NETAJI SUBHAS UNIVERSITY

Estd. Under Jharkhand State Private University Act, 2018

Department of Pharmacy

Bachelor of Pharmacy
(B.PHARM)
Course Curriculum
(with CO, PO Structure)

w.e.f. 2019

ESTD NSU JAMSHEDPUR 2018

SCHOOL OF PHARMACY

Netaji Subhas University

COURSE OUTCOME AND PROGRAM OUTCOME DETAILS

PROGRAMME:

BACHELOR OF PHARMACY

Dr. Saikat Ghosh
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NETAJI SUBHAS UNIVERSITY Jamshedpur

Dean Academics
Netaji Subhas University
Jamshedpur, Jharkhand

SCHOOL OF PHARMACY

Netaji Subhas University

COURSE OUTCOME AND PROGRAM OUTCOME DETAILS

PROGRAMME: BACHELOR OF PHARMACY

PROGRAM OUTCOMES

PO-1: Pharmacy Knowledge: Possess knowledge of the core pharmacy subjects such as Pharmaceutics, pharmacology, pharmaceutical chemistry and other allied subjects like pharmacy administration, cosmetics, marketing etc.

PO-2: Planning Abilities: Showcase effective planning abilities including time management, resource management, delegation skills and organizational skills develop and implement plans and organize work to meet deadlines.

PO-3: Problem analysis: Apply the scientific principles, analytical and critical thinking, while solving problems and making decisions during daily practice.

PO-4: Modern tool usage: Select, and apply appropriate procedures, resources, and modern pharmacy-related computing and analytical tools with an understanding of their working principles.

PO-5: Leadership skills: Inculcate leadership and team-building skills required for fulfillment of professional and societal responsibilities. Undertake participatory roles as responsible citizens or leadership roles to facilitate improvement in health and wellbeing.

PO-6: Professional Identity: Comprehend, evaluate and communicate their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).

PO-7: Pharmaceutical Ethics: Respect personal values and ethical principles in professional and social contexts. Apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

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PO-8: Communication: Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

PO-9: The Pharmacist and society: Apply reasoning informed by the appropriate knowledge to assess health, safety and legal issues and following the responsibilities relevant to the professional pharmacy practice.

PO-10: Environment and sustainability: Understand the impact of the professional pharmacy practices in environmental contexts, and showcase the knowledge of, and need for sustainable development.

PROGRAM SPECIFIC OUTCOME (PSO)

PSO-1: Understand the pharmacological and toxicological actions of synthetic and phyto-molecules in the diagnosis, prevention, and treatment of various diseases.

PSO-2: To emphasize the significance of quality control and assurance in drug design and formulation development.

PSO-3: Implementing expertise in medicinal chemistry, preparative pharmacy, analytical skills, and pharmaceutical engineering in coming up with novel dosage forms as well as drug delivery skills to cater the needs of industry.

PSO-4: Utilize the knowledge in drug laws for entrepreneurship development and marketing pertaining to drug distribution of all scheduled drugs and cosmetics.

SYLLABUS: BACHELOR OF PHARMACY

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

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

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

Unit I

- **Introduction to human body**

Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis and 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 signalling pathway activation by extracellular signal molecule, Forms of intra-cellular signalling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

- **Tissue level of organization**

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

Unit II

- **Integumentary system**

Structure and functions of skin

- **Skeletal system**

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

- **Joints**

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

Unit III

- **Body fluids and blood**

- Body fluids, composition and functions of blood, hemopoeisis, formation of haemoglobin, anaemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticuloendothelial system.

- **Lymphatic system**

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

Unit IV

Peripheral nervous system:

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

- **Special senses**

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

Unit V

- **Cardiovascular system**

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

COURSE OUTCOMES	
SUBJECTS	**OUTCOMES**
HUMAN ANATOMY AND PHYSIOLOGY-I	CO-1. Explain the gross morphology, structure and functions of various organs of the human body. CO-2. Describe the various homeostatic mechanisms and their imbalances. CO-3. Identify the various tissues and organs of different systems of human body. CO-4. Perform the various experiments related to special senses and nervous system. CO-5. Appreciate coordinated working pattern of different organs of each system

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Explain the gross morphology, structure and functions of various organs of the human body.	PO-1, PO-2, PO-3, PO-7, PO-9	K_3,K_2
CO-2	Describe the various homeostatic mechanisms and their imbalances.	PO-1, PO-5	K_3,K_2
CO-3	Identify the various tissues and organs of different systems of human body.	PO-1, PO-3	K_3,K_2
CO-4	Perform the various experiments related to special senses and nervous system	PO-1, PO-5, PO-10	K_5,K_4
CO-5	Appreciate coordinated working pattern of different organs of each system	PO-1, PO-5	K_3,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO –PO Mapping

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

CO –PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

Course Objectives:

Upon completion of the course student shall be able to develop analytical skills

- Carryout various volumetric and electrochemical titrations
- Understand the principles of volumetric and electro chemical analysis
- Develop analytical skills

UNIT-I

(a) Pharmaceutical analysis- Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

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

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

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

UNIT-II

- **Acid base titration**: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves
- **Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl.

UNIT-III

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

UNIT-IV

Redox titrations

(a) Concepts of oxidation and reduction

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

UNIT-V

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

SUBJECTS	OUTCOMES
PHARMACEUTICAL ANALYSIS	CO-1.understand the principles of volumetric and electro chemical analysis CO-2.carryout various volumetric and electrochemical titrations CO-3.develop analytical skills

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	understand the principles of volumetric and electro chemical analysis	PO-1, PO-5, PO-10	K_3,K_2
CO-2	carryout various volumetric and electrochemical titrations	PO-1, PO-5	K_3,K_2
CO-3	develop analytical skills	PO-1, PO-3	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO –PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√				√					
CO-3	√		√							

CO –PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	1	-	-	-	-	2
CO-2	3	-	-	-	2	-	-	-	-	-
CO-3	3	-	2	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP103T. PHARMACEUTICS- I (Theory)

Course Objectives: Upon completion of this course the student should be able to: □ Know the history of profession of pharmacy

□ Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations

□ Understand the professional way of handling the prescription

□ Preparation of various conventional dosage forms

UNIT – I

- **Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
- **Dosage forms:** Introduction to dosage forms, classification and definitions
- **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription.
- **Posology:** Definition, Factors affecting Posology. Pediatric dose calculations based on age, body weight and body surface area.

UNIT – II

- **Pharmaceutical calculations**: Weights and measures – Imperial & Metricsystem, Calculations involving percentage solutions, alligation, proof spirit andisotonic solutions based on freezing point and molecular weight.
- **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.

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

UNIT – III

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

• **Biphasic liquids:**

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

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

UNIT – IV

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

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

UNIV – V

• **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

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

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Know the history of profession of pharmacy	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations	PO-1, PO-5	K_3,K_2
CO-3	Understand the professional way of handling the prescription	PO-1, PO-3, PO-8	K_3,K_2
CO-4	Preparation of various conventional dosage forms	PO-1, PO-2, PO-5	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO –PO Mapping

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

CO –PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

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

□ know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals

□ understand the medicinal and pharmaceutical importance of inorganic compounds

UNIT I

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

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

UNIT II

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

UNIT III

- **Gastrointestinal agents**

Acidifiers: Ammonium chloride* and Dil. HCl

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

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

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

UNIT IV

- **Miscellaneous compounds**

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodiumnitrite333

Astringents: Zinc Sulphate, Potash Alum

UNIT V

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

SUBJECTS	OUTCOMES
PHARMACEUTICAL INORGANIC CHEMISTRY	CO-1. know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals CO-2. understand the medicinal and pharmaceutical importance of inorganic compounds

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	understand the medicinal and pharmaceutical importance of inorganic compounds	PO-1, PO-4, PO-5	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO –PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√		√		√					√
CO-2	√			√	√					

CO –PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	2	-	1	-	-	-	-	1
CO-2	3	-	-	2	1	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP105T.COMMUNICATION SKILLS (Theory)

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

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

- **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview
- **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V 04 Hours

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

SUBJECTS	OUTCOMES
COMMUNICATION SKILLS	CO-1. Understand the behavioural needs for a pharmacist to function effectively in the areas of pharmaceutical operation CO-2. Communicate effectively (Verbal and Non-Verbal) CO-3. Effectively manage the team as a team player CO-4. Develop interview skills CO-5. Develop Leadership qualities and essentials

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Communicate effectively (Verbal and Non-Verbal)	PO-1, PO-4	K_3,K_2
CO-3	Effectively manage the team as a team player	PO-1, PO-5	K_3,K_2
CO-4	Develop interview skills	PO-1, PO-3	K_5,K_4
CO-5	Develop Leadership qualities and essentials	PO-1, PO-3, PO-5, PO-10	K5,K4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO –PO Mapping

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

CO –PO Mapping

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 106RBT.REMEDIAL BIOLOGY (Theory)

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

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

UNIT I

Living world:

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

Body fluids and circulation

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

Digestion and Absorption

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

Breathing and respiration

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

UNIT III

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

Plants and mineral nutrition:

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

Photosynthesis

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

UNIT V

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

Plant growth and development

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

Cell - The unit of life

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

Tissues

- Definition, types of tissues, location and functions.

SUBJECTS	OUTCOMES
REMEDIAL BIOLOGY	CO-1. know the classification and salient features of five kingdoms of life CO-2. understand the basic components of anatomy & physiology of plant CO-3. know understand the basic components of anatomy & physiology animal with special reference to human

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	know the classification and salient features of five kingdoms of life	PO-1, PO-5	K_3,K_2
CO-2	understand the basic components of anatomy & physiology of plant	PO-1, PO-3	K_5,K_4
CO-3	know understand the basic components of anatomy & physiology animal with special reference to human	PO-1, PO-3, PO-5, PO-10	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO –PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					
CO-2	√		√							
CO-3	√		√		√					√

CO –PO Mapping matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	1	-	-	-	-	-
CO-2	3	-	3	-	-	-	-	-	-	-
CO-3	3	-	2	-	1	-	-	-	-	2

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 106RMT.REMEDIAL MATHEMATICS (Theory)

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

1. Know the theory and their application in Pharmacy

2. Solve the different types of problems by applying theory

3. Appreciate the important application of mathematics in Pharmacy

UNIT – I

- **Partial fraction**

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

- **Logarithms**

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

- **Function**:

Real Valued function, Classification of real valued functions,

- **Limits and continuity**:

Introduction, Limit of a function, Definition of limit of a function ($\in$ - δ

n n

definition) , lim

$x - a = na_{n-1}$, lim

$\sin\theta = 1$,

$x \to a$ $x - a$ $\theta \to 0$ θ

UNIT –II

- **Matrices and Determinant:**

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjointoradjugate 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

- **Calculus**

Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions(Quotient formula) – **Without Proof**, Derivative of x^n w.r.t x, where n is any rational number, Derivative of e^x, Derivative of $\log_e x$, Derivative of a^x, Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application

UNIT – IV

- **Analytical Geometry**

Introduction: Signs of the Coordinates, Distance formula,

Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line

Integration:

Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

UNIT-V 06 Hours

- **Differential Equations** : Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations**

- **Laplace Transform:** Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, **Application in solving Chemical Kinetics and Pharmacokinetics equations**

SUBJECTS	OUTCOMES
REMEDIAL MATHEMATICS	CO-1. Know the theory and their application in Pharmacy CO-2. Solve the different types of problems by applying theory CO-3. Appreciate the important application of mathematics in Pharmacy

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Know the theory and their application in Pharmacy	PO-1, PO-4	K_3,K_2
CO-2	Solve the different types of problems by applying theory	PO-1, PO-5	K_3,K_2
CO-3	Appreciate the important application of mathematics in Pharmacy	PO-1, PO-3	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√			√						
CO-2	√				√					
CO-3	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	1	-	-	-	-	-	-
CO-2	3	-	-	-	2	-	-	-	-	-
CO-3	3	-	1	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

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

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.

5. Appreciate coordinated working pattern of different organs of each system

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

Unit I

- **Nervous system**

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brainstem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

Unit II

- **Digestive system**

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

movements of GIT, digestion and absorption of nutrients and disorders of GIT.

- **Energetics**

Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III

- **Respiratory system 10 hours**

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

- **Urinary system**

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

Unit IV

- **Endocrine system**

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

Unit V

- **Reproductive system**

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

- **Introduction to genetics**

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

SUBJECTS	OUTCOMES
HUMAN ANATOMY AND PHYSIOLOGY-II	CO-1. Explain the gross morphology, structure and functions of various organs of the human body. CO-2. Describe the various homeostatic mechanisms and their imbalances. CO-3. Identify the various tissues and organs of different systems of human body. CO-4. Perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume. CO-5. Appreciate coordinated working pattern of different organs of each system CO-6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Explain the gross morphology, structure and functions of various organs of the human body.	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Describe the various homeostatic mechanisms and their imbalances.	PO-1, PO-4	K_3,K_2
CO-3	Identify the various tissues and organs of different systems of human body.	PO-1, PO-5	K_3,K_2
CO-4	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.	PO-1, PO-3	K_5,K_4
CO-5	Appreciate coordinated working pattern of different organs of each system	PO-1, PO-3, PO-5, PO-10	K5,K4
CO-6	Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.	PO-1, PO-3	K5,K4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√		√		√					√
CO-2	√			√						
CO-3	√				√					
CO-4	√		√							
CO-5	√		√		√					√
CO-6	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	1	-	2	-	-	-	-	2
CO-2	3	-	-	3	-	-	-	-	-	-
CO-3	3	-	-	-	1	-	-	-	-	-
CO-4	3	-	2	-	-	-	-	-	-	-
CO-5	3	-	1	-	2	-	-	-	-	1
CO-6	3	-	1	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

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

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

UNIT-I

- **Classification, nomenclature and isomerism**

Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds

(up to 10 Carbons open chain and carbocyclic compounds)Structural isomerisms in organic compounds

UNIT-II10 Hours

- **Alkanes*, Alkenes* and Conjugated dienes***

SP_3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP_2 hybridization in alkenes 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

- **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

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

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

UNIT-V

- **Carboxylic acids***

Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative

tests for carboxylic acids ,amide and ester

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

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

SUBJECTS	OUTCOMES
PHARMACEUTICAL ORGANIC CHEMISTRY –I	CO-1. write the structure, name and the type of isomerism of the organic compound CO-2. write the reaction, name the reaction and orientation of reactions CO-3. account for reactivity/stability of compounds, CO-4. identify/confirm the identification of organic compound

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	write the structure, name and the type of isomerism of the organic compound	PO-1, PO-4	K_3,K_2
CO-2	write the reaction, name the reaction and orientation of reactions	PO-1, PO-5	K_5,K_4
CO-3	account for reactivity/stability of compounds,	PO-1, PO-3	K_3,K_2
CO-4	identify/confirm the identification of organic compound	PO-1, PO-3, PO-5, PO-10	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	2	-	-	-	-	-	-

CO-2	3	-	-	-	1	-	-	-	-	-
CO-3	3	-	1	-	-	-	-	-	-	-
CO-4	3	-	2	-	1	-	-	-	-	1

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP203 T. BIOCHEMISTRY (Theory)

Course Objectives: Upon completion of course student shell able to

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

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

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

UNIT I

- **Biomolecules**

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

- **Bioenergetics**

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

UNIT II

- **Carbohydrate metabolism**

Glycolysis – Pathway, energetics and significance
Citric acid cycle- Pathway, energetics and significance
HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency

Glycogen metabolism Pathways and glycogen storage diseases (GSD)

Gluconeogenesis- Pathway and its significance

Hormonal regulation of blood glucose level and Diabetes mellitus

- **Biological oxidation**

Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate phosphorylation

Inhibitors ETC and oxidative phosphorylation/Uncouplers level

UNIT III

- **Lipid metabolism**

β-Oxidation of saturated fatty acid (Palmitic acid) 61

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

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

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

- **Amino acid metabolism**

General reactions of amino acid metabolism: Transamination,

deamination & decarboxylation, urea cycle and its disorders

Catabolism of phenylalanine and tyrosine and their metabolic disorders

(Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)

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

dopamine, noradrenaline, adrenaline

Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV

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

Biosynthesis of purine and pyrimidine nucleotides

Catabolism of purine nucleotides and Hyperuricemia and Gout disease

Organization of mammalian genome

Structure of DNA and RNA and their functions

DNA replication (semi conservative model)

Transcription or RNA synthesis

Genetic code, Translation or Protein synthesis and inhibitors

UNIT V 07

- **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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.	PO-1, PO-4	K_3,K_2
CO-2	Understand the metabolism of nutrient molecules in physiological and pathological conditions.	PO-1, PO-5	K_3,K_2
CO-3	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins	PO-1, PO-3, PO-7	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√			√						
CO-2	√				√					
CO-3	√		√				√			

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	1	-	-	-	-	-	-
CO-2	3	-	-	-	1	-	-	-	-	-
CO-3	3	-	2	-	-	-	1	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 204T.PATHOPHYSIOLOGY (THEORY)

Unit I

- **Basic principles of Cell injury and Adaptation:**

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

- **Basic mechanism involved in the process of inflammation and repair:**

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

Unit II

- **Cardiovascular System:**

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

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

Unit III

- **Haematological Diseases:**

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

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

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

• **Gastrointestinal system:** Peptic Ulcer

Unit IV

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

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

• **Principles of cancer:** classification, etiology and pathogenesis of cancer

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

• **Principles of Cancer:** Classification, etiology and pathogenesis of Cancer

Unit V 7 Hours

• **Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis

Urinary tract infections

• **Sexually transmitted diseases:** AIDS, Syphilis, and Gonorrhoea

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

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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Describe the etiology and pathogenesis of the selected disease states	PO-1, PO-4	K_3,K_2
CO-2	Name the signs and symptoms of the diseases; and	PO-1, PO-5	K_3,K_2
CO-3	Mention the complications of the diseases.	PO-1, PO-3, PO-7	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√			√						
CO-2	√				√					
CO-3	√		√				√			

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	2	-	-	-	-	-	-
CO-2	3	-	-	-	1	-	-	-	-	-
CO-3	3	-	1	-	-	-	1	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

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

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

UNIT – I

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

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

UNIT –II

Web technologies: Introduction to HTML, XML, CSS and

Programming languages, introduction to web servers and Server Products

Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

UNIT – II

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

UNIT – IV

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

UNIT-V

Computers as data analysis in Preclinical development:

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

SUBJECTS	OUTCOMES
COMPUTER APPLICATIONS IN PHARMACY	CO-1. know the various types of application of computers in pharmacy CO-2. know the various types of databases CO-3. know the various applications of databases in pharmacy

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	know the various types of application of computers in pharmacy	PO-1, PO-4	K_3,K_2
CO-2	know the various types of databases	PO-1, PO-5	K_3,K_2
CO-3	know the various applications of databases in pharmacy	PO-1, PO-3, PO-7	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√			√						
CO-2	√				√					
CO-3	√		√				√			

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	1	-	-	-	-	-	-
CO-2	3	-	-	-	1	-	-	-	-	-
CO-3	3	-	2	-	-	-	2	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

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

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

Unit-I

The Multidisciplinary nature of environmental studies

Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

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

Unit-II

Ecosystems

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

Unit- III

Environmental Pollution: Air pollution; Water pollution; Soil pollution

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Create the awareness about environmental problems among learners.	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Impart basic knowledge about the environment and its allied problems.	PO-1, PO-4	K_3,K_2
CO-3	Develop an attitude of concern for the environment.	PO-1, PO-5	K_3,K_2
CO-4	Motivate learner to participate in environment protection and environment improvement.	PO-1, PO-3	K_5,K_4
CO-5	Acquire skills to help the concerned individuals in identifying and solving environmental problems.	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-6	Strive to attain harmony with Nature.	PO-1, PO-3	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO-5	√		√		√					√
CO-6	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	1	-	2	-	-	-	-	3
CO-2	3	-	-	1	-	-	-	-	-	-
CO-3	3	-	-	-	1	-	-	-	-	-
CO-4	3	-	1	-	-	-	-	-	-	-
CO-5	3	-	1	-	2	-	-	-	-	3
CO-6	3	-	2	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

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

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

UNIT I

- **Benzene and its derivatives**

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

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

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

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

UNIT II

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols
- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts
- **Aromatic Acids*** –Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III

- **Fats and Oils**

a. Fatty acids – reactions.

b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT IV

- **Polynuclear hydrocarbons:**

a. Synthesis, reactions

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

UNIT V

- **Cyclo alkanes***

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

SUBJECTS	OUTCOMES
PHARMACEUTICAL ORGANIC CHEMISTRY –II	CO-1. write the structure, name and the type of isomerism of the organic compound CO-2. write the reaction, name the reaction and orientation of reactions CO-3. account for reactivity/stability of compounds, CO-4. prepare organic compounds

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	write the structure, name and the type of isomerism of the organic	PO-1, PO-4	K_3,K_2

	compound		
CO-2	write the reaction, name the reaction and orientation of reactions	PO-1, PO-5	K_3,K_2
CO-3	account for reactivity/stability of compounds,	PO-1, PO-3	K_3,K_2
CO-4	prepare organic compounds	PO-1, PO-3, PO-5, PO-10	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms

2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations

3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

UNIT-I

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

UNIT-II

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

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

SUBJECTS	OUTCOMES
PHYSICAL PHARMACEUTICS-I	CO-1. Understand various physicochemical properties of drug molecules in the designing the dosage forms CO-2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations

	CO-3. Demonstrate use of physicochemical properties in the formulation CO-4. Development and evaluation of dosage forms.

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand various physicochemical properties of drug molecules in the designing the dosage forms	PO-1, PO-4	K_3,K_2
CO-2	Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations	PO-1, PO-5	K_3,K_2
CO-3	Demonstrate use of physicochemical properties in the formulation	PO-1, PO-3	K_5,K_4
CO-4	Development and evaluation of dosage forms.	PO-1, PO-3, PO-5, PO-10	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

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

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

Unit I

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

Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.

Unit II

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

Unit III

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

Unit IV

Designing of aseptic area, laminar flow 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

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.

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand methods of identification, cultivation and preservation of various microorganisms	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	To understand the importance and implementation of sterilization in pharmaceutical processing and industry	PO-1, PO-4	K_5,K_4
CO-3	Learn sterility testing of pharmaceutical products.	PO-1, PO-5	K_3,K_2
CO-4	Carried out microbiological standardization of Pharmaceuticals.	PO-1, PO-3	K_5,K_4
CO-5	Understand the cell culture technology and its applications in pharmaceutical industries.	PO-1, PO-3, PO-5, PO-10	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√		√		√					√
CO-2	√			√						

CO-3	√				√					
CO-4	√		√							
CO-5	√		√		√					√

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

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

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

UNIT-I

- **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.
- **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.
- **Size Separation:** Objectives, applications & mechanism of size separation,

official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT-II

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

UNIT- III

- **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.
- **Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetarymixers, Propellers, Turbines, Paddles & Silverson Emulsifier,

UNIT-IV

- **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.
- **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V

- **Materials of pharmaceutical plant construction, Corrosion and its prevention:** Factors affecting during materials selected for Pharmaceutical plant

construction, Theories of corrosion, types of corrosion and there prevention.

Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	To know various unit operations used in pharmaceutical industries.	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	To understand the material handling techniques.	PO-1, PO-4	K_5,K_4
CO-3	To perform various processes involved in pharmaceutical manufacturing process.	PO-1, PO-5	K_3,K_2
CO-4	To carry out various test to prevent environmental pollution.	PO-1, PO-3	K_5,K_4
CO-5	To appreciate and comprehend significance of plant lay out design for optimum use of resources.	PO-1, PO-3, PO-5, PO-10	K3,K2
CO-6	To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.	PO-1, PO-3	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO-6	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	1	-	1	-	-	-	-	3
CO-2	3	-	-	3	-	-	-	-	-	-
CO-3	3	-	-	-	1	-	-	-	-	-
CO-4	3	-	2	-	-	-	-	-	-	-
CO-5	3	-	1	-	1	-	-	-	-	3
CO-6	3	-	1	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

Course Objectives: At the end of the course, the student shall be able to

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

UNIT-I

Stereo isomerism

Optical isomerism –

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

UNIT-II

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and

Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions

UNIT-III

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

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

UNIT-IV 8

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

UNIT-V

Reactions of synthetic importance

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

SUBJECTS	OUTCOMES
PHARMACEUTICAL ORGANIC CHEMISTRY –III	CO-1. understand the methods of preparation and properties of organic compounds CO-2. explain the stereo chemical aspects of organic compounds and stereo chemical reactions CO-3. know the medicinal uses and other applications of organic compounds

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	understand the methods of preparation and properties of organic compounds	PO-1, PO-4	K_3,K_2
CO-2	explain the stereo chemical aspects of organic compounds and stereo chemical reactions	PO-1, PO-5	K_3,K_2
CO-3	know the medicinal uses and other applications of organic compounds	PO-1, PO-3	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√			√						
CO-2	√				√					
CO-3	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	1	-	-	-	-	-	-
CO-2	3	-	-	-	3	-	-	-	-	-
CO-3	3	-	1	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP402T. MEDICINAL CHEMISTRY – I (Theory)

Course 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

UNIT- I

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

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

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

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

- Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.
- Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

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

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

UNIT-III

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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

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

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide,

Ipratropium bromide*.

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

UNIT- IV

Drugs acting on Central Nervous System

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 anticonvulsant action

Barbiturates: Phenobarbitone, Methabarbital. **Hydantoins:**

Phenytoin*, Mephenytoin, Ethotoin**Oxazolidine diones:**

Trimethadione, Paramethadione **Succinimides:**

Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V

Drugs acting on Central Nervous System

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, Levallorphantartarate, Naloxone hydrochloride.

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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	understand the chemistry of drugs with respect to their	PO-1, PO-3,	K_3,K_2

	pharmacological activity	PO-5, PO-10	
CO-2	understand the drug metabolic pathways, adverse effect and therapeutic value of drugs	PO-1, PO-4	K_5,K_4
CO-3	know the Structural Activity Relationship (SAR) of different class of drugs	PO-1, PO-5	K_3,K_4
CO-4	write the chemical synthesis of some drugs	PO-1, PO-3	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms

2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations

3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

UNIT-I

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

UNIT-II

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

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

UNIT-III

Coarse dispersion: Suspension, interfacial properties of suspended particles, 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

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

UNIT-V

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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand various physicochemical properties of drug molecules in the designing the dosage forms	PO-1, PO-4	K_3,K_2
CO-2	Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations	PO-1, PO-5	K_3,K_2
CO-3	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.	PO-1, PO-3	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√			√						
CO-2	√				√					
CO-3	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	1	-	-	-	-	-	-
CO-2	3	-	-	-	2	-	-	-	-	-
CO-3	3	-	2	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 404 T. PHARMACOLOGY-I (Theory)

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

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

UNIT-I

1. General Pharmacology

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

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

UNIT-II

General Pharmacology

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

b. Adverse drug reactions.

c. Drug interactions (pharmacokinetic and pharmacodynamic)

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

UNIT-III

2. Pharmacology of drugs acting on peripheral nervous system

a. Organization and function of ANS.

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

c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

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

e. Local anesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV

3. Pharmacology of drugs acting on central nervous system

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

b. General anesthetics and pre-anesthetics.

c. Sedatives, hypnotics and centrally acting muscle relaxants.

d. Anti-epileptics

e. Alcohols and disulfiram

UNIT-V

3. Pharmacology of drugs acting on central nervous system

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

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

c. CNS stimulants and nootropics.

d. Opioid analgesics and antagonists

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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the pharmacological actions of different categories of drugs	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels.	PO-1, PO-4	K_5,K_4
CO-3	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.	PO-1, PO-5	K_3,K_4
CO-4	Observe the effect of drugs on animals by simulated experiments	PO-1, PO-3	K3,K2
CO-5	Appreciate correlation of pharmacology with other bio medical sciences	PO-1, PO-3, PO-5, PO-10	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 405 T. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

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

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

UNIT-I

Introduction to Pharmacognosy:

(a) Definition, history, scope and development of Pharmacognosy

(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture

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

Classification of drugs:

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

Quality control of Drugs of Natural Origin:

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

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

UNIT-II

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

Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT-III

Plant tissue culture:

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

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

UNIT IV

Pharmacognosy in various systems of medicine:

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

Introduction to secondary metabolites:

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

UNIT V

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

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

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

Carbohydrates: Acacia, Agar, Tragacanth, Honey

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

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

Marine Drugs:

Novel medicinal agents from marine sources

SUBJECTS	OUTCOMES
PHARMACOGNOSY AND PHYTOCHEMISTRY I	CO-1. to know the techniques in the cultivation and production of crude drugs CO-2. to know the crude drugs, their uses and chemical nature CO-3. know the evaluation techniques for the herbal drugs CO-4. to carry out the microscopic and morphological evaluation of crude drugs

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	to know the techniques in the cultivation and production of crude drugs	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	to know the crude drugs, their uses and chemical nature	PO-1, PO-4	K_3,K_2

CO-3	know the evaluation techniques for the herbal drugs	PO-1, PO-5	K_5,K_4
CO-4	to carry out the microscopic and morphological evaluation of crude drugs	PO-1, PO-3	K_3,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP501T. MEDICINAL CHEMISTRY – II (Theory)

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

1. Understand the chemistry of drugs with respect to their pharmacological activity

2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs

3. Know the Structural Activity Relationship of different class of drugs

4. Study the chemical synthesis of selected drugs

UNIT- I

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

H_1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidaminetartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H_2-antagonists: Cimetidine*, Famotidine, Ranitidin.

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

Anti-neoplastic agents:

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

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

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II

Anti-anginal:

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

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopatehydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide,Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III

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

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

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

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

UNIT- IV

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

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

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

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

UNIT – V

Antidiabetic agents:

Insulin and its preparations

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

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.

Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the chemistry of drugs with respect to their pharmacological activity	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs	PO-1, PO-4	K_3,K_2
CO-3	Know the Structural Activity Relationship of different class of drugs	PO-1, PO-5	K_3,K_2
CO-4	Study the chemical synthesis of selected drugs	PO-1, PO-3	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√		√		√					√
CO-2	√			√						
CO-3	√				√					

CO-4	√		√							

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 502 T. Industrial PharmacyI (Theory)

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

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

UNIT-I

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

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

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

BCS classification of drugs & its significant

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

UNIT-II

Tablets:

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

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

c. Quality control tests: In process and finished product tests

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

UNIT-III

Capsules:

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

b. ***Soft gelatin capsules:*** Nature of shell and capsule content, size 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

Parenteral Products:

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

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

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

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

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

UNIT-V

Cosmetics: Formulation and preparation of the following cosmetic preparations:

lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

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

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

SUBJECTS	OUTCOMES
INDUSTRIAL PHARMACY I	CO-1. Know the various pharmaceutical dosage forms and their manufacturing techniques. CO-2. Know various considerations in development of pharmaceutical dosage forms CO-3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Know the various pharmaceutical dosage forms and their manufacturing techniques.	PO-1, PO-4	K_3,K_2
CO-2	Know various considerations in development of pharmaceutical dosage forms	PO-1, PO-5	K_3,K_2
CO-3	Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality	PO-1, PO-3	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√			√						
CO-2	√				√					
CO-3	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

CO-1	3	-	-	√	-	-	-	-	-	-
CO-2	3	-	-	-	√	-	-	-	-	-
CO-3	3	-	√	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP503.T. PHARMACOLOGY-II (Theory)

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

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

UNIT-I

1. Pharmacology of drugs acting on cardio vascular system

a. Introduction to hemodynamic and electrophysiology of heart.

b. Drugs used in congestive heart failure

c. Anti-hypertensive drugs.

d. Anti-anginal drugs.

e. Anti-arrhythmic drugs.

f. Anti-hyperlipidemic drugs.

UNIT-II

1. Pharmacology of drugs acting on cardio vascular system

a. Drug used in the therapy of shock.

b. Hematinics, coagulants and anticoagulants.

c. Fibrinolytics and anti-platelet drugs

d. Plasma volume expanders

2. Pharmacology of drugs acting on urinary system

a. Diuretics

b. Anti-diuretics.

UNIT-III

3. Autocoids and related drugs

a. Introduction to autacoids and classification

b. Histamine, 5-HT and their antagonists.

c. Prostaglandins, Thromboxanes and Leukotrienes.

d. Angiotensin, Bradykinin and Substance P.

e. Non-steroidal anti-inflammatory agents

f. Anti-gout drugs

g. Antirheumatic drugs

UNIT-IV

5. Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.

b. Anterior Pituitary hormones- analogues and their inhibitors.

c. Thyroid hormones- analogues and their inhibitors.

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

d. Insulin, Oral Hypoglycemic agents and glucagon.

e. ACTH and corticosteroids.

UNIT-V

5. Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.

b. Estrogens, progesterone and oral contraceptives.

c. Drugs acting on the uterus.

6. Bioassay

a. Principles and applications of bioassay.

b.Types of bioassay

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

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

	sciences

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the mechanism of drug action and its relevance in the treatment of different diseases	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments	PO-1, PO-4	K_3,K_2
CO-3	Demonstrate the various receptor actions using isolated tissue preparation	PO-1, PO-5	K_3,K_2
CO-4	Appreciate correlation of pharmacology with related medical sciences	PO-1, PO-3	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

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

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

UNIT-I

Metabolic pathways in higher plants and their determination

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

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

UNIT-II

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

secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

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

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

Tannins: Catechu, Pterocarpus

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

Glycosides: Senna, Aloes, Bitter Almond

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

UNIT-III

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin

b) Glycosides: Glycyrhetinic acid & Rutin

c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine

d) Resins: Podophyllotoxin, Curcumin

UNIT-IV

Industrial production, estimation and utilization of the following phytoconstituents:

Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT V

Basics of Phytochemistry

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

SUBJECTS	OUTCOMES
PHARMACOGNOSY AND PHYTOCHEMISTRY II	CO-1. To know the modern extraction techniques, characterization and identification of the herbal drugs and phyto-constituents CO-2. To understand the preparation and development of herbal formulation. CO-3. to understand the herbal drug interactions CO-4. to carryout isolation and identification of phyto-constituents

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	To know the modern extraction techniques, characterization and identification of the herbal drugs and phyto-constituents	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	To understand the preparation and development of herbal formulation.	PO-1, PO-4	K_5,K_4
CO-3	to understand the herbal drug interactions	PO-1, PO-5	K_3,K_2
CO-4	to carryout isolation and identification of phyto-constituents	PO-1, PO-3	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	3	-	1	-	-	-	-	3

CO-2	3	-	-	1	-	-	-	-	-	-
CO-3	3	-	-	-	2	-	-	-	-	-
CO-4	3	-	1	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

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

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

UNIT-I

Drugs and Cosmetics Act, 1940 and its rules 1945:

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

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

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

UNIT-II

Drugs and Cosmetics Act, 1940 and its rules 1945.

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

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

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

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

UNIT-III

- **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties
- **Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.
- **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV

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

- **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)**

SUBJECTS	OUTCOMES
PHARMACEUTICAL JURISPRUDENCE	CO-1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals. CO-2. Various Indian pharmaceutical Acts and Laws CO-3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals CO-4. The code of ethics during the pharmaceutical practice

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.	PO-1, PO-3, PO-5, PO-10	K_5,K_4
CO-2	Various Indian pharmaceutical Acts and Laws	PO-1, PO-4	K_3,K_4
CO-3	The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	PO-1, PO-5	K_3,K_2
CO-4	The code of ethics during the pharmaceutical practice	PO-1, PO-3, PO-8	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP601T. MEDICINAL CHEMISTRY – III (Theory)

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

1. Understand the importance of drug design and different techniques of drug design.

2. Understand the chemistry of drugs with respect to their biological activity. 3. Know the metabolism, adverse effects and therapeutic value of drugs.

4. Know the importance of SAR of drugs.

UNIT – I

Antibiotics

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

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II

Antibiotics

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

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

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

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III

Anti-tubercular Agents

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

Anti tubercular antibiotics: Rifampicin, Rifabutin, 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

Antifungal agents:

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

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

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

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

Sulphonamides and Sulfones

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

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V

Introduction to Drug Design

Various approaches used in drug design.

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

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications

chemistry: solid phase and solution phase synthesis.

of combinatorial

SUBJECTS	OUTCOMES
MEDICINAL CHEMISTRY – III	CO-1. Understand the importance of drug design and different techniques of drug design. CO-2. Understand the chemistry of drugs with respect to their biological activity. CO-3. Know the metabolism, adverse effects and therapeutic value of drugs. CO-4. Know the importance of SAR of drugs.

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the importance of drug design and different techniques of drug design.	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Understand the chemistry of drugs with respect to their biological activity.	PO-1, PO-4	K_3,K_2
CO-3	Know the metabolism, adverse effects and therapeutic value of drugs.	PO-1, PO-5	K_5,K_4
CO-4	Know the importance of SAR of drugs.	PO-1, PO-3, PO-8	K_3,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√		√		√					√
CO-2	√			√						
CO-3	√				√					

CO-4	√		√					√		

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP602 T. PHARMACOLOGY-III (Theory)

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

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

UNIT-I

1. Pharmacology of drugs acting on Respiratory system

a. Anti -asthmatic drugs

b. Drugs used in the management of COPD

c. Expectorants and antitussives

d. Nasal decongestants

e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.

b. Drugs for constipation and diarrhoea.

c. Appetite stimulants and suppressants.

d. Digestants and carminatives.

e. Emetics and anti-emetics.

UNIT-II

3. Chemotherapy

a. General principles of chemotherapy.

b. Sulfonamides and cotrimoxazole.

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

UNIT-III

3. Chemotherapy

a. Antitubercular agents

b. Antileprotic agents

c. Antifungal agents

d. Antiviral drugs

e.Anthelmintics

f. Antimalarial drugs

g. Antiamoebic agents

UNIT-IV

3. Chemotherapy

l. Urinary tract infections and sexually transmitted diseases.

m. Chemotherapy of malignancy.

4. Immunopharmacology

a. Immunostimulants

b. Immunosuppressant

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

UNIT-V

5. Principles of toxicology

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

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

c. General principles of treatment of poisoning

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

6. Chronopharmacology

a. Definition of rhythm and cycles.

b. Biological clock and their significance leading to chronotherapy.

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	understand the mechanism of drug action and its relevance in the treatment of different infectious diseases	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	comprehend the principles of toxicology and treatment of various poisonings and	PO-1, PO-4	K_5,K_4
CO-3	Appreciate correlation of pharmacology with related medical sciences.	PO-1, PO-5	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√		√		√					√
CO-2	√			√						
CO-3	√				√					

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	1	-	1	-	-	-	-	2
CO-2	3	-	-	1	-	-	-	-	-	-
CO-3	3	-	-	-	2	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 603 T. HERBAL DRUG TECHNOLOGY (Theory)

Course 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 .

UNIT-I

Herbs as raw materials

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

Source of Herbs

Selection, identification and authentication of herbal materials

Processing of herbal raw material

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.

Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

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

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

UNIT-II

Nutraceuticals

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

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

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

UNIT-III

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, 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

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

Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

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

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

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

UNIT-V

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

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

Schedule T – GoodManufacturing Practice of Indian systems of medicine

Components of GMP (Schedule – T) and its objectives

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

SUBJECTS	OUTCOMES
HERBAL DRUG TECHNOLOGY	CO-1. understand raw material as source of herbal drugs from cultivation to herbal drug product CO-2. know the WHO and ICH guidelines for evaluation of herbal drugs CO-3. know the herbal cosmetics, natural sweeteners, Nutraceuticals CO-4. Appreciate patenting of herbal drugs, GMP.

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	understand raw material as source of herbal drugs from	PO-1, PO-3,	K_3,K_2

	cultivation to herbal drug product	PO-5, PO-10	
CO-2	know the WHO and ICH guidelines for evaluation of herbal drugs	PO-1, PO-4	K_5,K_4
CO-3	know the herbal cosmetics, natural sweeteners, Nutraceuticals	PO-1, PO-5	K_3,K_4
CO-4	Appreciate patenting of herbal drugs, GMP.	PO-1, PO-3, PO-8	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

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

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.

2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.

3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.

4. Understand various pharmacokinetic parameters, their significance & applications.

UNIT-I

Introduction Biopharmaceuticsto 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

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

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

UNIT- III

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

UNIT- IV

Multicompartment models: Two compartment open model. IV bolus

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

UNIT- V

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

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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the basic concepts in bio pharmaceutics and pharmacokinetics and their significance.	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.	PO-1, PO-4	K_3,K_2
CO-3	To understand the concepts of bioavailability and bioequivalence of drug products and their significance.	PO-1, PO-5	K_5,K_4
CO-4	Understand various pharmacokinetic parameters, their significance & applications.	PO-1, PO-3, PO-8	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)

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

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

Unit I

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

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

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

d) Brief introduction to Protein Engineering.

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

f) Basic principles of genetic engineering.

Unit II

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

b) Recombinant DNA technology. Application of genetic engineering in medicine.

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

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

d) Brief introduction to PCR

Unit III

Types of immunity- humoral immunity, cellular immunity

a) Structure of Immunoglobulins

b) Structure and Function of MHC

c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.

d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine,

antitoxins, serum-immune blood derivatives and other products relative to immunity.

e) Storage conditions and stability of official vaccines

f) Hybridoma technology- Production, Purification and Applications

g) Blood products and Plasma Substituties.

Unit IV

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

b) Genetic organization of Eukaryotes and Prokaryotes

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

d) Introduction to Microbial biotransformation and applications.

e) Mutation: Types of mutation/mutants.

Unit V

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

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

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

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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understanding the importance of Immobilized enzymes in Pharmaceutical Industries	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Genetic engineering applications in relation to production of pharmaceuticals	PO-1, PO-4	K_3,K_2
CO-3	Importance of Monoclonal antibodies in Industries	PO-1, PO-5	K_5,K_4

CO-4	Appreciate the use of microorganisms in fermentation technology	PO-1, PO-3, PO-8	K_3,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP606TPHARMACEUTICAL QUALITY ASSURANCE (Theory)

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

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

UNIT – I

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

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

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM,

with special emphasis on Q-series guidelines, ICH stability 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

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

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

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

UNIT – III

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

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

UNIT – IV

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

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

UNIT – V

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

Warehousing: Good warehousing practice, materials management

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	understand the cGMP aspects in a pharmaceutical industry	PO-1, PO-5, PO-10	K_3,K_2
CO-2	appreciate the importance of documentation	PO-1, PO-4	K_3,K_2
CO-3	understand the scope of quality certifications applicable to pharmaceutical industries	PO-1, PO-5	K_5,K_4
CO-4	understand the responsibilities of QA & QC departments	PO-1, PO-3, PO-8	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory)

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

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

UNIT –I

UV Visible spectroscopy

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

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

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

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

UNIT –II

IR spectroscopy

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

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

Flame Photometry-Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III

Introduction to chromatography

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

Thin layer chromatography- Introduction, Principle, Methodology, Rf values,

advantages, disadvantages and applications.

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

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

UNIT –IV

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

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

UNIT –V

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

Gel chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

SUBJECTS	OUTCOMES
INSTRUMENTAL METHODS OF ANALYSIS	CO-1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis CO-2. Understand the chromatographic separation and analysis of drugs. CO-3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-2	Understand the chromatographic separation and analysis of drugs.	PO-1, PO-4	K_5,K_4
CO-3	Perform quantitative & qualitative analysis of drugs using various analytical instruments.	PO-1, PO-5	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√		√		√					√
CO-2	√			√						
CO-3	√				√					

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	2	-	2	-	-	-	-	1
CO-2	3	-	-	1	-	-	-	-	-	-
CO-3	3	-	-	-	2	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 702 T. INDUSTRIAL PHARMACYII (Theory)

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

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

UNIT-I

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

UNIT-II

Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API,

excipients, finished products, packaging materials) Documentation, Premises 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

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

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

UNIT-IV

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

UNIT-V

Indian Regulatory Requirements: 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.

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Know the process of pilot plant and scale up of pharmaceutical dosage forms	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Understand the process of technology transfer from lab scale to commercial batch	PO-1, PO-4	K_3,K_2
CO-3	Know different Laws and Acts that regulate pharmaceutical industry	PO-1, PO-5	K_5,K_4
CO-4	Understand the approval process and regulatory requirements for drug products	PO-1, PO-3, PO-8	K3,K2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 703T. PHARMACY PRACTICE (Theory)

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

1. Know various drug distribution methods in a hospital
2. Appreciate the pharmacy stores management and inventory control
3. Monitor drug therapy of patient through medication chart review and clinical review
4. Obtain medication history interview and counsel the patients
5. Identify drug related problems
6. Detect and assess adverse drug reactions
7. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
8. Know pharmaceutical care services
9. Do patient counseling in community pharmacy;
10. Appreciate the concept of rational drug therapy.

Unit I

a) Hospital and it's organization

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

b) Hospital pharmacy and its organization

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

c) Adverse drug reaction

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

d) Community Pharmacy

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

proprietary products, maintenance of records of retail and wholesale drug store.

Unit II:

a) Drug distribution system in a hospital

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

b) Hospital formulary

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

c) Therapeutic drug monitoring

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

d) Medication adherence

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

e) Patient medication history interview

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

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III:

a) Pharmacy and therapeutic committee

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

b) Drug information services

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

c) Patient counseling

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

d) Education and training program in the hospital

Role of pharmacist in the education and training program, Internal and external

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

e) Prescribed medication order and communication skills

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

Unit IV

a) Budget preparation and implementation

Budget preparation and implementation

b) Clinical Pharmacy

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

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

c) Over the counter (OTC) sales

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

Unit V

a) Drug store management and inventory control

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

b) Investigational use of drugs

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

c) Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

SUBJECTS	OUTCOMES
PHARMACY PRACTICE	CO-1. know various drug distribution methods in a hospital CO-2. appreciate the pharmacy stores management and inventory control CO-3. monitor drug therapy of patient through medication chart review and clinical review

	CO-4. obtain medication history interview and counsel the patients 5. identify drug related problems CO-6. detect and assess adverse drug reactions CO-7. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states CO-8. know pharmaceutical care services CO-9. do patient counselling in community pharmacy CO-10. Appreciate the concept of Rational drug therapy.

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	know various drug distribution methods in a hospital	PO-1, PO-5, PO-10	K_3,K_2
CO-2	appreciate the pharmacy stores management and inventory control	PO-1, PO-4	K_3,K_2
CO-3	monitor drug therapy of patient through medication chart review and clinical review	PO-1, PO-5	K_3,K_2
CO-4	obtain medication history interview and counsel the patients	PO-1, PO-3, PO-8	K3,K2
CO-5	identify drug related problems	PO-1, PO-3, PO-5, PO-10	K_5,K_4
CO-6	detect and assess adverse drug reactions	PO-1, PO-4	K_3,K_4
CO-7	interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states	PO-1, PO-5	K_3,K_2
CO-8	know pharmaceutical care services	PO-1, PO-3	K_3,K_2
CO-9	do patient counseling in community pharmacy	PO-1, PO-3, PO-5, PO-10	K_5,K_4
CO-10	Appreciate the concept of Rational drug therapy.	PO-1, PO-3	K_3,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO-5	√		√		√					√
CO-6	√			√						
CO-7	√				√					
CO-8	√		√							
CO-9	√		√		√					√
CO-10	√		√							

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

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

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

2. To understand the criteria for selection of drugs and polymers for the development of

Novel drug delivery systems, their formulation and evaluation

Unit-I

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

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

Unit-II

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

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

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

Unit-III

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

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

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

Unit-IV

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

Unit-V

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

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

SUBJECTS	OUTCOMES
NOVEL DRUG DELIVERY SYSTEMS	CO-1. To understand various approaches for development of novel drug delivery systems. CO-2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	To understand various approaches for development of novel drug delivery systems.	PO-1, PO-5, PO-10	K_3,K_4
CO-2	To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation	PO-1, PO-4	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√			√						

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	1	-	-	-	-	2
CO-2	3	-	-	1	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP801T. BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)

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

1. Know the operation of M.S. Excel, SPSS, R and MINITAB ®, DoE (Design of Experiment)

2. Know the various statistical techniques to solve statistical problems
3. Appreciate statistical techniques in solving the problems.

Unit-I

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples

Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems

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

Unit-II

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

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems

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

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

Unit-III

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

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

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

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

Unit-IV

Blocking and confounding system for Two-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels

Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R -

Online Statistical Software's to Industrial and Clinical trial approach

Unit-V

Design and Analysis of experiments:

Factorial Design: Definition, 2_2, 2_3design. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design,

Optimization Techniques

SUBJECTS	OUTCOMES
BIOSTATISITCS AND RESEARCH METHODOLOGY	CO-1. Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment) CO-2. Know the various statistical techniques to solve statistical problems CO-3. Appreciate statistical techniques in solving the problems.

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Know the various statistical techniques to solve statistical problems	PO-1, PO-4	K_5,K_4
CO-3	Appreciate statistical techniques in solving the problems.	PO-1, PO-5	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√			√						
CO-3	√				√					

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	1	-	-	-	-	2
CO-2	3	-	-	1	-	-	-	-	-	-
CO-3	3	-	-	-	1	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 802T SOCIAL AND PREVENTIVE PHARMACY

Course Objectives:

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

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

Unit I:

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

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

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

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

Unit II:

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

Unit III:

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

Unit IV:

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

WHO in Indian national program

Unit V:

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

SUBJECTS	OUTCOMES
SOCIAL AND PREVENTIVE PHARMACY	CO-1. Acquire high consciousness/realization of current issues related to health and Pharmaceutical problems within the country and worldwide. CO-2. Have a critical way of thinking based on current healthcare development. CO-3. Evaluate alternative ways of solving problems related to health and pharmaceutical issues

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Acquire high consciousness/realization of current issues related to health and Pharmaceutical problems within the country and worldwide.	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Have a critical way of thinking based on current healthcare development.	PO-1, PO-4	K_3,K_2
CO-3	Evaluate alternative ways of solving problems related to health and pharmaceutical issues	PO-1, PO-5	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√			√						
CO-3	√				√					

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	√	-	-	-	-	√
CO-2	3	-	-	√	-	-	-	-	-	-
CO-3	3	-	-	-	√	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP803ET. PHARMA MARKETING MANAGEMENT (Theory)

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

Unit I

Marketing:

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

Pharmaceutical market:

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

Unit II

Product decision:

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

Unit III

Promotion:

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV

Pharmaceutical marketing channels:

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

No co-relation: -

BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

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

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

Unit I

New Drug Discovery and development

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

Unit II

Regulatory Approval Process

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

Regulatory authorities and agencies

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

Unit III

Registration of Indian drug product in overseas market

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

Unit IV

Clinical trials

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

Unit V

Regulatory Concepts

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

SUBJECTS	OUTCOMES
PHARMACEUTICAL REGULATORY SCIENCE	CO-1. Know about the process of drug discovery and development CO-2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals CO-3. Know the regulatory approval process and their registration in Indian and international markets

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals	PO-1, PO-4	K_3,K_2
CO-3	Know the regulatory approval process and their registration in Indian and international markets	PO-1, PO-5	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√			√						
CO-3	√				√					

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	1	-	-	-	-	3
CO-2	3	-	-	1	-	-	-	-	-	3
CO-3	3	-	-	-	2	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 805T: PHARMACOVIGILANCE (Theory)

Course Objectives:

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

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

Unit I

Introduction to Pharmacovigilance

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

Introduction to adverse drug reactions

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

- Management of adverse drug reactions

Basic terminologies used in pharmacovigilance

- Terminologies of adverse medication related events
- Regulatory terminologies

Unit II

Drug and disease classification

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

Drug dictionaries and coding in pharmacovigilance

- WHO adverse reaction terminologies
- MedDRA and Standardised MedDRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

- Basic drug information resources
- Specialised resources for ADRs

Establishing pharmacovigilance programme

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

Unit III

Vaccine safety surveillance

- Vaccine Pharmacovigilance
- Vaccination failure
- Adverse events following immunization

Pharmacovigilance methods

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

- Targeted clinical investigations

Communication in pharmacovigilance

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

Unit IV

Safety data generation

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

ICH Guidelines for Pharmacovigilance

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

Unit V

Pharmacogenomics of adverse drug reactions

- Genetics related ADR with example focusing PK parameters.

Drug safety evaluation in special population

- Paediatrics
- Pregnancy and lactation
- Geriatrics

CIOMS

- CIOMS Working Groups
- CIOMS Form

CDSCO (India) and Pharmacovigilance

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

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

SL. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Why drug safety monitoring is important?	PO-1, PO-5, PO-10	K_3,K_2
CO-2	History and development of Pharmacovigilance	PO-1, PO-4	K_3,K_2
CO-3	National and international scenario of Pharmacovigilance	PO-1, PO-5	K_5,K_4
CO-4	Dictionaries, coding and terminologies used in Pharmacovigilance	PO-1, PO-3, PO-8	K_3,K_2
CO-5	Detection of new adverse drug reactions and their assessment	PO-1, PO-3, PO-5, PO-10	K_5,K_4
CO-6	International standards for classification of diseases and drugs	PO-1, PO-4	K_3,K_2
CO-7	Adverse drug reaction reporting systems and communication in Pharmacovigilance	PO-1, PO-5	K_5,K_4
CO-8	Methods to generate safety data during pre-clinical, clinical and post approval phases of drugs' life cycle	PO-1, PO-3	K_3,K_2
CO-9	Drug safety evaluation in pediatrics, geriatrics, pregnancy and lactation	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-10	Pharmacovigilance Program of India (PvPI) requirement for ADR	PO-1, PO-3	K3,K2

	reporting in India		
CO-11	ICH guidelines for ICSR, PSUR, expedited reporting, Pharmacovigilance planning	PO-1, PO-5, PO-10	K_3,K_2
CO-12	CIOMS requirements for ADR reporting	PO-1, PO-4	K_3,K_2
CO-13	Writing case narratives of adverse events and their quality.	PO-1, PO-5	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√			√						
CO-3	√				√					
CO-4	√		√					√		
CO-5	√		√		√					√
CO-6	√			√						
CO-7	√				√					
CO-8	√		√							
CO-9	√		√		√					√
CO-10	√		√							
CO-11	√				√					√
CO-12	√			√						
CO-13	√				√					

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	2	-	-	-	-	3
CO-2	3	-	-	1	-	-	-	-	-	-
CO-3	3	-	-	-	1	-	-	-	-	-
CO-4	3	-	1	-	-	-	-	1	-	-
CO-5	3	-	1	-	1	-	-	-	-	1
CO-6	3	-	-	1	-	-	-	-	-	-
CO-7	3	-	-	-	1	-	-	-	-	-

CO-8	3	-	2	-	-	-	-	-	-	-
CO-9	3	-	1	-	1	-	-	-	-	2
CO-10	3	-	2	-	-	-	-	-	-	
CO-11	3	-	-	-	1	-	-	-	-	1
CO-12	3	-	-	1	-	-	-	-	-	-
CO-13	3	-	-	-	2	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

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

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

Unit I

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

Unit II

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

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

WHO Guidelines on GACP for Medicinal Plants.

Unit III

EU and ICH guidelines for quality control of herbal drugs.

Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

Unit IV

Stability testing of herbal medicines.Application of various chromatographic techniques in standardization of herbal products.

Preparation of documents for new drug application and export registration

GMP requirements and Drugs & Cosmetics Act provisions.

Unit V

Regulatory requirements for herbal medicines.

WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems

Comparison of various Herbal Pharmacopoeias.

Role of chemical and biological markers in standardization of herbal products

SUBJECTS	OUTCOMES
QUALITY CONTROL AND STANDARDIZATION OF HERBALS	CO-1. know WHO guidelines for quality control of herbal drugs CO-2. know Quality assurance in herbal drug industry CO-3. know the regulatory approval process and their registration in Indian and international markets CO-4. appreciate EU and ICH guidelines for quality control of herbal drugs

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	know WHO guidelines for quality control of herbal drugs	PO-1, PO-5, PO-10	K_3,K_2
CO-2	know Quality assurance in herbal drug industry	PO-1, PO-4	K_3,K_2
CO-3	know the regulatory approval process and their registration in Indian and international markets	PO-1, PO-5	K_3,K_2
CO-4	appreciate EU and ICH guidelines for quality control of herbal drugs	PO-1, PO-3, PO-8	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	3	-	-	-	-	1
CO-2	3	-	-	1	-	-	-	-	-	-

CO-3	3	-	-	-	1	-	-	-	-	-
CO-4	3	-	2	-	-	-	-	2	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 807 ET. COMPUTER AIDED DRUG DESIGN (Theory)

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

1. Design and discovery of lead molecules
2. The role of drug design in drug discovery process
3. The concept of QSAR and docking
4. Various strategies to develop new drug like molecules.
5. The design of new drug molecules using molecular modeling software

UNIT-I

Introduction to Drug Discovery and Development

Stages of drug discovery and development

Lead discovery and Analog Based Drug Design

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

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

UNIT-II

Quantitative Structure Activity Relationship (QSAR)

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

UNIT-III

Molecular Modeling and virtual screening techniques

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

Molecular docking: Rigid docking, flexible docking, manual docking,

Docking based screening. *De novo* drug design.

UNIT-IV

Informatics & Methods in drug design

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

UNIT-V

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

SUBJECTS	OUTCOMES
COMPUTER AIDED DRUG DESIGN	CO-1. Design and discovery of lead molecules CO-2. The role of drug design in drug discovery process CO-3. The concept of QSAR and docking CO-4. Various strategies to develop new drug like molecules. CO-5. The design of new drug molecules using molecular modelling software

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Design and discovery of lead molecules	PO-1, PO-5, PO-10	K_3,K_2
CO-2	The role of drug design in drug discovery process	PO-1, PO-4	K_3,K_2
CO-3	The concept of QSAR and docking	PO-1, PO-5	K_5,K_4
CO-4	Various strategies to develop new drug like molecules.	PO-1, PO-3, PO-8	K_3,K_2
CO-5	The design of new drug molecules using molecular modelling software	PO-1, PO-5, PO-10	K_5,K_4

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√			√						

CO-3	√				√					
CO-4	√		√					√		
CO-5	√				√					√

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject)

Unit I

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

b) Cell and Molecular Biology: History and Summation.

c) Properties of cells and cell membrane.

d) Prokaryotic versus Eukaryotic

e) Cellular Reproduction

f) Chemical Foundations – an Introduction and Reactions (Types)

Unit II

a) DNA and the Flow of Molecular Information

b) DNA Functioning

c) DNA and RNA

d) Types of RNA

e) Transcription and Translation

Unit III

a) Proteins: Defined **and** Amino Acids

b) Protein Structure

c) Regularities in Protein Pathways

d) Cellular Processes

e) Positive Control and significance of Protein Synthesis

Unit IV

a) Science of Genetics

b) Transgenics and Genomic Analysis

c) Cell Cycle analysis

d) Mitosis and Meiosis

e) Cellular Activities and Checkpoints

Unit V

a) Cell Signals: Introduction

b) Receptors for Cell Signals

c) Signaling Pathways: Overview

d) Misregulation of Signaling Pathways

e) Protein-Kinases: Functioning

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

1. Summarize cell and molecular biology history.
2. Summarize cellular functioning and composition.
3. Describe the chemical foundations of cell biology.
4. Summarize the DNA properties of cell biology.
5. Describe protein structure and function.
6. Describe cellular membrane structure and function.
7. Describe basic molecular genetic mechanisms.
8. Summarize the Cell Cycle

SUBJECTS	OUTCOMES
CELL AND MOLECULAR BIOLOGY (Elective subject)	CO-1. Summarize cell and molecular biology history. CO-2. Summarize cellular functioning and composition. CO-3. Describe the chemical foundations of cell biology. CO-4.Summarize the DNA properties of cell biology. CO-5. Describe protein structure and function. CO-6. Describe cellular membrane structure and function. CO-7. Describe basic molecular genetics mechanisms. CO-8. Summarize the Cell Cycle

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Summarize cell and molecular biology history.	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Summarize cellular functioning and composition.	PO-1, PO-4	K_3,K_2

CO-3	Describe the chemical foundations of cell biology.	PO-1, PO-5	K_3,K_2
CO-4	Summarize the DNA properties of cell biology.	PO-1, PO-3, PO-8	K_5,K_4
CO-5	Describe protein structure and function.	PO-1, PO-3, PO-5, PO-10	K_3,K_2
CO-6	Describe cellular membrane structure and function.	PO-1, PO-4	K_5,K_4
CO-7	Describe basic molecular genetics mechanisms.	PO-1, PO-5	K_3,K_2
CO-8	Summarize the Cell Cycle	PO-1, PO-3	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√
CO-2	√			√						
CO-3	√				√					
CO-4	√		√					√		
CO-5	√		√		√					√
CO-6	√			√						
CO-7	√				√					
CO-8	√		√							

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	3	-	-	-	3	-	-	-	-	2
CO-2	3	-	-	2	-	-	-	-	-	-
CO-3	3	-	-	-	1	-	-	-	-	-
CO-4	3	-	1	-	-	-	-	3	-	-
CO-5	3	-	1	-	3	-	-	-	-	2
CO-6	3	-	-	2	-	-	-	-	-	-
CO-7	3	-	-	-	2	-	-	-	-	-
CO-8	3	-	2	-	-	-	-	-	-	-

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP810 ET. PHARMACOLOGICAL SCREENING METHODS

Course Objectives:

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

1. Appreciate the applications of various commonly used laboratory animals.
2. Appreciate and demonstrate the various screening methods used in preclinical research
3. Appreciate and demonstrate the importance of biostatistics and researchmethodology
4. Design and execute a research hypothesis independently

Unit –I

Laboratory Animals:

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

Unit –II

Preclinical screening models

a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study.

b. **Study of screening animal models for**

Diuretics, nootropics, anti-Parkinson's,antiasthmatics,

Preclinical screening models: for CNS activity- analgesic,

antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic,

antidepressant, antiepileptic,

antiparkinsonism, alzheimer's disease

Unit –III

Preclinical screening models: for ANS activity, sympathomimetics,

sympatholytics, parasympathomimetics, parasympatholytics, skeletal

muscle relaxants, drugs acting on eye, local anaethetics

Unit –IV

Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

Research methodology and Bio-statistics

Selection of research topic, review of literature, research hypothesis and study design

Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data

SUBJECTS	OUTCOMES
PHARMACOLOGICAL SCREENING METHODS	1. Appreciate the applications of various commonly used laboratory animals. 2. Appreciate and demonstrate the various screening methods used in preclinical research 3. Appreciate and demonstrate the importance of biostatistics and research methodology 4. Design and execute a research hypothesis independently

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
1	Appreciate the applications of various commonly used laboratory animals.	PO-1, PO-5, PO-10	K_3,K_2
2	Appreciate and demonstrate the various screening methods used in preclinical research	PO-1, PO-4	K_3,K_2
3	Appreciate and demonstrate the importance of biostatistics and research methodology	PO-1, PO-5	K_3,K_2
4	Design and execute a research hypothesis independently	PO-1, PO-3, PO-8	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

Objectives:

Upon completion of the course the student shall be able to

1. Understand the advanced instruments used and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Understand the calibration of various analytical instruments
4. Know analysis of drugs using various analytical instruments.

UNIT-I

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

UNIT-II

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, Xray Crystallography, rotating crystal technique, single crystal diffraction,powder diffraction, structural elucidation and applications.

UNIT-III

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

UNIT-IV

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

UNIT-V

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS.

SUBJECTS	OUTCOMES
ADVANCED INSTRUMENTATION TECHNIQUES	CO-1. understand the advanced instruments used and its applications in drug analysis CO-2. Understand the chromatographic separation and analysis of drugs. CO-3. understand the calibration of various analytical instruments CO-4. Know analysis of drugs using various analytical instruments.

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	understand the advanced instruments used and its applications in drug analysis	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Understand the chromatographic separation and analysis of drugs.	PO-1, PO-4	K_3,K_2
CO-3	understand the calibration of various analytical instruments	PO-1, PO-5	K_5,K_4
CO-4	Know analysis of drugs using various analytical instruments.	PO-1, PO-3, PO-8	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1	√				√					√

CO-2	√			√						
CO-3	√				√					
CO-4	√		√					√		

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

Course Objective:

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to :

1. Understand the need of supplements by the different group of people to maintain healthy life.

2. Understand the outcome of deficiencies in dietary supplements.

3. Appreciate the components in dietary supplements and the application.

4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

UNIT I

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

UNIT II

Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin

b) Sulfides: Diallyl sulfides, Allyl trisulfide.

c) Polyphenolics: Reservetrol

d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones

e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lactobacillum

f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans

g) Tocopherols

h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.

UNIT III

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.

b) Dietary fibres and complex carbohydrates as functional food ingredients.

UNIT IV

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione

Vitamin C, Vitamin E, α- Lipoic acid, melatonin

Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

c) Functional foods for chronic disease prevention

UNIT V

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

SUBJECTS	OUTCOMES
DIETARY SUPPLEMENTS AND NUTRACEUTICALS	CO-1. Understand the need of supplements by the different group of people to maintain healthy life. CO-2. Understand the outcome of deficiencies in dietary supplements. CO-3. Appreciate the components in dietary supplements and the application. CO-4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

Sl. NO	COURSE OUTCOMES	PO MAPPING	Knowledge Level, KL
CO-1	Understand the need of supplements by the different group of people to maintain healthy life.	PO-1, PO-5, PO-10	K_3,K_2
CO-2	Understand the outcome of deficiencies in dietary supplements.	PO-1, PO-4	K_3,K_2
CO-3	Appreciate the components in dietary supplements and the application.	PO-1, PO-5	K_5,K_4
CO-4	Appreciate the regulatory and commercial aspects of dietary supplements including health claims.	PO-1, PO-3, PO-8	K_3,K_2

KL-Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, and K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6- Create

CO – PO Mapping

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

CO – PO Mapping Matrix

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

High co-relation: 3

Moderate co-relation: 2

Low co-relation: 1

No co-relation: -

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