ACHARYA NAGARJUNA UNIVERSITY

A State Government University, Accredited with "A" Grade by NAAC

Nagarjuna Nagar - 522 510, Guntur, Andhra Pradesh, India.

B.PHARMACY

SYLLABUS

2017- 2018 onwards

-

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIECNES

PROGRAM CODE:

ANUCPSUG01


ACHARYA NAGARJUNA UNIVERSITY
సత్యం సర్వం ప్రతిష్ఠితమ్

ACHARYA NAGARJUNA UNIVERSITY (ANU)

- A Brief Profile

Acharya Nagarjuna University, a State University established in 1976, has been constantly striving towards achieving progress and expansion during its existence for over four decades, in terms of introducing new courses in the University Colleges, affiliated colleges and professional colleges. Spread over 300 acres of land on the National High Way (NH-16) between Vijayawada and Guntur of Andhra Pradesh, the University is one of the front ranking and fastest expanding Universities in the state of Andhra Pradesh. The University was inaugurated on 11th September, 1976 by the then President of India, Sri Fakruddin Ali Ahmed and celebrated its Silver Jubilee in 2001. The National Assessment and Accreditation Council (NAAC) awarded "A" grade to Acharya Nagarjuna University and also has achieved 108 International ranks, 39 National ranks UI Green Metrics rankings and many more It is named after Acharya Nagarjuna – one of the most brilliant preceptors and philosophers, whose depth of thought, clarity of perception and spiritual insight were such that even after centuries, he is a source of inspiration to a vast number of people in many countries. The University is fortunate to be situated on the very soil where he was born and lived, a soil made more sacred by the aspiration for light and a state of whole someness by generations of students. With campus student strength of over 5000, the University offers instruction for higher learning in 68 UG & PG programs and guidance for the award of M.Phil. and Ph.D. in 48 disciplines spread over six campus colleges and one PG campus at Ongole. It also offers 160 UG programs in 440 affiliated colleges in the regions of Guntur and Prakasam Districts. It has a Centre for Distance Education offering 87 UG & PG programs. Characterized by its heterogeneous students and faculty hailing from different parts of the state and the country, the University provides most hospitable environment for pursuing Higher Learning and Research. Its aim is to remain connected academically at the forefront of all higher educational institutions. The University provides an excellent infrastructure and on- Campus facilities such as University Library with over one lakh books & 350 journals; Computer Centre; University Scientific Instrumentation Centre; Central Research Laboratory with Ultra-modern Equipment; Well-equipped Departmental Laboratories; Career Guidance and Placement Cell; Health Centre; Sports Facilities with Indoor & Outdoor Stadiums and Multipurpose Gym; Sports Hostel; Separate hostels for Boys, Girls, Research Scholars and International Students; Pariksha Bhavan (Examinations Building); Computers to all faculty members; Wi-Fi connectivity to all Departments and Hostels; Canteen, Student Centre & Fast-food Centre; Faculty Club; Dr. H.H. Deichmann & Dr. S.John David Auditorium cum Seminar Hall; Post office; Telecom Centre; State Bank of India; Andhra Bank; Energy Park; Silver Jubilee Park; Fish ponds; internet center; xerox center; cooperative stores; Water harvesting structures.

VISION, MISSION & OBJECTIVES OF THE UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY

VISION

To generate sources of knowledge that dispels ignorance and establish truth through teaching, learning and research.

MISSION

To promote a bank of human talent in diversified faculties – Commerce & Management Studies, Education, Engineering & Technology, Humanities, Law, Natural Sciences, Pharmacy, Physical Education & Sports Sciences, Physical Sciences and Social Sciences that would become an investment for a prosperous society.

OBJECTIVES

- To inspire and encourage all who would seek knowledge through higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice of the principles of higher education.
- To develop human talent necessary for the industry.
- To open up avenues of higher education and research through non-formal means.
- To invite and implement collaborations with other institutes of higher learning on a continuous basis for mutual academic progress.
- To motivate and orient each academic department/centre to strive for and to sustain advanced levels of teaching and research so that the university emerges as an ideal institute of higher learning.
- To focus specially on the studies involving rural economy, justifying its existence in the rural setting.

VISION

&

MISSION OF THE COLLEGE

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

VISION OF THE COLLEGE:

To become a world class institution in Education & Research by providing Quality Education in Pharmaceutical Sciences with utmost care and discipline. We, at ANUCPS endeavour to achieve highest satisfaction by imparting Quality Pharmacy Education, Training, and Research & Development.

MISSION OF THE COLLEGE:

Our mission is to impart technical education in cutting edge technologies and to inculcate research and creative endeavour in the minds of students, who will definitely take part in the economic and social development of the Nation.

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

PROGRAMME OUTCOMES (PO's):

S.No.	PROGRAMME OUTCOME	LEVEL
PO1:	**Pharmacy knowledge:** to obtain holistic knowledge in the field of Pharmaceutical sciences and the profession associated with Pharmacy like biomedical sciences, life sciences and chemical sciences.	2
PO2:	**Planning abilities:** Making the students learn proper planning abilities like time management, resource management, soft skills and organizational skills.	1
PO3:	**Problem analysis:** Increasing scientific temperament in the students, so that problem solving would become easy. Applying proper information systematically and solving the problems encountered by the students using scientific enquiry.	1
PO4:	**Modern tool usage:** Pharmacy profession is full of usage of modern tools for problem solving. Learn, select appropriate methods, procedures, resources, advanced computational tools and skills in diagnosing and treatment of diseases based on clinical approaches.	2
PO5:	**Leadership skills:** pharmacy profession is full of teamwork and team building. Learn and develop leadership skills for the effective functioning in industry, community and hospital pharmacy	1
PO6:	**Professional identity:** understand the importance of the profession. Accommodating themselves in various roles of healthcare professionals, educators, managers, employers and employees.	2
PO7:	**Pharmaceutical ethics:** pharmacy is a noble profession which deals with the lives of people. Inculcating the importance of professional ethics in education..	2
PO8:	**Communication:** learning communication is very important in terms of analyzing reports presentations, documentation and giving instructions regarding medicines and their usage.	3
PO9:	**The pharmacist and society:** Along with professional ethics rationale in knowledge to assess health safety, legal issues, and other responsibilities related to professional pharmacy practice.	2
PO10:	**Environment and sustainability:** Understand the importance of professional pharmacy applications in community and environmental contacts and potentiating the implementation of sustainable development goals.	2
PO11:	**Life-long learning:** Understand the need to have the preparation and ability to handle the problems ever thrown by nature to the medical field. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on ongoing basis.	2

STRUCTURE

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY COURSE STRUCTURE

SEMESTER-I

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP101T	Human Anatomy and Physiology I–	3	1	4
BP 102 T	Pharmaceutical Analysis I – Theory	3	1	4
BP 103 T	Pharmaceutics I – Theory	3	1	4
BP 104 T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP 105 T	Communication skills – Theory *	2	-	2
BP 106 RBT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP 107 RMT	Human Anatomy and Physiology – Practical	4	-	2
BP 108 P	Pharmaceutical Analysis I – Practical	4	-	2
BP 109 P	Pharmaceutics I – Practical	4		2
BP 110 P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP 111 P	Communication skills –Practical*	2	-	1
BP 112 RBP	Remedial Biology – Practical*	2	-	1
	Total	**32/34$/36#**	4	**27/29$/30#**

SEMESTER-II

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP 101 T	Human Anatomy and Physiology II – Theory	3	1	4
BP 102 T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP 103 T	Biochemistry – Theory	3	1	4
BP 104 T	Pathophysiology – Theory	3	1	4
BP 105 T	Computer Applications in Pharmacy – Theory	3	-	3
BP 106 T	Environmental sciences – Theory	3	-	3
BP 107 P	Human Anatomy and Physiology II – Practical	4	-	2
BP 108 P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP 109 P	Biochemistry – Practical	4	-	2
BP 110 P	Computer Applications in Pharmacy – Practical	2	-	1
Total		**32**	**4**	**29**

SEMESTER-III

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP 301 T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP 302 T	Physical Pharmaceutics I – Theory	3	1	4
BP 303 T	Pharmaceutical Microbiology – Theory	3	1	4
BP 304 T	Pharmaceutical Engineering – Theory	3	1	4
BP 305 P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP 306 P	Physical Pharmaceutics I – Practical	4	-	2
BP 307 P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308 P	Pharmaceutical Engineering –Practical	4	-	2
Total		**28**	**4**	**24**

SEMESTER-IV

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP 401 T	Pharmaceutical Organic Chemistry III–Theory	3	1	4
BP 402 T	Medicinal Chemistry I – Theory	3	1	4
BP 403 T	Physical Pharmaceutics II – Theory	3	1	4
BP 404 T	Pharmacology I – Theory	3	1	4
BP 405 T	Pharmacognosy and Phytochemistry I–Theory	3	1	4
BP 406 P	Medicinal Chemistry I – Practical	4	-	2
BP 407 P	Physical Pharmaceutics II – Practical	4	-	2
BP 408 P	Pharmacology I – Practical	4	-	2
BP 409 P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
Total		**31**	**5**	**28**

SEMESTER-V

Course Code	Name of the Course	No. of Hours	Tutorial	Credi Point
BP 501 T	Medicinal Chemistry II – Theory	3	1	4
BP 502 T	Industrial PharmacyI– Theory	3	1	4
BP 503 T	Pharmacology II – Theory	3	1	4
BP 504 T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP 505 T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP 506 P	Industrial PharmacyI – Practical	4	-	2
BP 507 P	Pharmacology II – Practical	4	-	2
BP 508 P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
Total		**27**	**5**	**26**

SEMESTER-VI

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP 601 T	Medicinal Chemistry III – Theory	3	1	4
BP 602 T	Pharmacology III – Theory	3	1	4
BP 603 T	Herbal Drug Technology – Theory	3	1	4
BP 604 T	Biopharmaceutics and Pharmacokinetics –Theory	3	1	4
BP 605 T	Pharmaceutical Biotechnology – Theory	3	1	4
BP 606 T	Quality Assurance –Theory	3	1	4
BP 607 P	Medicinal chemistry III – Practical	4	-	2
BP 608 P	Pharmacology III – Practical	4	-	2
BP 609 P	Herbal Drug Technology – Practical	4	-	2
	Total	**30**	**6**	**30**

SEMESTER-VII

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP 701 T	Instrumental Methods of Analysis – Theory	3	1	4
BP 702 T	Industrial Pharmacy II – Theory	3	1	4
BP 703 T	Pharmacy Practice – Theory	3	1	4
BP 704 T	Novel Drug Delivery System – Theory	3	1	4
BP 705 P	Instrumental Methods of Analysis – Practical	4	-	2
BP 706 PS	Practice School	12	-	6
	Total	**28**	**5**	**24**

SEMESTER-VIII

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP 801 T	Biostatistics and Research Methodology	3	1	4
BP 802 T	Social and Preventive Pharmacy	3	1	4
BP 803 ET	Pharma Marketing Management			
BP 804 ET	Pharmaceutical Regulatory Science			
BP 805 ET	Pharmacovigilance			
BP 806 ET	Quality Control and Standardization of Herbals			
BP 807 ET	Computer Aided Drug Design			
BP 808 ET	Cell and Molecular Biology			
BP 809 ET	Cosmetic Science			
BP 810 ET	Experimental Pharmacology			
BP 811 ET	Advanced Instrumentation Techniques		1+1	
BP 812 ET	Dietary Supplements and Nutraceuticals	3+3=6	=2	4+4=8
BP 813 PW	Project Work	**12**	**-**	**6**

Semester I

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-I

BPH 101 (17): HUMAN ANATOMY AND PHYSIOLOGY-I

COURSE OBJECTIVES

Upon completion of this course the student should be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Identify the various tissues and organs of different systems of human body.
- Describe the various homeostatic mechanisms and their imbalances.

COURSE OUTCOMES

S.No.	Course outcomes	Knowledge level (BLOOMS level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Define and explain the anatomy and physiology, various levels of organizations basic homeostatic mechanism and cellular organization	L1: Remember; L2: Understand; L3: Apply
CO2	Define and explain the anatomy and physiology, various levels of organizations basic homeostatic mechanism.	L2: Understand; L3: Apply; L4: Analyse
CO3	Explain and describe the composition, function of various body fluids like blood and lymph, their significance and related disorders.	L2: Understand; L3: Apply; L5 Evaluate
CO4	Classify the peripheral nervous system, nerves and morphology of special senses.	L1: Remember; L2: Understand; L3: Apply
CO5	Explain the anatomy and physiology and parameters related to CVS and related disorders and blood pressure	L1: Remember; L2: Understand; L3: Apply

BLOOMS TOXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5 Evaluate; L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1	Pharmacy knowledge	3	Assignments/viva/Internals
PO2	Planning abilities	2	Assignments/Internals
PO3	Conduct Investigations of complex problems	3	Practical's
PO4	Problem Analysis	2	Assignments/ Internals
PO5	Modern Tool Usage	2	Academic activity
PO6	Leadership Skills	2	Role play
PO7	Professional Identity	3	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Student Interaction
P010	The Pharmacist and society	3	Awareness program/Role play
PO11	Environment and Sustainability	2	Seminars
PO12	Life Long Learning	3	Assignments

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course outcomes and program outcomes (CO-PO) mapping:

Course Content:

Unit I **10 hours**

Introduction to human body

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

Cellular level of organization

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

Tissue level of organization

Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II

10 hours

Integumentary system

Structure and functions of skin

Skeletal system

Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system

Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

Joints

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

Unit III

10 hours

Body fluids and blood

Body fluids, composition and functions of blood, 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

08 hours

Peripheral nervous system:

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.

Special senses

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

Unit V

07 hours

Cardiovascular system

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

Recommended Books (Latest Editions)

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

Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

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

Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.

Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

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

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

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

Reference Books (Latest Editions):

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

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

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	3	2	3	2	3	2	3
CO2	2	3	3	3	3	2	3	3	3	2	2	3
CO3	3	3	3	2	2	3	3	2	2	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	3
CO5	2	3	3	2	3	2	2	3	2	2	2	2
Avg	2.6	2.8	2.6	2.6	2.6	2.6	2.6	2.8	2.4	2.6	2.4	2.6

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of 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.

BPH 102 (17): PHARMACEUTICAL ANALYSIS-I

COURSE OBJECTIVES:

Upon completion of the course student shall be able to understand the principles of volumetric and electro chemical analysis carryout various volumetric and electrochemical titrations develop analytical skills.

COURSE OUTCOMES

S NO.	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	To study fundamentals of pharmaceutical analysis and pharmacopoeia. Understand basic concepts involved in errors and to know the sources of impurities and methods to determine the impurities.	L1: Remember L2: Understand L3: Apply
CO2	Understand the basic principles of Acid Base titration and non-aqueous titration and their applications in pharmaceutical industry.	L2: Understand L3: Apply L4: Analyze
CO3	Concepts of complexometric titration, precipitation titration, gravimetric analysis and their application in pharmaceutical industry.	L3: Apply L4: Analyze L5: Evaluate
CO4	Concepts of oxidation and reduction titrations and their application in pharmaceutical industry.	L3: Apply L4: Analyze L5: Evaluate
CO5	The principles, types of electrodes, instrumentation and applications of potentiometry, conductometry and polarography.	L3: Apply L4: Analyze L5: Evaluate

BLOOMS TAXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyze; L5 Evaluate; L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1	Pharmacy knowledge	3	Assignments/viva/Internals
PO2	Planning abilities	2	Assignments/Internals
PO3	Problem Analysis	2	Assignments/ Internals
PO4	Modern Tool Usage	2	Academic activity
PO5	Leadership Skills	2	Role play
PO6	Professional Identity	3	Group discussion
PO7	Pharmaceutical Ethics	2	Personality development seminars
PO8	Communication	3	Student Interaction
P09	The Pharmacist and society	3	Awareness program/Role play
PO10	Environment and Sustainability	2	Seminars
PO11	Life Long Learning	3	Assignments

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course outcomes and program outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	2	3	3	2	3	2	2	3
CO2	3	2	3	3	2	2	1	2	3	3	1
CO3	1	1	3	2	1	1	2	2	1	2	2
CO4	3	2	2	1	2	3	3	3	3	1	3
CO5	1	3	1	3	3	2	1	2	1	3	1
Avg	**2**	**2**	**2.4**	**2.2**	**2.2**	**2.2**	**1.8**	**2.4**	**2**	**2**	**2**

COURSE CONTENT:

UNIT-I
10 Hours

(a)Pharmaceutical analysis- Definition and scope

Different techniques of analysis

Methods of expressing concentration

Primary and secondary standards.

Preparation and standardization of various molar and normal solutions Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate.

(b)Errors: Sources of errors, types of errors, methods of minimizing errors,

accuracy, precision and significant figures.**(c)**Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.

UNIT-II
10 Hours

Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves.

Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

UNIT-III
10 Hours

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

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

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

Basic Principles, methods and application of diazotization titration.

UNIT-IV **08 Hours** **Redox titrations**

Concepts of oxidation and reduction:

Types of redox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromometry, Dichrometry, Titration with potassium iodate

UNIT-V **07Hours**
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.

BP108P. PHARMACEUTICAL ANALYSIS (Practical) 4 Hours / Week

I. Limit Test of the following

Chloride

Sulphate

Iron

Arseni

II. Preparation and standardization of

Sodium hydroxide

Sulphuric acid

Sodium thiosulfate

Potassium permanganate

Ceric ammonium sulphate

III. Assay of the following compounds along with Standardization of Titrant

Ammonium chloride by acid base titration

Ferrous sulphate by Cerimetry

Copper sulphate by Iodometry

Calcium gluconate by complexometry

Hydrogen peroxide by Permanganometry

Sodium benzoate by non-aqueous titration

Sodium Chloride by precipitation titration

IV. Determination of Normality by electro-analytical methods

Conductometric titration of strong acid against strong base

Conductometric titration of strong acid and weak acid against strong base

Potentiometric titration of strong acid against strong base

Recommended Books: (Latest Editions)

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

Press of University of London

A.I. Vogel, Text Book of Quantitative Inorganic analysis

P. Gundu Rao, Inorganic Pharmaceutical Chemistry

Bentley and Driver's Textbook of Pharmaceutical Chemistry

John H. Kennedy, Analytical chemistry principles

Indian Pharmacopoeia.

BP103(17): PHARMACEUTICS-I

OBJECTIVES

- Learning this subject content will develop the ideas with the fundamental aspects of different types of dosage forms.
- It constructs the fundamental methodology to prepare various types of dosage forms.
- Upon completion of this program the student will have fundamental knowledge in developing dosage forms.

How program outcomes are assessed by:

Program Outcome		Level	Proficiency Assessed by
PO1	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2	Planning Abilities	1	Assignments/ Internals
PO3	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4	Problem Analysis	2	Assignments/ Internals
PO5	Modern Tool Usage	2	Seminars/academic activities
PO6	Leadership Skills	1	Group discussion / Role play
PO7	Professional Identity	2	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Students' seminars/ student -teacher interaction
PO10	The Pharmacist and Society	2	Group discussion / Role play
PO11	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO 2	2	2	2	2	2	1	1	1	2	2	1	2
CO 3	1	2	2	2	2	1	2	1	2	2	1	2
CO 4	1	1	2	2	2	1	2	1	2	2	2	2
CO 5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	1.6	1.4	1.8	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

Course Content:

UNIT – I **10 Hours**

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

Dosage forms: Introduction to dosage forms, classification and definitions

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

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

UNIT – II
10 Hours

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

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

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

UNIT – III **08 Hours**

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

Biphasic liquids:
Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
Emulsions: Definition, classification, emulsifying agent, test for the identification of type ofEmulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV **08 Hours**

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

UNIT – V **07 Hours**

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

BP109P. PHARMACEUTICS I (Practical) **3 Hours / week**

1. Syrups) Syrup IP'66 Compound syrup of Ferrous Phosphate BPC'68

2. Elixirsa) Piperazine citrate elixir Paracetamol pediatric elixir

3. Linctus a) Terpin Hydrate Linctus IP'66

b) Iodine Throat Paint (Mandles Paint)

4. Solutions

Strong solution of ammonium acetate
Cresol with soap solution
Lugol's solution

5. Suspensions
Calamine lotion
Magnesium Hydroxide mixture
Aluminimum Hydroxide gel

6.Emulsions a) Turpentine Liniment b) Liquid paraffin emulsion

Powders and Granules
ORS powder (WHO)

Effervescent granules
c) Dusting powder d) Divded powders

7. Suppositories
Glycero gelatin suppository
Coca butter suppository
Zinc Oxide suppository
8. Semisolids Sulphur ointment Non staining-iodine ointment with methyl salicylate Carbopal gel
Gargles and Mouthwashes Iodine gargle Chlorhexidine mouthwash

BP104 (17): PHARMACEUTICAL INORGANIC CHEMISTRY

Course Objectives

- To learn and understand the monographs of inorganic drugs and pharmaceuticals.
- Upon completion of course student shall be able to
- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals understand the medicinal and pharmaceutical importance of inorganic compounds Course

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Discuss Impurities in pharmaceutical substances,Generalmethods of preparation, assay for the compounds,.	L1:Remember L2:Understand L3: Apply
CO2:	Acids, Bases and Buffers, Major extra and intracellular electrolytes: Functions of major physiological ions, Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc,eugenol cement.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Gastrointestinal Agents ,Acidifiers: Ammonium chloride,Cathartics,Antimicrobials: Mechanism, classification	L3: Apply L4: Analyse L5: Evaluate
CO4:	Expectorants,Emetics: Sodium potassium tartarate,Haematinics: Ferrous sulphate*, Ferrous gluconate,Poison and Antidote,Astringents	L3: Apply L4: Analyse L5: Evaluate
CO5:	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO9	PO10	PO11	PO12

CO1	3	2	1	1	2	2	2	2	1	2	2
CO2	3	2	2	2	2	1	1	2	2	1	2
CO3	3	2	2	2	2	1	2	2	2	1	2
CO4	3	1	2	2	2	2	2	2	2	2	2
CO5	3	2	2	2	2	2	2	2	2	2	2
Avg	3	1.8	1.8	1.8	2	1.6	1.8	2	1.8	1.6	2

Course Content:

BP104 (17). PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

UNIT I
10 Hours

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

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

UNIT II
10 Hours

- **Acids, Bases and Buffers**: Buffer equations and 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
10 Hours

Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium40Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite.

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

UNIT IV
08 Hours

- **Miscellaneous compounds**

Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodiumthiosulphate*, Activated charcoal, Sodium nitrite333 Astringents: Zinc Sulphate, Potash Alum

UNIT V
07 Hours

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

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

1. **Limit tests for following ions**

Limit test for Chlorides and Sulphates

Modified limit test for Chlorides and Sulphates

Limit test for Iron ,Limit test for Heavy metals, Limit test for Lead, Limit test for Arsenic

II.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)

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

BP105 (17): COMMUNICATION SKILLS

Course Objectives:

Upon completion of the course the student shall be able to

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

Course Outcomes:

After completion of this course, students will be able to –

CO1	The learner should be efficient to construct a context-determined text in addition to learning Technical Writing Skills. One should be enabled to use English Language efficiently in the written medium to communicate Personal as well as Professional.
CO2	Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
CO3	Read, interpret and analyze a given text effectively, and use cohesive devices in spoken and written English.
CO4	Apply the concepts of accurate English while writing and become equally at ease in using good vocabulary and language skills.
CO5	Understand English and converse effectively and write flawless sentences, essays and letters.

Mapping of course outcomes with program outcomes & with program specific outcomes:

Mapping of COs to POs:

	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	--	2	--	--	3	2	1	3	-	-	--	-	--	--
CO2	--	2	--	--	3	2	1	3	-	--	--	-	--	--
CO3	--	2	--	--	3	2	1	3	--	--	--	-	--	--
CO4	--	2	--	--	3	2	1	3	--	--	--	-	--	--
CO5	--	2	--	--	3	2	1	3	--	--	--	-	--	--
CO	-	2	--	--	3	2	1	3	--	--	-	-	--	--

Course content:

UNIT – I 07 Hours

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

UNIT – II 07 Hours

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication
Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication.

UNIT – III 07 Hours

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations
Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication
Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message
UNIT – IV 05 Hours

Interview Skills: Purpose of an interview, Do's and Dont's of an interview
Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery
UNIT – V 04 Hours

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

.

BP111P.COMMUNICATION SKILLS (Practical) Hours / week

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

Basic communication covering the following topics

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

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

BP 106RMT: REMEDIAL MATHEMATICS

Course Objectives:

- Upon completion of the course the student shall be able to:-
- Know the theory and their application in Pharmacy
- Solve the different types of problems by applying theory
- Appreciate the important application of mathematics in Pharmacy

Course Outcomes		
CO-1	Know the theory and their application in Pharmacy	2
CO-2	The student will get the ability to find the solution to different Types of problem by applying theory	3
CO-3	Appreciate the important application of Mathematics in Pharmacy	2
CO-4	The student will get the ability to find the solution to system of linear equation by using matrix method like Cramer's Rule	3
CO-5	The student will get the ability to verify the application of limits continuity and derivatives of different functions.	3

Mapping of COs to POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO1 0	PO 11	PO1 2	PSO 1	PSO 2
CO1	--	2	--	--	3	2	1	3	-	-	--	-	--	--
CO2	--	2	--	--	3	2	1	3	-	--	--	-	--	--
CO3	--	2	--	--	3	2	1	3	--	--	--	-	--	--
CO4	--	2	--	--	3	2	1	3	--	--	--	-	--	--
CO5	--	2	--	--	3	2	1	3	--	--	--	-	--	--
CO	-	2	--	--	3	2	1	3	--	--	-	-	--	--

Course Content:

UNIT – I
06 Hours

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

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

Function:
Real Valued function, Classification of real valued functions,

•Limits and continuity :
Introduction , Limit of a function, Definition of limit of a function
Introduction , Limit of a function, Definition of limit of a function ($\in$ - δ definition) , $\lim_{x \to a} \frac{x^n - a^n}{x - a} = na^{n-1}$, $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} =$

UNIT –II
06 Hours

Matrices and Determinant:
Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix,Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or 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
06 Hours

•Calculus

Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – Without Proof,Derivative of xn w.r.tx,where n is any rational number, Derivative of ex,, Derivative of logex , Derivative of ax, Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application.

UNIT – IV **06 Hours**

Analytical Geometry
Introduction: Signs of the Coordinates, Distance formula,
Straight Line : Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line
Integration:
Introduction, Definition, Standard formulae, Rules of integration , Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

UNIT-V **06 Hours**

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

Recommended Books (Latest Edition)

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

BP106RBT: REMEDIAL BIOLOGY

Upon completion of this course the student should be able to:

1. Know the classification and salient features of fire kingdoms of life.
2. Understand the basic components of anatomy physiology of plant.
3. Know understand the basic components of anatomy and physiology animal with special reference of human.

COURSE OUTCOMES

S. No	Course Outcomes (CO)	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Discuss characters of living organism, Diversity in the living world, Binominal nomenclature, five kingdoms of the life and basis of classification. Salient features of monera , potista , fungi, animalia and plantae, virus.	L1: Remember L2: Understand L3: Apply
CO2:	Composition of blood, blood groups, coagulation of blood, composition an functions of lymph, human circulatory system, structure of human heart and blood vessels, cardiac cycle, cardiac output and ECG, digestion and absorption, breathing and respiration.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Excretory products and their elimination, neural control and coordination, chemical coordination and regulation, endocrine glands and their secretion, human reproduction.	L3: Apply L4: Analyse L5: Evaluate
CO4:	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.	L3: Apply L4: Analyse L5: Evaluate
CO5:	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 .	L3: Apply L4: Analyse L5: Evaluate

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate.

How program outcomes are assessed:

S.NO.	Program Outcome	Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/Internals/Viva
PO2:	Planning Abilities	2	Assignments/Internals
P03:	Problem Analysis	3	Assignments/Internals
P04:	Modern Tool Usage	2	Seminars/Academic Activities
P05:	Leadership Skills	1	Group Discussion /Role play
P06:	Professional Identity	3	Group Discussion
P07:	Pharmaceutical Ethics	2	Personality development seminars
P08:	Communication	3	Students' Seminars / Students – teacher interaction
P09:	ThePharmacist and Society	3	Group Discussion / Role play
P10:	Environment And Sustainability	2	Students' Seminars
P11:	Life-Long Learning	2	Assignments / Internals

LEVEL: 1- Slight(Low), 2-Moderate(Medium), 3-Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Outcomes	Program Outcomes (PO)										
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11
C01	3	2	2	3	3	2	3	3	2	2	3
C02	2	3	3	3	3	2	2	2	3	3	3
C03	2	2	2	2	3	3	3	3	3	2	2
C04	3	3	3	3	2	2	2	2	3	3	3
C05	3	2	2	2	3	3	2	3	3	2	3
AVG	2.6	2.4	2.4	2.6	2.8	2.4	2.4	2.6	2.8	2.4	2.8

COURSE CONTENT

UNIT I

0

7 Hours

Living world:

Definition and characters of living organisms
Diversity in the living world
Binomial nomenclature
Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants

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

UNIT II

0

7 Hours

Body fluids and circulation

Composition of blood, blood groups, coagulation of blood
Composition and functions of lymphHuman circulatory systemStructure 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

0

7 Hours

Excretory products and their elimination

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

Neural control and coordination

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

Chemical coordination and regulation

Endocrine glands and their secretions
Functions of hormones secreted by endocrine glands

Human reproduction

Parts of female reproductive system
Parts of male reproductive system

Spermatogenesis and Oogenesis
Menstrual cycle

UNIT IV

0

5 Hours

Plants and mineral nutrition:

Essential mineral, macro and micronutrients**,** Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

UNIT V

0

4 Hours

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

Plant growth and development

Phases and rate of plant growth, Condition of growth,Introduction to plant growth Regulators

Cell - The unit of life

Structure and functions of cell and cell organelles.Cell division

Tissues

Definition, types of tissues, location and functions.

Text Books

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

Reference Books

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

BP112RBP.REMEDIAL BIOLOGY (Practical) 30 Hours

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

Semester II

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-II

BPA 201(17): HUMAN ANOTOMY AND PHYSIOLOGY

Objectives:

Upon completion of this course the student should be able to:

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the hematological tests like blood cell counts, hemoglobin estimation,
- bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system.
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

COURSE OUTCOMES

S.NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	To relate the basic knowledge about central nervous system including nervous tissue, brain and spinal cord.	L1: Remember L2: Understand
CO2	To illustrate the structure and functions of gastrointestinal tract and to learn about ATP/CTP/BMR.	L1: Remember L2: Understand L5: Evaluate

CO3	To learn about structure and functions of respiratory system and various mechanisms involved in regulation of respiration. To categorize the anatomy of urinary system and physiology of urine formation/micturition.	L1: Remember L2: Understand
CO4	To appraise the essentiality of endocrine glands and their hormones.	L1: Remember L2: Understand L4: Analyze
CO5	To predict the physiology of male and female reproductive organs and concepts of genetics.	L1: Remember L2: Understand

BLOOMS TAXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyze; L5 Evaluate; L6: Create

Course outcomes and program outcomes (CO-PO) Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2	3	2	3	3	2	3	2	2	3
CO2	3	2	3	3	2	2	1	2	3	3	1
CO3	1	1	1	2	1	1	2	2	1	2	2
CO4	3	2	2	1	2	2	3	3	3	1	3
CO5	1	3	1	3	3	2	2	2	1	3	1
Avg	**2**	**2**	**2.3**	**2.2**	**2.2**	**2.1**	**2**	**2.4**	**2**	**2**	**2**

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course Content:

Unit I **10 hours**

Nervous system

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fiber, 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 **6 hours**

Digestive system

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through

parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

Energetics Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III **10 hours**

Respiratory System

Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

Urinary system

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

Unit IV **10 hours**

Endocrine system

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

Unit V **09 hours**

Reproductive system

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

Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical) 4 Hours/week

1. Practical physiology is complimentary to the theoretical discussions in physiology.
2. Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings.
3. This is helpful for developing an insight on the subject.
4. To study the integumentary and special senses using specimen, models, etc.,
5. To study the nervous system using specimen, models, etc.,
6. To study the endocrine system using specimen, models, etc.
7. To demonstrate the general neurological examination
8. To demonstrate the function of olfactory nerve
9. To examine the different types of taste.
10. To demonstrate the visual acuity

11. To demonstrate the reflex activity
12. Recording of body temperature
13. To demonstrate positive and negative feedback mechanism.
14. Determination of tidal volume and vital capacity.
15. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
16. Recording of basal mass index.
17. Study of family planning devices and pregnancy diagnosis test.
18. Demonstration of total blood count by cell analyzer
19. Permanent slides of vital organs and gonads.
20.

Recommended Books (Latest Editions)

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

Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

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

Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.

Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

Textbook of Human Histology by Inderbir Singh, Jaypee brothers' medical publishers, New Delhi.

Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers' medical publishers, New Delhi.

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

Reference Books:

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

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

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

BPA 202(17): PHARMACEUTICAL ORGANIC CHEMISTRY –I

Objectives:

- Write the structure and name of organic compounds,Compare the types of isomerism.
- Write the reaction and its orientation.
- Acquire Knowledge of functional groups with their reaction mechanisms.
- Expertise in the reactivity/stability of compounds.
- Demonstrate identification of the unknown organic compounds.

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	1	2	2	2	1	2
CO4	3	2	2	2	3	2	1	2	1	2	1	2
CO5	3	3	3	3	3	2	1	2	1	2	1	2
CO6	3	3	2	3	3	2	1	2	1	2	2	2
Avg	3	2.3	2.2	2.3	2.5	2	2	2	1.5	2	1.3	2

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

UNIT-I **07 Hours**

Classification, nomenclature and isomerism Classification of Organic Compounds

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

UNIT-II **10 Hours**

Alkanes*, Alkenes* and Conjugated dienes*

SP hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP hybridization in alkene.

E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

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

UNIT-III
10 Hours

Alkyl halides*

SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions

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

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

UNIT-IV **10 Hours**

Carbonyl compounds* (Aldehydes and ketones)

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

UNIT-V **08 Hours**

Carboxylic acids*

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

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

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

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours / week

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

Recommended Books (Latest Editions)

Organic Chemistry by Morrison and Boyd

Organic Chemistry by I.L. Finar , Volume-I

Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.

Organic Chemistry by P.L.Soni

Practical Organic Chemistry by Mann and Saunders.

Vogel's text book of Practical Organic Chemistry

Advanced Practical organic chemistry by N.K.Vishnoi.

Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

Reaction and reaction mechanism by Ahluwaliah/Chatwal.

BPA 203 (17): BIOCHEMISTRY

Objectives:

Upon completion of course, student shall able to-

Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.

Understand the metabolism of nutrient molecules in physiological and pathological conditions.

Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

S NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	To remember the properties, significance and metabolic reactions of carbohydrates, lipids, Nucleic acids, Proteins and amino acids.	L1: Remember L2: Understand
CO2	To understand the Metabolism of Carbohydrates and Process of Electron transport and ATP formation.	L1: Remember L2: Understand L5: Evaluate
CO3	To Apply the concept of Catalytic activity and enzyme inhibition in design of New Drugs, Diagnostic and Therapeutic applications of enzyme.	L1: Remember L2: Understand L3: Apply L4: Analyse
CO4	To Distinguish the process of DNA replication, Transcription and Translation.	L1: Remember L2: Understand
CO5	To Discuss the Metabolism of Nucleic acid, Lipids and Amino acids	L1: Remember L2: Understand

BLOOMS TOXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyze; L5: Evaluate**How program out comes are assessed:**

Program Outcome		Level	Proficiency assessed by
PO1	Pharmacy knowledge	3	Assignments/viva/Internals
PO2	Planning abilities	2	Assignments/Internals
PO3	Problem Analysis	2	Assignments/ Internals
PO4	Modern Tool Usage	2	Academic activity
PO5	Leadership Skills	2	Role play
PO6	Professional Identity	3	Group discussion
PO7	Pharmaceutical Ethics	2	Personality development seminars
PO8	Communication	3	Student Interaction
P09	The Pharmacist and society	3	Awareness program/Role play
PO10	Environment and Sustainability	2	Seminars
PO11	Life Long Learning	3	Assignments

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course outcomes and program outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	3	1	3	3	2	3	2	2	3
CO2	3	2	3	3	2	1	1	2	3	2	1
CO3	1	3	1	2	1	1	2	2	1	2	2
CO4	3	2	2	2	2	3	3	3	3	2	3
CO5	1	3	1	3	3	2	2	2	3	3	1
Avg	**2**	**2.3**	**2.3**	**2.1**	**2.2**	**2**	**2**	**2.4**	**2.2**	**2.1**	**2**

COURSE CONTENT

UNIT I **08 Hours**

Biomolecules

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

Bioenergetics

Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.Energy rich compounds; classification; biological significances of ATP and cyclic AMP

UNIT II
10 Hours

Carbohydrate metabolism

Glycolysis – Pathway, energetics and significance
Citric acid cycle- Pathway, energetics and significance

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

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

Hormonal regulation of blood glucose level and Diabetes mellitus

Biological oxidation
Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation

Inhibitors ETC and oxidative phosphorylation/Uncouplers

UNIT III **10 Hours**

Lipid metabolism

β-Oxidation of saturated fatty acid (Palmitic acid)

Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid)

Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D

Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

Amino acid metabolism

General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders

Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)

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

Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV **10 Hours**

Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides

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

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

Genetic code, Translation or Protein synthesis and inhibitors

UNIT V **07 Hours**

Enzymes

Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)

Enzyme inhibitors with examples

Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation

Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions

BP 209 P. BIOCHEMISTRY (Practical) **4 Hours / Week**

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

Recommended Books (Latest Editions)

Principles of Biochemistry by Lehninger.
Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
Biochemistry by Stryer.
Biochemistry by D. Satyanarayan and U.Chakrapani
Textbook of Biochemistry by Rama Rao.
Textbook of Biochemistry by Deb.
Outlines of Biochemistry by Conn and Stumpf
Practical Biochemistry by R.C. Gupta and S. Bhargavan.
Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
Practical Biochemistry by Harold Varley.

BPA 204(17): PATHOPHYSIOLOGY

Objectives:

Upon completion of the subject student shall be able to –

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

COURSE OUTCOMES

S NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	To understand the process of cell injury, morphology of cell injury andcellular adaptations	L1: Remember L2: Understand
CO2	To understand the etiopathogenesis of cardiovascular,respiratory and renaldiseases mentioned.	L1: Remember L2: Understand
CO3	To apply the principles of pathogenesis in understanding symptoms,signand complications of disease states mentioned	L1: Remember L2: Understand
CO4	To explain the etiopathogenesis of hematologic,endocrine,nervous, gastrointestinal, musculo skeletal diseases and Immunopathogenesis of infectious diseases To appraise the principles of physical, chemical and biological carcinogenesis	L1: Remember L2: Understand
CO5	To adapt the principles of inflammation in understanding pathogenesis ofvarious disease states	L1: Remember L2: Understand

BLOOMS TAXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyze; L5 Evaluate; L6: Create

How program outcomes are assessed:

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)Course Outcomes and Program Out comes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	2	3	2	2	3	3	2
CO2	2	3	3	2	3	2	2	2	3	2	2
CO3	3	3	2	3	2	2	2	3	2	2	3
CO4	2	3	3	2	3	2	3	2	2	3	2
CO5	2	3	2	2	2	3	3	2	3	2	3
Avg	2.4	2.8	2.4	2.4	2.4	2.4	2.4	2.1	2.6	2.4	2.4

Course content:

Unit I **10 Hours**

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,Mechanismof 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 10 Hours

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

Respiratory system: Asthma, Chronic obstructive airways diseases.
Renal system: Acute and chronic renal failure .

Unit III 10 Hours

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

Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones
Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia andAlzheimer's disease.

Gastrointestinal system: Peptic Ulcer

Unit IV 8 Hours

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

Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout **Principles of cancer:** classification, etiology and pathogenesis of cancer **Diseases of bones and joints**:Rheumatoid Arthritis, Osteoporosis,Gout **Principles of Cancer**: Classification, etiology and pathogenesis of Cancer

Unit V 7 Hours

Infectious diseases: Meningitis,Typhoid, Leprosy, Tuberculosis Urinary tract infections
Sexually transmitted diseases:AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)

Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition;India; Elsevier; 2014.

Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.

Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition;New York; McGraw-Hill; 2011.

Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states; William and Wilkins, Baltimore;1991[1990 printing].

Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21stedition; London; ELBS/Churchill Livingstone; 2010.

Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB SaundersCompany; 2010.

Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-HillMedical; 2014.

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

Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London;Churchill Livingstone publication; 2003.

Recommended Journals

The Journal of Pathology. ISSN: 1096-9896 (Online)

The American Journal of Pathology. ISSN: 0002-9440

Pathology. 1465-3931 (Online)

International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171(Online)

Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

Semester III

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-III

BP301(17): PHARMACEUTICAL ORGANIC CHEMISTRY II

Objectives

Upon completing the course the student

- Shall be able to write the structure, name,synthesis and the reactions of aromatic benzene, naphthalene, anthracene and cycloalkanes (cyclopropane and cyclobutane).
- Able to compare the reactivity of organic compounds.
- Understand the concept of resonance.
- Chemistry of fats and oils are also included and students will understand analytical constants' applications like acid value, saponification value, and ester value useful in the quality assurance of oils and fats.

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars

PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course outcomes and program outcomes (CO-PO) mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	1	2	2	2	1	2
CO4	3	2	2	2	3	2	1	2	1	2	1	2
CO5	3	3	3	3	3	2	1	2	1	2	1	2
CO6	3	3	2	3	3	2	1	2	1	2	2	2
Avg	3	2.3	2.2	2.3	2.5	2	2	2	1.5	2	1.3	2

Course Content:

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

UNIT I **10 Hours**

Benzene and its derivatives

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

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

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

Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II **10 Hours**

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols

Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

Aromatic Acids* –Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III **10 Hours**

Fats and Oils

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

UNIT IV **08 Hours**

Polynuclear hydrocarbons:

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

UNIT V **07 Hours**

Cyclo alkanes*

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

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 **Hrs/week**

1. Experiments involving laboratory techniques

Recrystallization

Steam distillation

2. Determination of following oil values (including standardization of reagents)

a.Acid value

b.Saponification value

c. Iodine value

3.Preparation of compounds

a. Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.

b.2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/

c.Acetanilide by halogenation (Bromination) reaction.

d.5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.

e.Benzoic acid from Benzyl chloride by oxidation reaction.

f.Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.

g.1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.

h.Benzil from Benzoin by oxidation reaction.

i.Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction

j.Cinnammic acid from Benzaldehyde by Perkin reaction

k.*P*-Iodo benzoic acid from *P*-amino benzoic acid

Recommended Books (Latest Editions)

Organic Chemistry by Morrison and Boyd
Organic Chemistry by I.L. Finar , Volume-I
Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
Organic Chemistry by P.L.Soni
Practical Organic Chemistry by Mann and Saunders.
Vogel's text book of Practical Organic Chemistry
Advanced Practical organic chemistry by N.K.Vishnoi.

BP302 (17) : Physical Pharmaceutics – I

Upon successful completion of thecourse, students will be able to:

- State the physicochemical properties of drug molecules, pH, and solubility etc.
- Explain the role of surfactants, interfacial phenomenon and Thermodynamics
- Describe the concept of complexation and protein binding.
- Analyze the chemical stability tests of various drug products
- Understand the physical properties of solutions, buffers, isotonicity, disperse systems and rheology.

How program outcomes are assessed by:

Program Outcome		Level	Proficiency Assessed by
PO1	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2	Planning Abilities	1	Assignments/ Internals
PO3	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4	Problem Analysis	2	Assignments/ Internals
PO5	Modern Tool Usage	2	Seminars/academic activities
PO6	Leadership Skills	1	Group discussion / Role play
PO7	Professional Identity	2	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Students' seminars/ student - teacher interaction
PO10	The Pharmacist and Society	2	Group discussion / Role play
PO11	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO 2	2	2	2	2	2	1	1	1	2	2	1	2
CO 3	1	2	2	2	2	1	2	1	2	2	1	2
CO 4	1	1	2	2	2	1	2	1	2	2	2	2
CO 5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	1.6	1.4	1.8	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

Course Content:

UNIT-I **10 Hours**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions)

Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

UNIT-II **10Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols

– inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

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

UNIT-III **08 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions,

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

UNIT-IV **08Hours**

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

UNIT-V **07 Hours**

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

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

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

Recommended Books: (Latest Editions)

i. Physical Pharmacy by Alfred Martin
ii. Experimental Pharmaceutics by Eugene, Parott.
iii. Tutorial Pharmacy by Cooper and Gunn.
iv. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
v. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
vi. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
vii. Physical Pharmaceutics by Ramasamy C and ManavalanR.
viii. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
ix. Physical Pharmaceutics by C.V.S. Subramanyam
x. Test book of Physical Pharmacy, by Gaurav Jain & Roop K. Khar

BP 303 (17) : Pharmaceutical Microbiology

OBJECTIVES:

- Students will be able to acquire, articulate, retain and apply specialized language and knowledge relevant to microbiology.
- Students will acquire knowledge, demonstrate competency in laboratory safety and skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.
- Students will demonstrate isolation of and identification of microbes.
- Students will acquire knowledge about handling the microbiological equipment.

How program outcomes are assessed by:

Program Outcome		Level	Proficiency Assessed by
PO1	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2	Planning Abilities	1	Assignments/ Internals
PO3	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4	Problem Analysis	1	Assignments/ Internals
PO5	Modern Tool Usage	3	Seminars/academic activities
PO6	Leadership Skills	1	Group discussion / Role play
PO7	Professional Identity	3	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Students' seminars/ student - teacher interaction
PO10	The Pharmacist and Society	2	Group discussion / Role play
PO11	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	1	2	2	2	1	2	2
CO 2	2	2	2	2	1	1	1	1	2	2	1	2
CO 3	1	2	2	2	2	1	2	1	2	2	1	2
CO 4	1	1	1	2	2	1	2	1	1	2	2	2
CO 5	2	1	2	1	2	1	2	2	2	2	2	2
Avg	1.6	1.4	1.7	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

Course content:

Unit I **10 Hours**

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

Unit II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC).

Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous,radiation and mechanical method of sterilization.
Evaluation of the efficiency of sterilization methods.

Unit III **10 Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.

Classification and mode of action of disinfectants

Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions

Evaluation of bactericidal & Bacteriostatic.

Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Unit IV **08 Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.
Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids.
Assessment of a new antibiotic.

Unit V **07Hours**

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.

BP 307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

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

Recommended Books (Latest edition)

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

BP 304 T: PHARMACEUTICAL ENGIENEERING

OBJECTIVES:

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

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

S.No	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Student would know various unit operations used in pharmaceutical industries.	L1:Remember L2:Understand L3: Apply
CO2:	Student would understand the material handling techniques.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Student would perform various processes involved in pharmaceutical manufacturing process.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Student would be able to carry out the various tests to prevent	L3: Apply L4: Analyse L5: Evaluate

	environmental pollution.	
CO5:	Student would appreciate and comprehend significance of plant lay out design for optimum use of resources.	L3: Apply L4: Analyse L5: Evaluate
C06	Student would appreciate the various preventive methods used for corrosion control in pharmaceutical industries.	L3: Apply L4: Analyse L5: Evaluate

How program outcomes are assessed:

Program outcomes		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ internals/ Viva
PO2:	Planning Abilities	1	Assignments/ internals
PO3:	Conduct Investigations Of Complex Problems	1	Assignments/ internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ internals
PO5:	Modern Tool Usage	2	Seminars/ academic activities
PO6:	Leadership Skills	1	Group discussion/ Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' Seminars/ Student-teacher interaction
PO10:	The Pharmacist And Society	2	Group discussion/ Role play
PO11:	Environment And Sustainability	2	Students' seminar

Level: 1 – slight (low), Level: 2- Moderate (medium), Level: 3- Substantial (high)

Course outcomes and program outcomes (CO-PO) mapping:

Course outcomes	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11
CO1	3	3	2	2	3	2	3	2	2	2	2
CO2	2	2	3	2	2	3	2	2	3	3	2
CO3	2	1	2	3	3	2	2	2	2	3	2
CO4	2	3	2	3	2	2	2	2	1	2	3
CO5	1	2	2	1	1	1	1	2	2	1	1
CO6	2	1	1	2	1	2	2	2	2	1	2
AVG	2	2	2	2	2	2	2	2	2	2	2

COURSE CONTENT

UNIT-I **10 Hours**

a. 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.

b.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.

c. 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 **10 Hours**

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

b.**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.

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

UNIT- III **08 Hours**

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

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

UNIT-IV **08 Hours**

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

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

UNIT- V **07 Hours**

Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

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

Recommended Books: (Latest Editions)

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

Semester IV

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-IV

BP401(17): PHARMACEUTICAL ORGANIC CHEMISTRY – III

Course Objectives

At the end of the course, the student shall be able to

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

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Stereo isomerism Optical isomerism –Optical activity, enantiomerism, diastereoisomerism, meso compounds,Elements of symmetry, chiral and achiral molecules,DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers,Reactions of chiral molecules,Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute	L1:Remember L2:Understand L3: Apply
CO2:	Geometrical isomerism,Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems)Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.Stereospecific and stereoselective reactions	L3: Apply L4: Analyse L5: Evaluate
CO3:	Heterocyclic compounds: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene	L3: Apply L4: Analyse L5: Evaluate
CO4:	Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and ThiazolePyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives	L3: Apply L4: Analyse L5: Evaluate
CO5:	Reactions of syntheticimportance Metal hydride reduction (NaBH4 and	L3: Apply

	LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishnerreduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation	L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program outcomes are assessed:

Program Outcome		**Level**	**Proficiency assessed by**
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	2	2	2	1	2	2
CO2	3	2	2	2	2	1	1	1	2	2	1	2
CO3	3	2	2	2	2	1	2	2	2	2	1	2
CO4	3	1	2	2	2	2	2	1	2	2	2	2
CO5	3	2	2	2	2	2	2	2	2	2	2	2
Avg	3	1.8	1.8	1.8	2	1.6	1.8	1.6	2	1.8	1.6	2

Course Content

Theory 45 Hrs.

UNIT-I **10Hours**

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

UNIT-II **10Hours**

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems)

Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane.

Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.

Stereospecific and stereoselective reactions

UNIT-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classification,Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene,Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **8Hours**

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 **7Hours**

Reactions of syntheticimportance Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishnerreduction.Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation

Recommended Books (Latest Editions)

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

BP402T: MEDICINAL CHEMISTRY-I

Objectives

Upon completion of the course the student shall be able to

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

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	The students will acquire wide knowledge on drug metabolic pathways (Phase-I and II) and factors effecting metabolism	L1: Remember L2:Understand L3: Apply
CO2:	To understand the different chemical aspects along with the synthesis, mode of action, medicinal benefits for Sympathomimetics and Sympatholytics.	L2:Understand L3: Apply
CO3:	The student shall understand the synthetic methods as well as the basic structural requirements, pharmacophoric features as well as the structural activity relationships for drugs acting on cholinergic system	L2:Understand L3: Apply
CO4:	The student shall understand the role of various drugs acting on Central nervous system. The students shall apply their knowledge in understanding the synthesis, SAR and medicinal benefits of Antiepileptics,Antipsychotics, sedatives and hypnotics.	
CO5:	The student shall understand the structural aspects and synthesis of various agents used as Narcotic and non narcotic analgesics, Non steroidalAntiinflammatory agents and drugs applied in Local anaesthesia.	

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	ConductInvestigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	2	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	2	1.6	1.8	1.8	2	1.4	1.8	1.4	2	2	1.6	2

Course Content:

UNIT- I **10 Hours**

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

UNIT-II **10 Hours**

Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, 89 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 **08 Hours**

Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine. Cholinergic receptors

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

mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

Unit IV **08 Hours**

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* Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.
Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine. Fluro buterophenones: Haloperidol, Droperidol, Risperidone.
Beta amino ketones: Molindone hydrochloride.
Benzamides: Sulpieride.
C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anti convulsant action
Barbiturates: Phenobarbitone, Methabarbital. Hydantoins: Phenytoin*, Mephenytoin, Ethotoin
Oxazolidine diones: Trimethadione, Paramethadione
Succinimides: Phensuximide, Methsuximide, Ethosuximide*
Urea and monoacylureas: Phenacemide, Carbamazepine*
Benzodiazepines: Clonazepam
Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V **07 Hours**

Drugs acting on Central Nervous System
General anesthetics: Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane,
Isoflurane, Desflurane.
Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium,Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride.*
Narcotic and non-narcotic analgesics
Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.
Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.
Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

BP406P. MEDICINAL CHEMISTRY – I (Practical) 4 Hours/Week

I Preparation of drugs/ intermediates

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

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 (Latest Editions)

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

BP403 (17) – Physical Pharmacy – II

OBJECTIVES

Upon the completion of the course student shall be able to

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

How program outcomes are assessed by:

Program Outcome		Level	Proficiency Assessed by
PO1	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2	Planning Abilities	1	Assignments/ Internals
PO3	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4	Problem Analysis	1	Assignments/ Internals
PO5	Modern Tool Usage	3	Seminars/academic activities
PO6	Leadership Skills	1	Group discussion / Role play
PO7	Professional Identity	3	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Students' seminars/ student - teacher interaction
PO10	The Pharmacist and Society	2	Group discussion / Role play
PO11	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	1	2	2	2	1	2	2

CO 2	2	2	2	2	1	2	1	1	2	2	1	2
CO 3	2	2	2	2	2	2	2	1	2	2	1	2
CO 4	2	2	1	2	2	2	2	1	1	2	2	2
CO 5	2	1	2	1	2	2	2	2	2	2	2	2
Avg	2	1.6	1.7	1.8	2	1.8	1.8	1.4	2	1.8	1.6	2

Course Content:

UNIT-I **07 Hours**

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

UNIT-II **10 Hours**

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

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

UNIT-III **10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method

UNIT-IV **10Hours**

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 **10 Hours**

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

BP405T: PHARMACOGNOSY AND PHYTOCHEMISTY - I

OBJECTIVES:

- To have the knowledge of modern extraction techniques, characterization, identification of the herbal drugs and phytochemistry
  Acknowledge the preparation and development of herbal
- formulations
- Understand the herbal drug interactions
- Performing the isolation and identification of phytoconstituents.

COURSE OUTCOMES

S.No	Course outcomes (CO)	Knowledge Level (BLOOMS level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	They would understand the phytochemical production in medicinal plants ,their extraction, isolation, identification, estimation and characterization.	L1: Remember L2:Understand L3:Apply L4: Analyse
CO2	Shall be able to explain the herbal drug-drug, food- herb interaction, basic principles of traditional systems of medicine, modern extraction techniques, preparation and development of herbal formulations.	L1: Remember L2:Understand L3:Apply L4:Analyse L5: Evaluate
CO3	Identification and quality assessment of crud drugs including detection of type of adulteration and type of adulterants of crude drugs.	L1:Apply L2:Analyse L3: Evaluate
CO4	They would understand the isolation, estimation and structure elucidation of phytochemicals of pharmaceutical significance by UV –VIS Spectrometry , CC ,HPTLC , MS , IR ,NMR.	L1:Apply L2:Analyse L3: Evaluate
CO5	Explaining the methods for industrial production, estimation and utilisation of some therapeutically important phytoconstituents .	L1:Apply L2:Analyse L3: Evaluate

Bloom's Taxonomy:L1: Remember,L2: Understand,L3:Apply,L4: Analyse,L5: Evaluate

How program outcomes are assessed:

S.NO.	Program Outcome	Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/Internals/Viva

PO2:	Planning Abilities	2	Assignments/Internals
P03:	Problem Analysis	3	Assignments/Internals
P04:	Modern Tool Usage	2	Seminars/Academic Activities
P05:	Leadership Skills	1	Group Discussion /Role play
P06:	Professional Identity	3	Group Discussion
P07:	Pharmaceutical Ethics	2	Personality development seminars
P08:	Communication	3	Students' Seminars / Students – teacher interaction
P09:	ThePharmacist and Society	3	Group Discussion / Role play
P10:	Environment And Sustainability	2	Students' Seminars
P11:	Life-Long Learning	2	Assignments / Internals

LEVEL: 1- Slight(Low), 2-Moderate(Medium), 3-Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Outcomes	Program Outcomes (PO)										
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11
C01	3	3	3	3	2	3	2	2	3	3	2
C02	2	3	2	3	3	2	3	3	2	2	3
C03	3	3	2	3	3	2	3	2	3	3	3
C04	2	2	3	2	3	2	2	2	2	3	2
C05	2	3	2	3	3	2	3	3	3	2	2
AVG	2.4	2.8	2.4	2.8	2.8	2.2	2.6	2.4	2.6	2.6	2.4

Course Content:

UNIT-I **10 Hours**

Introduction to Pharmacognosy:

Definition, history, scope and development of Pharmacognosy

Sources of Drugs – Plants, Animals, Marine & Tissue culture

Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

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

Quality control of Drugs of Natural Origin:

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

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

UNIT-II **10 Hours**

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

Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT-III **07 Hours**

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:

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

Introduction to secondary metabolites:

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

UNIT V **08 Hours**

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

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey

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

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

Marine Drugs:

Novel medicinal agents from marine sources.

Semester V

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-V

BP501(17): MEDICINAL CHEMISTRY-II

Objectives

Upon completion of the course the student shall be able to

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

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	To understand the classification, nomenclature and structure activity relationship with respect to their mechanism of actions of various anti histamines, proton pump inhibitors and anti neoplastic agents.	L1: Remember L2:Understand L3: Apply
CO2:	To understand the different chemical aspects along with the synthesis, mode of action, medicinal benefits for various classes of cardiovascular agents viz Diuretics, anti anginal, calcium channel blockers and other anti hypertensive agents	L2:Understand L3: Apply
CO3:	The student shall understand the synthetic methods as well as the basic structural requirements, pharmacophoric features as well as the structural activity relationships for various classes of medicinal agents used as anti arrhythmics, anti hyperlipidemics, coagulants and anticoagulants and drugs used in congestive heart failure.	L2:Understand L3: Apply
CO4:	The student shall understand the role of hormones, their structure, biological and therapeutic significance.	L2:Understand L3: Apply
CO5:	The student shall understand the structural aspects and synthesis of various agents used for the treatment of diabetes and drugs applied in Local anaesthesia.	L2:Understand L3: Apply

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate,

L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	1.8	1.4	1.8	1.8	2	1.4	1.8	1.4	2	2	1.6	2

Course Content:

UNIT- I **10 Hours**

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*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H2-antagonists: Cimetidine*, Famotidine, Ranitidin. Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents: Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

Anti-anginal: Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

Diuretics: Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone,

Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazeprilhydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidinemonosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III **10 Hours**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, 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 **08 Hours**

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 **07 Hours**

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

Recommended Books (Latest Editions)

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

BP 502 T. INDUSTRIAL PHARMACY – I

OBJECTIVES:

After successful completion of the course,

Know the various pharmaceutical dosage forms and their manufacturing techniques.

Know various considerations in development of pharmaceutical dosage forms

Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Student would know the various pharmaceutical dosage forms and their manufacturing techniques.	L1: Remember L2:Understand L3: Apply
CO2:	Student would know various considerations in development of pharmaceutical dosage forms.	L2:Understand L3: Apply
CO3:	Student would formulate solid, liquid and semisolid dosage forms and evaluate them for their quality.	L2:Understand L3: Apply

How program outcomes are assessed:

Program outcomes		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ internals/ Viva

PO2:	Planning Abilities	1	Assignments/ internals
PO3:	Conduct Investigations Of Complex Problems	1	Assignments/ internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ internals
PO5:	Modern Tool Usage	2	Seminars/ academic activities
PO6:	Leadership Skills	1	Group discussion/ Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' Seminars/ Student-teacher interaction
PO10:	The Pharmacist And Society	2	Group discussion/ Role play
PO11:	Environment And Sustainability	2	Students' seminar

Level: 1 – slight (low), Level: 2- Moderate (medium), Level: 3- Substantial (high)

Course outcomes and program outcomes (CO-PO) mapping:

Course outcomes	Program outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	1	2	2	3	3	2	1
CO2	3	3	2	2	1	3	2	1	3	3	3
CO3	3	1	2	1	1	1	2	2	3	1	2
AVG	3	2	2	2	1	2	2	2	3	2	2

Course content

UNIT-I **07 Hours**

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

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

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

classification of drugs & its significant

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

UNIT-II **10 Hours**

Tablets:

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

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

Quality control tests: In process and finished product tests

Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia

UNIT-III **08 Hours**

Capsules:

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

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

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

UNIT-IV **10 Hours**

Parenteral Products:

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

Production procedure, production facilities and controls, aseptic processing

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

Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-V **10 Hours**

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

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

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

BP 506 P. Industrial PharmacyI (Practical) **4 Hours/week**

Preformulation studies on paracetamol/asparin/or any other drug

Preparation and evaluation of Paracetamol tablets

Preparation and evaluation of Aspirin tablets

Coating of tablets- film coating of tables/granules

Preparation and evaluation of Tetracycline capsules

Preparation of Calcium Gluconate injection

Preparation of Ascorbic Acid injection

Qulaity control test of (as per IP) marketed tablets and capsules

Preparation of Eye drops/ and Eye ointments

Preparation of Creams (cold / vanishing cream)

Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
Theory and Practice of Industrial Pharmacy by Liberman & Lachman
Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5thedition, 2005
Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

BP503.T. PHARMACOLOGY-II

OBJECTIVES:

Upon completion of this course the student should be able to

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

Course Content:

UNIT-I **10hours**

Pharmacology of drugs acting on cardio vascular system

Introduction to hemodynamic and electrophysiology of heart.
Drugs used in congestive heart failure
Anti-hypertensive drugs.
Anti-anginal drugs.
Anti-arrhythmic drugs.
Anti-hyperlipidemic drugs.

UNIT-II **10hours**

Pharmacology of drugs acting on cardio vascular system

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

Pharmacology of drugs acting on urinary system

Diuretics
Anti-diuretics.

UNIT-III **10hours**

Autocoids and related drugs

Introduction to autacoids and classification
Histamine, 5-HT and their antagonists.
Prostaglandins, Thromboxanes and Leukotrienes.
Angiotensin, Bradykinin and Substance P.
Non-steroidal anti-inflammatory agents
Anti-gout drugs
Antirheumatic drug

UNIT-IV **08hours**

Pharmacology of drugs acting on endocrine system

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

UNIT-V **07hours**

Pharmacology of drugs acting on endocrine system

Androgens and Anabolic steroids.

Estrogens, progesterone and oral contraceptives.

Drugs acting on the uterus.

Bioassay

a. Principles and applications of bioassay.

b.Types of bioassay

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

507 P. PHARMACOLOGY-II (Practical) 4Hrs/Week

Introduction to *in-vitro* pharmacology and physiological salt solutions.

Effect of drugs on isolated frog heart.

Effect of drugs on blood pressure and heart rate of dog.

Study of diuretic activity of drugs using rats/mice.

DRC of acetylcholine using frog rectus abdominis muscle.

Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.

Bioassay of histamine using guinea pig ileum by matching method.

Bioassay of oxytocin using rat uterine horn by interpolation method.

Bioassay of serotonin using rat fundus strip by three point bioassay.

Bioassay of acetylcholine using rat ileum/colon by four point bioassay.

Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).

Determination of PD_2 value using guinea pig ileum.

Effect of spasmogens and spasmolytics using rabbit jejunum.

Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.

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)

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

Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.

Goodman and Gilman's, The Pharmacological Basis of Therapeutics

Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.

Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology.

K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher

Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.

Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

BP504(17): PHARMACOGNOSY AND PHYTOCHEMISTY-II

OBJECTIVES:

- To have the knowledge of modern extraction techniques, characterization, identification of the herbal drugs and phytochemistry
  Acknowledge the preparation and development of herbal
- formulations
- Understand the herbal drug interactions
- Performing the isolation and identification of phytoconstituents.
  COURSE OUTCOMES

S.No	Course outcomes (CO)	Knowledge Level (BLOOMS level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	They would understand the phytochemical production in medicinal plants, their extraction, isolation, identification, estimation and characterization.	L1: Remember L2:Understand L3:Apply L4: Analyse
CO2	Shall be able to explain the herbal drug-drug, food- herb interaction, basic principles of traditional systems of medicine, modern extraction techniques, preparation and development of herbal formulations.	L1: Remember L2:Understand L3:Apply L4:Analyse L5: Evaluate
CO3	Identification and quality assessment of crud drugs including detection of type of adulteration and type of adulterants of crude drugs.	L1:Apply L2:Analyse L3: Evaluate
CO4	They would understand the isolation, estimation and structure elucidation of phytochemicals of pharmaceutical significance by UV –VIS Spectrometry , CC ,HPTLC , MS , IR ,NMR.	L1:Apply L2:Analyse L3: Evaluate
CO5	Explaining the methods for industrial production, estimation and utilisation of some therapeutically important phytoconstituents .	L1:Apply L2:Analyse L3: Evaluate

Bloom's Taxonomy:L1: Remember,L2: Understand,L3:Apply,L4: Analyse,L5: Evaluate

How program outcomes are assessed:

S.NO.	Program Outcome	Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/Internals/Viva
PO2:	Planning Abilities	2	Assignments/Internals

P03:	Problem Analysis	3	Assignments/Internals
P04:	Modern Tool Usage	2	Seminars/Academic Activities
P05:	Leadership Skills	1	Group Discussion /Role play
P06:	Professional Identity	3	Group Discussion
P07:	Pharmaceutical Ethics	2	Personality development seminars
P08:	Communication	3	Students' Seminars / Students – teacher interaction
P09:	ThePharmacist and Society	3	Group Discussion / Role play
P10:	Environment And Sustainability	2	Students' Seminars
P11:	Life-Long Learning	2	Assignments / Internals

LEVEL: 1- Slight(Low), 2-Moderate(Medium), 3-Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Outcomes	Program Outcomes (PO)										
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11
C01	3	2	3	3	2	3	2	3	3	3	3
C02	3	3	2	3	3	2	3	3	2	3	2
C03	2	3	2	2	2	3	2	3	2	3	3
C04	3	2	3	3	2	3	3	2	3	3	2
C05	3	2	2	3	3	2	2	3	3	3	3
AVG	2.8	2.4	2.4	2.8	2.4	2.6	2.4	2.8	2.6	3	2.6

Course Content:

UNIT-I **7 Hours**

Metabolic pathways in higher plants and their determination

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

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

UNIT-II **14 Hours**

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

secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,
Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta
Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis
Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,
Tannins: Catechu, Pterocarpus
Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony
Glycosides: Senna, Aloes, Bitter Almond
Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin
b) Glycosides: Glycyrhetinic acid & Rutin
c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d) Resins: Podophyllotoxin, Curcumin

UNIT-IV **10 Hours**

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

UNIT V **8 Hours**

Basics of Phytochemistry

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

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

4 Hours/Week

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

Recommended Books: (Latest Editions)

W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007

Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
The formulation and preparation of cosmetic, fragrances and flavours.
Remington's Pharmaceutical sciences.
Text Book of Biotechnology by Vyas and Dixit.
Text Book of Biotechnology by R.C. Dubey.

BP 505 (17). PHARMACEUTICAL JURISPRUDENCE

OBJECTIVES:

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

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

COURSE OUTCOMES:

S.no	Course outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1	To recall the pharmaceutical legislations, ethics, right to information, medical termination of pregnancy and intellectual property rights	L1-Remember L2-Understand
CO2	To relate the significance of Drugs and cosmetics act 1940 and its rules 1945 in relation to import and manufacture of drugs	L1-Remember L2-Understand L3-Apply
CO3	To apply the knowledge on schedules pertaining to Drugs and cosmetics act 1940 and its rules 1945 and also administration of the act and rules	L1-Remember L3-Apply
CO4	To understand the functions of pharmacy councils and implementation of education regulations in pharmacy	L2-Understand L3-Apply
CO5	To appraise the importance of medicinal and toilet preparations act and narcotic drugs and psychotropic substances act and rules	L2-Understand L5-Evaluate
CO6	To discuss the salient features of drugs and magic remedies act, prevention of cruelty to animals act and drugs price control order	L1-Remember L2-Understand

BLOOMS TOXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5 Evaluate; L6: Create

How program out comes are assessed:

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course Outcomes and Program Out comes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	2	3	3	2	3	2	3
CO2	3	3	3	3	2	3	3	3	3	2	2	3
CO3	2	2	3	3	2	2	2	3	2	3	2	2
CO4	3	3	3	3	3	3	3	2	3	3	3	2
CO5	2	3	2	2	3	3	2	3	3	2	3	2
Avg	2.6	2.8	2.6	2.8	2.4	2.6	2.6	2.8	2.6	2.6	2.5	2.4

Course Content:

UNIT-I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

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

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

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

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

UNIT-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

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

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

Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

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

UNIT-III **10 Hours**

Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties

Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic 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 **08 Hours**

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V **07 Hours**

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

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

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

Recommended books: (Latest Edition)

Forensic Pharmacy by B. Suresh

Text book of Forensic Pharmacy by B.M. Mithal

Hand book of drug law-by M.L. Mehra

A text book of Forensic Pharmacy by N.K. Jain

Drugs and Cosmetics Act/Rules by Govt. of India publications.

Medicinal and Toilet preparations act 1955 by Govt. of India publications.

Narcotic drugs and psychotropic substances act by Govt. of India publications

Drugs and Magic Remedies act by Govt. of India publication

Bare Acts of the said laws published by Government. Reference books (Theory)

Semester VI

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-VI

BP601T: MEDICINAL CHEMISTRY-III

Objectives

Upon completion of the course student shall be able to:

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

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	To understand the historical background of antibiotics, their nomenclature and chemical aspects. Apply the knowledge in understanding the structure activity relationship of beta lactam antibiotics with respect to their pharmacological actions.	L2:Understand L3: Apply
CO2:	To understand the different chemical aspects along with the metabolites and their pharmacological or adverse effects for various classes of antibiotics viz Macrolides, antimalarials and Chloramphenicol. The student needs to apply their knowledge to understand the basic concepts and applications of prodrugs.	L1: Remember L2:Understand L3: Apply
CO3:	The student shall understand the synthetic methods as well as the basic structural requirements, pharmacophoric features as well as the structural activity relationships for various classes of medicinal agents used in the treatment of Tuberculosis, Urinary tract infections and various viral diseases.	L2:Understand L3: Apply
CO4:	The student shall understand the role of various anti fungal, anti protozoal agents and sulphonamides. The students shall apply their knowledge in understanding the synthesis, SAR and medicinal benefits of these drugs.	L1: Remember L2:Understand L3: Apply
CO5:	The student shall understand and apply their knowledge in basic concepts of drug design like QSAR studies, Pharmacophore modeling and docking methods, applications of Combinatorial chemistry.	L3: Apply L4: Analyse

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	1	2	2	1	2
CO4	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	1.6	1.4	1.8	1.8	2	1.4	1.8	1.4	2	2	1.6	2

Course Content:

UNIT – I **10 Hours**

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

UNIT – II **10 Hours**

Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. Macrolide: Erythromycin Clarithromycin, Azithromycin. Miscellaneous: Chloramphenicol*, Clindamycin. Prodrugs: Basic concepts and application of prodrugs design. Antimalarials: Etiology of malaria. Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil. Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III **10 Hours**

Anti-tubercular Agents Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate.

Urinary tract anti-infective agents Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

UNIT – IV **08 Hours**

Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole 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 **07 Hours**

Introduction to Drug Design Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques.

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

BP607P. MEDICINAL CHEMISTRY- III (Practical) 4 Hours / week

I. Preparation of drugs and intermediates

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

II.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 (Latest Editions)

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

BP602 (17). PHARMACOLOGY-III

OBJECTIVES

Upon completion of this course the student should be able to:

Understand the mechanism of drug action and its relevance in the treatment of

Different infectious diseases

Comprehend the principles of toxicology and treatment of various poisonings and

Appreciate correlation of pharmacology with related medical sciences.

COURSE OUTCOMES

S.No.	Course outcomes	Knowledge level (BLOOMS level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Define and explain 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 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.	L1: Remember; L2: Understand; L3: Apply
CO2	Define and explain Chemotherapy a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides	L2: Understand; L3: Apply; L4: Analyse
CO3	Explain and describe Chemotherapy a. Antitubercular agents b. Antileprotic agents 131 c. Antifungal agents d. Antiviral drugs e.Anthelmintics	L2: Understand; L3: Apply; L5 Evaluate

	f. Antimalarial drugs g. Antiamoebic agents	
CO4	To Understand Chemotherapy l. Urinary tract infections and sexually transmitted diseases. m. Chemotherapy of malignancy. 4. Immunopharmacology a. Immunostimulants b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars.	L1: Remember; L2: Understand; L3: Apply
CO5	Explain the . 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.	L1: Remember; L2: Understand; L3: Apply

BLOOMS TOXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5 Evaluate; L6: Create

How program outcomes are assessed:

Program Outcome		**Level**	**Proficiency assessed by**
PO1	Pharmacy knowledge	3	Assignments/viva/Internals
PO2	Planning abilities	2	Assignments/Internals
PO3	Conduct Investigations of complex problems	3	Practical's
PO4	Problem Analysis	2	Assignments/ Internals
PO5	Modern Tool Usage	2	Academic activity

PO6	Leadership Skills	2	Role play
PO7	Professional Identity	3	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Student Interaction
P010	The Pharmacist and society	3	Awareness program/Role play
PO11	Environment and Sustainability	2	Seminars
PO12	Life Long Learning	3	Assignments

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course Outcomes and Program Out comes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	3	2	3	2	3	2	3
CO2	2	3	3	3	3	2	3	3	3	2	2	3
CO3	3	3	3	2	2	3	3	2	2	3	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	3
CO5	2	3	3	2	3	2	2	3	2	2	2	2
Avg	2.6	2.8	2.6	2.6	2.6	2.6	2.6	2.8	2.4	2.6	2.4	2.6

Course Content:

UNIT-I **10hours**

Pharmacology of drugs acting on Respiratory system
Anti -asthmatic drugs
Drugs used in the management of COPD
Expectorants and antitussives
Nasal decongestants
Respiratory stimulants
Pharmacology of drugs acting on the Gastrointestinal Tract
Antiulcer agents.
Drugs for constipation and diarrhoea.
Appetite stimulants and suppressants.
Digestants and carminatives.
Emetics and anti-emetics.

UNIT-II **10hours**

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

UNIT-III **10hours**

- Chemotherapy
- Antitubercular agents
- Antileprotic agents
- Antifungal agents
- Antiviral drugs
- Anthelmintics
- Antimalarial drugs
- Antiamoebic agents

UNIT-IV **08hours**

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

UNIT-V **07hours**

Principles of toxicology

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

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

General principles of treatment of poisoning

Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning.

Chronopharmacology

Definition of rhythm and cycles.

Biologica l clock and their significance leading to chronotherapy.

BP603(17): HERBAL DRUG TECHNOLOGY

OBJECTIVES:

Upon completion of this course the student should be able to:
1. Understand raw material as source of herbal drugs from cultivation to herbal drug product
2. Know the WHO and ICH guidelines for evaluation of herbal drugs
3. Know the herbal cosmetics, natural sweeteners, nutraceuticals
4. Appreciate patenting of herbal drugs, GMP

Would be able to understand the basic knowledge of herbal drug industry, the raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc.

COURSE OUTCOMES

S. No		Course Outcomes (CO)	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain			
CO1:	Students will remember definition of herb, herbal medicine, herbal medicinal product. Cultivation of medicinal plants including Organic farming. Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy	L1: Remember L2: Understand L3: Apply	
CO2:	Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Herbal-Drug and Herb-Food Interactions	L3: Apply L4: Analyse L5: Evaluate	
CO3:	Students will be able to understand and prepare herbal cosmetics, herbal excipients, herbal formulations.	L3: Apply L4: Analyse L5: Evaluate	
CO4:	Students will be able to understand WHO & ICH guidelines for the assessment of herbal drugs, Patenting and Regulatory requirements of natural products and regulations in India.	L3: Apply L4: Analyse L5: Evaluate	
CO5:	Students will understand Herbal drugs industry: Present scope and future prospects.Schedule T – GoodManufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives.	L3: Apply L4: Analyse L5: Evaluate	

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate.

How program outcomes are assessed:

LEVEL: 1- Slight(Low), 2-Moderate(Medium), 3-Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Outcomes	Program Outcomes (PO)										
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11
C01	3	3	3	3	3	2	3	2	3	3	3
C02	2	2	2	3	3	3	2	3	2	2	2
C03	3	3	2	2	2	3	2	3	3	2	2
C04	2	2	3	3	3	2	2	3	2	2	3
C05	2	3	3	3	2	2	2	3	3	2	2
AVG	2.4	2.6	2.6	2.8	2.6	2.4	2.2	2.8	2.6	2.2	2.4

Course content:

UNIT-I **11 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs

Selection, identification and authentication of herbal materials Processing of herbal raw material

Biodynamic Agriculture

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

Indian Systems of Medicine

Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy

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

UNIT-II **7 Hours**

Nutraceuticals

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

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

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

UNIT-III **10 Hours**

Herbal Cosmetics

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

Herbal excipients:

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

Herbal formulations :

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

UNIT- IV **10 Hours**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

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

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

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

UNIT-V **07 Hours**

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives

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

BP 604 (17). BIOPHARMACEUTICS AND PHARMACOKINETICS

OBJECTIVES:

Upon completion of the course student shall be able to:

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

COURSE OUTCOMES:

S. No	Course Outcomes (CO)	Knowledge level (BLOOMS Level)
After successful completion of the course		
CO1:	Student would understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.	L1: Remember L2: Understand L3: Apply
CO2:	Student would use plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Student would understand the concepts of bioavailability and bioequivalence of drug products and their significance.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Student would understand various pharmacokinetic parameters, their significance & applications.	L3: Apply L4: Analyse L5: Evaluate

How program outcomes are assessed:

Program outcomes		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ internals/ Viva
PO2:	Planning Abilities	1	Assignments/ internals
PO3:	Conduct Investigations Of Complex Problems	1	Assignments/ internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ internals
PO5:	Modern Tool Usage	2	Seminars/ academic activities
PO6:	Leadership Skills	1	Group discussion/ Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' Seminars/ Student-teacher interaction
PO10:	The Pharmacist And Society	2	Group discussion/ Role play
PO11:	Environment And Sustainability	2	Students' seminar

Level: 1 – slight (low), Level: 2- Moderate (medium), Level: 3- Substantial (high)

Course outcomes and program outcomes (CO-PO) mapping:

Course outcomes	Program outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	2	3	2	2	3	3	2
CO2	2	2	1	3	3	1	2	2	3	1	1
CO3	1	1	2	1	1	2	3	2	1	2	2
CO4	2	3	2	2	1	2	1	2	1	2	3
AVG	2	2	2	2	2	2	2	2	2	2	2

Course Content:

UNIT-I **10 Hours**

Introductionto Biopharmaceutics

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

UNIT- II **10 Hours**

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

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

UNIT- III **10 Hours**

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

UNIT- IV **08 Hours**

Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.

UNIT- V **07 Hours**

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)

Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
Biopharmaceutics and Pharmacokinetics; By Robert F Notari
Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA
Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
Biopharmaceutics; By Swarbrick

Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.
Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.

BPA 605 (17): BIOTECHNOLOGY

OBJECTIVES : Upon completion of the subject student shall be able to Understand

The importance of Immobilized enzymes in Pharmaceutical Industries
Genetic engineering applications in relation to production of pharmaceuticals
Importance of Monoclonal antibodies in Industries
Appreciate the use of microorganisms in fermentation technology

COURSE OUTCOMES

S NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. Enzyme Biotechnology- Methods of enzyme immobilization and applications. Biosensors- Working and applications of biosensors in Pharmaceutical Industries. Brief introduction to Protein Engineering. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering.	L1: Remember L2: Understand
CO2	To understand Study of cloning vectors, restriction endonucleases and DNA ligase. Recombinant DNA technology. Application of genetic engineering in medicine. Application of r DNA technology and genetic engineering in the production of: Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. Brief introduction to PCR	L1: Remember L2: Understand L5: Evaluate

CO3	To understand Types of immunity- humoral immunity, cellular immunity Structure of Immunoglobulins Structure and Function of MHC Hypersensitivity reactions, Immune stimulation and Immune suppressions. General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. Storage conditions and stability of official vaccines Hybridoma technology- Production, Purification and Applications Blood products and Plasma Substituties	L1: Remember L2: Understand L3: Apply L4: Analyse
CO4	To Distinguish Immuno blotting techniques- ELISA, Western blotting, Southern blotting. Genetic organization of Eukaryotes and Prokaryotes Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. Introduction to Microbial biotransformation and applications. Mutation: Types of mutation/mutants.	L1: Remember L2: Understand
CO5	To Discuss Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.	L1: Remember L2: Understand

BLOOMS TOXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyze; L5: Evaluate

How program out comes are assessed:

Program Outcome		**Level**	**Proficiency assessed by**
PO1	Pharmacy knowledge	3	Assignments/viva/Internals
PO2	Planning abilities	2	Assignments/Internals
PO3	Problem Analysis	2	Assignments/ Internals
PO4	Modern Tool Usage	2	Academic activity
PO5	Leadership Skills	2	Role play
PO6	Professional Identity	3	Group discussion
PO7	Pharmaceutical Ethics	2	Personality development seminars
PO8	Communication	3	Student Interaction
P09	The Pharmacist and society	3	Awareness program/Role

			play
PO10	Environment and Sustainability	2	Seminars
PO11	Life Long Learning	3	Assignments

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course outcomes and program outcomes (CO-PO) Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	3	3	1	3	3	2	3	2	2	3
CO2	3	2	3	3	2	1	1	2	3	2	1
CO3	1	3	1	2	1	1	2	2	1	2	2
CO4	3	2	2	2	2	3	3	3	3	2	3
CO5	1	3	1	3	3	2	2	2	3	3	1
Avg	**2**	**2.3**	**2.3**	**2.1**	**2.2**	**2**	**2**	**2.4**	**2.2**	**2.1**	**2**

Course Content

Unit I **10 Hours**

Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.

Enzyme Biotechnology- Methods of enzyme immobilization and applications.

Biosensors- Working and applications of biosensors in Pharmaceutical Industries.

Brief introduction to Protein Engineering.

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

Basic principles of genetic engineering.

Unit II **10 Hours**

Study of cloning vectors, restriction endonucleases and DNA ligase.

Recombinant DNA technology. Application of genetic engineering in medicine.

Application of r DNA technology and genetic engineering in the production of:

Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.

Brief introduction to PCR

Unit III **10 Hours**

Types of immunity- humoral immunity, cellular immunity

Structure of Immunoglobulins

Structure and Function of MHC

Hypersensitivity reactions, Immune stimulation and Immune suppressions.

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

Storage conditions and stability of official vaccines

Hybridoma technology- Production, Purification and Applications

Blood products and Plasma Substituties.

Unit IV **08Hours**

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

Genetic organization of Eukaryotes and Prokaryotes

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

Introduction to Microbial biotransformation and applications.

Mutation: Types of mutation/mutants.

Unit V **07 Hours**

Fementation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.

Large scale production fermenter design and its various controls.

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

Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.

Recommended Books (Latest edition):

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

BP606 (17). PHARMACEUTICAL QUALITY ASSURANCE

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

- understand the cGMP aspects in a pharmaceutical industry
- appreciate the importance of documentation
- understand the scope of quality certifications applicable to pharmaceutical industries understand the
- responsibilities of QA & QC departments

COURSE OUTCOMES

S.No	Course outcomes	Knowledge level (BLOOMS level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	To remember the concepts of quality assurance, quality management and ICH guidelines	L1: Remember; L2: Understand; L3: Apply
CO2	To explain the ISO, NABL and QbD concepts in pharmaceutical industry	L2: Understand; L3: Apply; L4: Analyse
CO3	To identify the organization and personnel responsibilities.	L2: Understand; L3: Apply; L5 Evaluate
CO4	To analyze quality control parameters and good laboratory practices in pharmaceutical industry.	L2: Understand; L3: Apply; L5 Evaluate
CO5	To evaluate the complaints and documents maintenance in industry with required regulatory guidelines.	L2: Understand; L3: Apply; L5 Evaluate
CO6	To elaborate the calibration, validation procedures and good warehousing practices.	L2: Understand; L5 Evaluate; L6: Create

BLOOMS TOXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5 Evaluate; L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1	Pharmacy knowledge	3	Assignments/viva/Internals
PO2	Planning abilities	2	Assignments/Internals
PO3	Conduct Investigations of complex problems	3	Practical's
PO4	Problem Analysis	2	Assignments/ Internals
PO5	Modern Tool Usage	2	Academic activity
PO6	Leadership Skills	2	Role play
PO7	Professional Identity	3	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Student Interaction
P010	The Pharmacist and society	3	Awareness program/Role play
PO11	Environment and Sustainability	2	Seminars
PO12	Life Long Learning	3	Assignments

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course Outcomes and Program Out comes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	3	2	3	2	3	2	3
CO2	2	3	3	3	2	2	2	3	3	2	2	3
CO3	3	2	3	2	2	2	3	2	2	3	3	2
CO4	3	3	2	3	3	3	3	2	3	3	3	2
CO5	2	3	3	2	3	2	2	3	2	2	2	2
Avg	2.5	2.6	2.6	2.6	2.4	2.4	2.4	2.6	2.4	2.6	2.4	2.4

Course content:

UNIT – I **10 Hours**

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

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

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

Quality by design (QbD): Definition, overview, elements of QbD program, tools

ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration

NABL accreditation : Principles and procedures

UNIT – II **10 Hours**

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

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

UNIT – III **10 Hours**

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 **08 Hours**

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

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

UNIT – V **07 Hours**

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

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

Quality Assurance Guide by organization of Pharmaceutical Products of India.
Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.

A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
How to Practice GMP's – P P Sharma.
ISO 9000 and Total Quality Management – Sadhank G Ghosh
The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and

Semester VII

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-VII

BP701(17). INSTRUMENTAL METHODS OF ANALYSIS

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

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

COURSE OUTCOMES:

S.NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	The basic theoretical principles and instrumentation and applications of UV, IR, fluorimeter, flame photometer.Theoretically understand the aspects of estimation of multi components.	L1:Remember L2:Understand L3:Apply
CO2:	The separation and identification of compounds by various chromatographic techniques. Principles, Instrumentation, separation and identification of compounds by TLC, column chromatography, paper chromatography and electrophoresis technique.	L3:Apply L4:Analyse L5:Evaluate
CO3:	Explain theory and instrumentation of GC, HPLC, gel chromatography, ion exchange chromatography and affinity chromatography	L3:Apply L4:Analyse L5:Evaluate
CO4:	Learn applications of various chromatographic techniques for organic, inorganic and natural products.	L3:Apply L4:Analyse L5:Evaluate
CO5:	Practical skills for the analysis of drugs and excipients using various instrumentation techniques.	L3:Apply L4:Analyse L5:Evaluate

How programme outcomes are assessed

S.NO	PROGRAMME OUTCOME	LEVEL
PO1:	**Pharmacy knowledge:** to obtain holistic knowledge in the field of Pharmaceutical sciences and the profession associated with Pharmacy like biomedical sciences, life sciences and chemical sciences.	2
PO2:	**Planning abilities:** Making the students learn proper planning abilities like time management, resource management, soft skills and organizational skills.	1
PO3:	**Problem analysis:** Increasing scientific temperament in the students, so that problem solving would become easy. Applying proper information systematically and solving the problems encountered by the students using scientific enquiry.	1
PO4:	**Modern tool usage:** Pharmacy profession is full of usage of modern tools for problem solving. Learn, select appropriate methods, procedures, resources, advanced computational tools and skills in diagnosing and treatment of diseases based on clinical approaches.	2
PO5:	**Leadership skills:** pharmacy profession is full of teamwork and team building. Learn and develop leadership skills for the effective functioning in industry, community and hospital pharmacy	1
PO6:	**Professional identity:** understand the importance of the profession. Accommodating themselves in various roles of healthcare professionals, educators, managers, employers and employees.	2
PO7:	**Pharmaceutical ethics:** pharmacy is a noble profession which deals with the lives of people. Inculcating the importance of professional ethics in education. .	2
PO8:	**Communication:** learning communication is very important in terms of analyzing reports presentations, documentation and giving instructions regarding medicines and their usage.	3
PO9:	**The pharmacist and society:** Along with professional ethics rationale in knowledge to assess health safety, legal issues, and other responsibilities related to professional pharmacy practice.	2
PO10:	**Environment and sustainability:** Understand the importance of professional pharmacy applications in community and environmental contacts and potentiating the implementation of sustainable development goals.	2

PO11:	**Life-long learning:** Understand the need to have the preparation and ability to handle the problems ever thrown by nature to the medical field. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on ongoing basis.	2

Course Outcomes and Program Out comes (CO-PO) Mapping:

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	3	2	3	3	2	3	2	2	2	3
CO3	3	2	3	2	2	2	2	3	3	3	3	2
CO4	3	2	3	3	3	2	3	2	3	2	3	2
CO5	3	3	3	2	3	2	2	3	2	2	2	2
Avg												

Course Content:

UNIT –I **10 Hours**

UV Visible spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors-Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

UNIT –II **10 Hours**

IR spectroscopy

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

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

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

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III **10 Hours**

Introduction to chromatography

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

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

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

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

UNIT –IV **08 Hours**

Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

UNIT –V **07 Hours**

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications

Gel chromatography- Introduction, theory, instrumentation and applications **Affinity**

chromatography- Introduction, theory, instrumentation and applications

705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical) **4 Hours/Week**

Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
Estimation of dextrose by colorimetry
Estimation of sulfanilamide by colorimetry
Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
Assay of paracetamol by UV- Spectrophotometry
Estimation of quinine sulfate by fluorimetry
Study of quenching of fluorescence

Determination of sodium by flame photometry
Determination of potassium by flame photometry
Determination of chlorides and sulphates by nephelo turbidometry
Separation of amino acids by paper chromatography
Separation of sugars by thin layer chromatography
Separation of plant pigments by column chromatography
Demonstration experiment on HPLC
Demonstration experiment on Gas Chromatography

Recommended Books (Latest Editions)

Instrumental Methods of Chemical Analysis by B.K Sharma

Organic spectroscopy by Y.R Sharma

Text book of Pharmaceutical Analysis by Kenneth A. Connors

Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel

Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake

Organic Chemistry by I. L. Finar

Organic spectroscopy by William Kemp

Quantitative Analysis of Drugs by D. C. Garrett

BP 702 T. INDUSRIAL PHARMACY- II

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

Know the process of pilot plant and scale up of pharmaceutical dosage forms

Understand the process of technology transfer from lab scale to commercial batch

Know different Laws and Acts that regulate pharmaceutical industry

Understand the approval process and regulatory requirements for drug products

COURSE OUTCOMES

S.NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After successful completion of the course, student would		
CO1:	know the process of pilot plant and scale up of pharmaceutical dosage forms	L1:Remember L2:Understand L3:Apply
CO2:	understand the process of technology transfer from lab scale to commercial batch	L3:Apply L4:Analyse L5:Evaluate
CO3:	Know different Laws and Acts that regulate pharmaceutical industry	L3:Apply L4:Analyse L5:Evaluate
CO4	understand the approval process and regulatory requirements for drug products.	L1:Remember L2:Understand L3:Apply

How program outcomes are assessed:

Program outcomes		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ internals/ Viva
PO2:	Planning Abilities	1	Assignments/ internals
PO3:	Conduct Investigations Of Complex Problems	1	Assignments/ internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ internals
PO5:	Modern Tool Usage	2	Seminars/ academic activities

PO6:	Leadership Skills	1	Group discussion/ Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' Seminars/ Student-teacher interaction
PO10:	The Pharmacist And Society	2	Group discussion/ Role play
PO11:	Environment And Sustainability	2	Students' seminar

Level: 1 – slight (low), Level: 2- Moderate (medium), Level: 3- Substantial (high)

Course outcomes and program outcomes (CO-PO) mapping:

Course outcomes	Program outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	1	1	3	2	2	3	2
CO2	2	2	1	3	3	2	1	1	3	2	3
CO3	2	2	2	1	3	2	1	3	2	1	1
CO4	1	2	2	2	1	3	3	2	1	2	2
AVG	2	2	2	2	2	2	2	2	2	2	2

Course Content:

UNIT-I **10 Hours**

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

UNIT-II **10 Hours**

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

SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues

UNIT-III **10 Hours**

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

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

UNIT-IV **08 Hours**

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

UNIT-V **07 Hours**

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

Recommended Books: (Latest Editions)

Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs.

International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php

Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.Regulatory Affairs brought by learning

BP 703(17): PHARMACY PRACTICE

OBJECTIVES:

Upon completion of the subject student shall be able to –

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

COURSE OUTCOMES:

S NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	To acquire the knowledge on organization of hospitals, various methods of distribution and hospital formulary in hospitals and apply it in the practice of pharmacy.	L1: Remember L2: Understand L4: Analyze
CO2	To outline the organization and structure of community pharmacy and to build ability to design and run own community pharmacy. To demonstrate the knowledge of therapeutic drug monitoring, patient medication history interview and to apply the knowledge on assessment of drug related problems	L1: Remember L2: Understand L4: Analyze
CO3	To categorize and evaluate the role of hospital pharmacist in pharmacy and therapeutic committee, drug information services, patient counseling, education and training programmes in hospitals	L1: Remember L2: Understand L4: Analyze L3: Apply
CO4	Understand the Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist Understand the Over the Counter drugs	L1: Remember L2: Understand L4: Analyze L3: Apply

CO5	To explain the principles of drug store management and inventory control methods during practice. To interpret clinical laboratory tests of specific disease states to provide better patient centered service	L1: Remember L2: Understand L4: Analyze L3: Apply

BLOOMS TAXONOMY: L1: Remember; L2: Understand; L3: Apply; L4: Analyze; L5 Evaluate; L6: Create

How program out comes are assessed:

Program Outcome		**Level**	**Proficiency assessed by**
PO1	Pharmacy knowledge	3	Assignments/viva/Internals
PO2	Planning abilities	2	Assignments/Internals
PO3	Problem Analysis	2	Assignments/ Internals
PO4	Modern Tool Usage	2	Academic activity
PO5	Leadership Skills	2	Role play
PO6	Professional Identity	3	Group discussion
PO7	Pharmaceutical Ethics	2	Personality development seminars
PO8	Communication	3	Student Interaction
P09	The Pharmacist and society	3	Awareness program/Role play
PO10	Environment and Sustainability	2	Seminars
PO11	Life Long Learning	3	Assignments

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

Course Outcomes and Program Out comes (CO-PO) Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**
CO3	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**3**
CO4	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**3**
Avg	**2.4**	**2.1**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.1**	**2.6**	**2.4**	**2.4**

Course content

Unit I: **10 Hours**

Hospital and it's organization

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

Hospital pharmacy and its organization

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

Adverse drug reaction

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II: **10 Hours**

Drug distribution system in a hospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.

Hospital formulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

Therapeutic drug monitoring

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

Medication adherence

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

Patient medication history interview

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

Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III: **10 Hours**

Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in

including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

Drug information services

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

Patient counseling

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

Education and training program in the hospital

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

Prescribed medication order and communication skills

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

Unit IV **8 Hours**

Budget

preparation and implementation

Budget preparation and implementation

Clinical Pharmacy

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.

Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

Over the counter (OTC) sales

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

Unit V **7 Hours**

Drug store management and inventory control

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

Investigational use of drug

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

Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

Recommended Books (Latest Edition):

Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4thed. Ahmadabad: B.S. Shah Prakakshan; 2001.

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

Journals:

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

BP704(17) – Novel Drug Delivery Systems

Objectives: Upon completion of the course student shall be able

To understand various approaches for development of novel drug delivery systems.

To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course outcomes:

- Drug delivery system give a detailed information transporting a pharmaceutical compound in the body as needed to safely achieve its desired therapeutic effect.
- Also it refers to approaches, formulations, technologies, and systems for transporting a pharmaceutical compound in the body as needed to safely achieve its desired therapeutic effect with suitable drug delivery.
- They know the different types of Drug carrier used in the process of drug delivery which serves to improve the selectivity, effectiveness, and/or safety of drug administration.
- The students will know the latest drug delivery knowledge and think to develop new formulation based on the rationale sustained/controlled drug delivery systems.
- Recent developments in targeted drug delivery, ocular drug delivery approaches will give new dimension of drug deliver for antibiotics, insulin, etc.

How program outcomes are assessed by:

Program Outcome		Level	Proficiency Assessed by
PO1	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2	Planning Abilities	1	Assignments/ Internals
PO3	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4	Problem Analysis	1	Assignments/ Internals
PO5	Modern Tool Usage	3	Seminars/academic activities
PO6	Leadership Skills	1	Group discussion / Role play
PO7	Professional Identity	3	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars

PO9	Communication	3	Students' seminars/ student - teacher interaction
PO10	The Pharmacist and Society	2	Group discussion / Role play
PO11	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	1	2	2	2	1	2	2
CO 2	2	2	2	2	1	2	1	1	2	2	1	2
CO 3	2	2	2	2	2	2	2	1	2	2	1	2
CO 4	2	2	1	2	2	2	2	1	1	2	2	2
CO 5	2	1	2	1	2	2	2	2	2	2	2	2
Avg	2	1.6	1.7	1.8	2	1.8	1.8	1.4	2	1.8	1.6	2

Course content

Unit-I **10 Hours**

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

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

Unit-II **10 Hours**

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

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

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

Unit-III **10 Hours**

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

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

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

Unit-IV **08 Hours**

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

Unit-V **07 Hours**

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

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

Recommended Books: (Latest Editions)

Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.

Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.

Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim

N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).

S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Journals

Indian Journal of Pharmaceutical Sciences (IPA)
Indian Drugs (IDMA)
Journal of Controlled Release (Elsevier Sciences)
Drug Development and Industrial Pharmacy (Marcel & Decker)
International Journal of Pharmaceutics (Elsevier Sciences)

BP705 (17) INSTRUMENTAL METHODS OF ANALYSIS

OBJECTIVES:

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

COURSE OUTCOMES:

S.NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	The basic theoretical principles and instrumentation and applications of UV, IR, fluorimeter, flame photometer.Theoretically understand the aspects of estimation of multi components.	L1:Remember L2:Understand L3:Apply
CO2:	The separation and identification of compounds by various chromatographic techniques. Principles, Instrumentation, separation and identification of compounds by TLC, column chromatography, paper chromatography and electrophoresis technique.	L3:Apply L4:Analyse L5:Evaluate
CO3:	Explain theory and instrumentation of GC, HPLC, gel chromatography, ion exchange chromatography and affinity chromatography	L3:Apply L4:Analyse L5:Evaluate
CO4:	Learn applications of various chromatographic techniques for organic, inorganic and natural products.	L3:Apply L4:Analyse L5:Evaluate
CO5:	Practical skills for the analysis of drugs and excipients using various instrumentation techniques.	L3:Apply L4:Analyse L5:Evaluate

Course Outcomes and Program Out comes (CO-PO) Mapping:

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	3	2	3	3	2	3	2	2	2	3
CO3	3	2	3	2	2	2	2	3	3	3	3	2
CO4	3	2	3	3	3	2	3	2	3	2	3	2
CO5	3	3	3	2	3	2	2	3	2	2	2	2
Avg												

COURSE CONTENT

UNIT –I 10 Hours

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

UNIT –II 10 Hours

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

UNIT –III 10 Hours

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

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.
Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications
Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications

UNIT –IV 08 Hours
Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications
High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

UNIT –V 07 Hours
Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications
Gel chromatography- Introduction, theory, instrumentation and applications
Affinity chromatography- Introduction, theory, instrumentation and applications

BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical) 4 Hours/Week

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

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

Semester VIII

UNIVERSITY COLLEGE OF PHARMACEUTICAL SCIENCES

B.PHARMACY

SEMESTER-VIII

BP 801(17) – Biostatistics & Research Methodology

Objectives:

1. Know the various statistical methods to solve different types of problems.

2. Operate various statistical software packages.

3. Appreciate the importance of Computer in hospital and Community Pharmacy.

4. Appreciate the statistical technique in solving the pharmaceutical problems

How program outcomes are assessed by:

Program Outcome		Level	Proficiency Assessed by
PO1	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2	Planning Abilities	1	Assignments/ Internals
PO3	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4	Problem Analysis	1	Assignments/ Internals
PO5	Modern Tool Usage	3	Seminars/academic activities
PO6	Leadership Skills	1	Group discussion / Role play
PO7	Professional Identity	3	Group discussion
PO8	Pharmaceutical Ethics	2	Personality development seminars
PO9	Communication	3	Students' seminars/ student - teacher interaction
PO10	The Pharmacist and Society	2	Group discussion / Role play
PO11	Environment And Sustainability	3	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	1	2	2	2	1	2	2
CO 2	2	2	2	2	1	2	1	1	2	2	1	2
CO 3	2	2	2	2	2	2	2	1	2	2	1	2
CO 4	2	2	1	2	2	2	2	1	1	2	2	2
CO 5	2	1	2	1	2	2	2	2	2	2	2	2
Avg	2	1.6	1.7	1.8	2	1.8	1.8	1.4	2	1.8	1.6	2

Course content:

Unit-I **10 Hours**

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples **Measures of dispersion**: Dispersion, Range, standard deviation, Pharmaceutical problems

Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples

Unit-II **10 Hours**

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples
Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems

Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

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

Unit-III **10 Hours**

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

Introduction to Research: Need for research, Need for design of Experiments, 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 **8 Hours**

Blocking and confounding system for Two-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels
Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB® , DESIGN OF EXPERIMENTS, R - Online Statistical Sofware's to Industrial and Clinical trial approach

Unit-V **7Hours**

Design and Analysis of experiments:

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

Recommended Books (Latest edition):

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

BP 802(17) SOCIAL AND PREVENTIVE PHARMACY

Objectives:

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

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

COURSE OUTCOMES:

S.NO	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.	L1:Remember L2:Understand L3:Apply
CO2:	Have a critical way of thinking based on current healthcare development.	L3:Apply L4:Analyse L5:Evaluate
CO3:	Evaluate alternative ways of solving problems related to health and pharmaceutical issues	L3:Apply L4:Analyse L5:Evaluate
CO4:	Design a better health care service system	L3:Apply L4:Analyse L5:Evaluate
CO5:	Students will engage in	L3:Apply L4:Analyse L5:Evaluate

LEVEL: 1 – Slight (low), 2- Moderate (medium), 3- Substantial (High) Hours: 45

Course Outcomes and Program Out comes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	2	3	3	2	3	3	2	3	2	2	2	3
CO3	3	2	3	2	2	2	2	3	3	3	3	2
CO4	3	2	3	3	3	2	3	2	3	2	3	2
CO5	3	3	3	2	3	2	2	3	2	2	2	2
Avg												

Course content:

Unit I: **10 Hours**

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

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

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

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

Unit II: **10 Hours**

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

Unit III: 10 Hours National health programs, its objectives, functioning and outcome of the following:

HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

Unit IV: **08 Hours**

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

Unit V: **07 Hours**

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Recommended Books (Latest edition)*:*

Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications

Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications

Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications

Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications

Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.

Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

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

BP 804 ET: PHARMACEUTICAL REGULATORY SCIENCE

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

Know about the process of drug discovery and development

Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals

Know the regulatory approval process and their registration in Indian and international markets

COURSE OUTCOMES:

S.No.	COURSE OUTCOMES	Knowledge level (BLOOMS Level)
After successful completion of the course, student would		
CO1:	know about the process of drug discovery and development	L1:Remember L2:Understand L3:Apply
CO2:	know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.	L3:Apply L4:Analyse L5:Evaluate
CO3:	know the regulatory approval process and their registration in Indian and international markets.	L3:Apply L4:Analyse L5:Evaluate

How program outcomes are assessed:

Program outcomes		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ internals/ Viva
PO2:	Planning Abilities	1	Assignments/ internals
PO3:	Conduct Investigations Of Complex Problems	1	Assignments/ internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ internals
PO5:	Modern Tool Usage	2	Seminars/ academic activities
PO6:	Leadership Skills	1	Group discussion/ Role play
PO7:	Professional Identity	2	Group discussion

PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' Seminars/ Student-teacher interaction
PO10:	The Pharmacist And Society	2	Group discussion/ Role play
PO11:	Environment And Sustainability	2	Students' seminar

Level: 1 – slight (low), Level: 2- Moderate (medium), Level: 3- Substantial (high)

Course outcomes and program outcomes (CO-PO) mapping:

Course outcomes	Program outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	3	1	2	2	2	2	3	2
CO2	1	2	1	3	1	1	3	1	2	2	1
CO3	2	2	2	3	1	3	1	3	2	1	3
AVG	2	2	2	3	1	2	2	2	2	2	2

Course content:

Unit I **10Hours**

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 **10Hours**

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 **10Hours**

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 **08Hours**

Clinical trials

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

Unit V **07Hours**

Regulatory Concepts

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

Recommended books (Latest edition):

Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.

The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.

New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.

Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.

FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.

Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143

Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams

Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene

Drugs: From Discovery to Approval, Second Edition By Rick Ng

* * * * *