pharmacy (Theory)
- BP210P Computer application in Pharmacy (Practical)

  In their 3rd and 4th semester as per PCI guidelines.