I

YEAR

B.Pharmacy

B PHARMACY

I SEMESTER

- 18BP001 Human Anatomy and Physiology I-Theory
- 18BP002 Pharmaceutical Analysis I – Theory
- 18BP003 Pharmaceutics I – Theory
- 18BP004 Pharmaceutical Inorganic Chemistry –Theory
- 18BP005 Communication skills – Theory *
- 18BP006 Remedial Biology – Theory* /
- 18BP007 Remedial Mathematics – Theory*
- 18BP008 Human Anatomy and Physiology –Practical
- 18BP009 Pharmaceutical Analysis I – Practical
- 18BP010 Pharmaceutics I – Practical
- 18BP011 Pharmaceutical Inorganic Chemistry –Practical
- 18BP012 Communication skills – Practical*
- 18BP013 Remedial Biology – Practical*

II SEMESTER

- 18BP016 Human Anatomy and Physiology II – Theory
- 18BP017 Pharmaceutical Organic Chemistry I – Theory
- 18BP018 Biochemistry – Theory
- 18BP019 Pathophysiology – Theory
- 18BP020 Computer Applications in Pharmacy – Theory *
- 18BP021 Environmental sciences – Theory *
- 18BP022 Human Anatomy and Physiology II –Practical
- 18BP023 Pharmaceutical Organic Chemistry I– Practical
- 18BP024 Biochemistry – Practical
- 18BP025 Computer Applications in Pharmacy – Practical*

COURSE CONTENTS

I SEM AND II SEM

18BP001 HUMAN ANATOMY AND PHYSIOLOGY - I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms anatomy and physiology.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C101.1	To recognize the various homeostatic mechanisms, basic anatomical terms and cellular level organization.
C101.2	To summarize the characteristics of different types of tissues and their location in various organs
C101.3	To organize the structure and functions of skin, bones and joints of human body.
C101.4	To analyze the importance of blood, lymphatic system and immunity in human body.
C101.5	To relate the basic knowledge about central nervous system including nervous tissue, brain and spinal cord.
C101.6	To adapt the anatomy and physiology of heart and blood vessels.

UNIT - I **10 HOURS**

INTRODUCTION TO HUMAN BODY: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis 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 signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

TISSUE LEVEL OF ORGANIZATION: Classification of tissues, structure, location and functions of epithelial, muscular,nervous and connective tissues.

UNIT - II **10 HOURS**

Musculoskeletal system:

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

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

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

UNIT - III **10 HOURS**

Body fluids and blood : Body fluids, composition and functions of blood, hemopoesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rah factors, transfusion, its significance and Reticule endothelial system.

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

UNIT - IV **08 HOURS**

Nervous system

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

UNIT - V **07 HOURS**

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

18BP002 PHARMACEUTICAL ANALYSIS-I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C102.1	To understand the principles of volumetric/gravimetric and gasometric analytical techniques.
C102.2	To gain knowledge of sources of errors and minimizing techniques.
C102.3	To analyze the techniques of volumetric, gravimetric and gas analysis.
C102.4	To explain about accuracy, precision and significant figure error concepts.
C102.5	To compute analytical results and understand the physiochemical concepts of analysis, theories of acids and bases, stoichiometry etc.,
C102.6	To analyze various electro chemical titrations.

UNIT-I **10 HOURS**

(A) PHARMACEUTICAL ANALYSIS: Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

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

(B) ERRORS: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures

UNIT-II **10 HOURS**

ACID BASE TITRATIONS: 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 TITRATIONS: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

UNIT-III **10 HOURS**

PRECIPITATION TITRATIONS: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

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

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

Basic Principles, methods and application of diazotisation titration.

UNIT-IV **08 HOURS**

REDOX TITRATIONS

(a) Concepts of oxidation and reduction

(b) Types of Redox titrations (Principles and applications)

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

(c) principles, procedure involved in the estimation of moisture content using karl - fischer reagent.

UNIT-V **07 HOURS**

ELECTROCHEMICAL METHODS OF ANALYSIS

Conductometry: Introduction, Conductivity cell, Conductometric titrations, applications.

Potentiometry: Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

Polarography: Principle, Ikovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications.

18BP003 PHARMACEUTICS - I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C103.1	To know the historical background and profession of pharmacy and basics of pharmaceutical dosage forms.
C103.2	To understand the importance of prescription and posology.
C103.3	To solve pharmaceutical calculations and understand the formulation of powders and liquid dosage forms.
C103.4	To develop monophasic and biphasic liquid dosage forms.
C103.5	To explain the concepts of suppositories and pharmaceutical incompatibilities.
C103.6	To formulate and evaluate semi solid dosage forms.

UNIT– I **10HOURS**

HISTORICAL BACKGROUND AND DEVELOPMENT OF PROFESSION OF PHARMACY: Professional history 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 **10HOURS**

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

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

Solid dosage forms-Tablets- Introduction and figures

UNIT– III **08HOURS**

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

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 **08HOURS**

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 **07HOURS**

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

18BP004 PHARMACEUTICAL INORGANIC CHEMISTRY - I

Hours Per Week :

L	T	P	CP	CL
3	1	2	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C104.1	To understand the history and concept of pharmacopoeia and its editions.
C104.2	To know the sources of impurities and methods to determine the impurities in inorganic pharmaceuticals.
C104.3	To gain knowledge on limit tests of different pharmaceutical inorganic compounds.
C104.4	To understand the method to prepare inorganic pharmaceuticals.
C104.5	To justify the medicinal importance of acidifiers, antacids, cathartics and antimicrobial agents as gastrointestinal agents.
C104.6	To discuss the handling and applications of radiopharmaceuticals.

UNIT – I **10 HOURS**

IMPURITIES IN PHARMACEUTICAL SUBSTANCES: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.

GENERAL METHODS OF PREPARATION: assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes.

UNIT – II **10 HOURS**

ACIDS, BASES AND BUFFERS: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting the tonicity.

MAJOR EXTRA AND INTRA CELLULAR ELECTROLYTES: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

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

UNIT – III **10HOURS**

GASTROINTESTINAL AGENTS

ACIDIFIERS: Ammonium chloride* and Dil. HCL

ANTACID: Ideal properties of antacids, combinations of antacids, Sodium

Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

CATHARTICS: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

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

UNIT - IV **08HOURS**

MISCELLANEOUS COMPOUNDS

EXPECTORANTS: Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Sodium potassium tartarate **Haematinics** Ferrous sulphate*, Ferrous gluconate.

POISON AND ANTIDOTE: Sodium thio sulphate*, Activated charcoal, Sodium nitrite333

ASTRINGENTS: Zinc Sulphate, Potash Alum

UNIT - V **07HOURS**

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

18BP005 COMMUNICATION SKILLS

Hours Per Week :

L	T	P	CP	CL
2	-	2	1	2

Total Hours :

L	T	P
30	-	30

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C105.1	To understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation.
C105.2	To communicate effectively (Verbal and Non Verbal).
C105.3	To effectively manage the team as a team player.
C105.4	To understand Do's and Don'ts of an interview.
C105.5	To analyze and apply communication skills and other interpersonal skills.
C105.6	To develop Leadership qualities and essentials.

UNIT–I **07 HOURS**

COMMUNICATION SKILLS: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context.

BARRIERS TO COMMUNICATION: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers.

PERSPECTIVES IN COMMUNICATION: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

UNIT–II **07 HOURS**

ELEMENTS OF COMMUNICATION: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

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

UNIT– III **07 HOURS**

BASIC LISTENING SKILLS: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations

EFFECTIVE WRITTEN COMMUNICATION: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication.

WRITING EFFECTIVELY: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message.

UNIT–IV **05HOURS**

INTERVIEW SKILLS: Purpose of an interview, Do's and Don'ts of an interview.

GIVING PRESENTATIONS: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery.

UNIT–V **04HOURS**

GROUP DISCUSSION: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

18BP006 REMEDIAL BIOLOGY

Hours Per Week :

L	T	P	CP	CL
2	-	2	1	2

Total Hours :

L	T	P
30	-	30

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C106.1	To understand the characters of living organisms and classification of kingdoms
C106.2	To develop basic knowledge on morphology and functions of various plant parts such as root, stem, leaf, flower, fruit and seed.
C106.3	To analyze functions of organs in the cardiovascular, digestive and respiratory systems of human body
C106.4	To assess the physiology of brain and spinal cord, and role of kidney in regulation of body fluids
C106.5	To determine role of hormones in regulation of various organs functioning in the body and process of oogenesis and spermatogenesis.
C106.6	To Express the physiology, nutrient requirements for plants and to predict plant/animal tissues.

UNIT–I **07 Hours**

LIVING WORLD:

Definition and characters of living organisms. Diversity in the living world. Binomial nomenclature.

Five kingdoms of life and basis of classification. Salient features of Monera , Protesta, Fungi, Animalia and Plantae.

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 & Dicotyledons.

UNIT-II **07 Hours**

Plants and mineral nutrition:

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

Photosynthesis

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

UNIT-III **04 Hours**

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

Plant growth and development

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

Cell - The unit of life

Structure and functions of cell and cell organelles. Classification of tissues

UNIT-IV **07 Hours**

Body fluids and circulation

Composition of blood, blood groups, coagulation of blood. Composition and functions of lymph. Human circulatory system - Structure of heart and blood vessels.

Digestion and Absorption

Human alimentary canal - Basic Structure and Functions.

Breathing and respiration

Human respiratory system - Basic Structure and Functions.

UNIT-V **07 Hours**

Excretory products and their elimination

Modes of excretion. Human excretory system- Basic Structure and Functions.

Neural control and coordination

Definition and classification of nervoussystem, Structure of neuron.

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.

TEXT BOOKS:

a. Text book of Biology by S. B.Gokhale

b. A Text book of Biology by Dr. Thulajappa and Dr.Seetaram.

REFERENCE BOOKS:

A. A Text book of Biology by B.V. Sreenivasa Naidu

B. A Text book of Biology by Naidu and Murthy

C. Botany for Degree students By A.C.Dutta.

D. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.

E. A manual for pharmaceutical biology practical by S.B. Go hale and C. K. Kolkata

18BP007 REMEDIAL MATHEMATICS

Hours Per Week :

L	T	P	CP	CL
2	-	2	1	2

Total Hours :

L	T	P
30	-	30

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C106.1	To understand the role of mathematics in pharmacy
C106.2	To know about theory and their applications in pharmacy.
C106.3	To relate the mathematical tools in the wide professional views and solve problems of trigonometry, calculus and matrices.
C106.4	To solve the different types of problems by applying theory.
C106.5	To adopt both conventional and creativetechniques to the solutions of mathematical problems
C106.6	Apply a range of techniques effectively to solve problems including theory deduction, approximation and simulation.

UNIT– I **06 HOURS**

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

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

FUNCTION*:* Real Valued function, Classification of real valued functions.

LIMITS AND CONTINUITY: Introduction, Limit of a function, Definition of limit of a function (?- ?

Definition), limXn?a n ?*ann*?1, limsin? ? 1, *lxia* ??0 ?

UNIT–II **06HOURS**

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, Ad joint or adjure gate 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, Clayey –Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.

UNIT– III **06HOURS**

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 a^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 **06HOURS**

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 **06HOURS**

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

LAPLACE TRANSFORM : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations

RECOMMENDED BOOKS (LATEST EDITION)

1. Differential Calculus by Shanthi narayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gouda D.H.
3. Integral Calculus by Shanthi narayana
4 Higher Engineering Mathematics by Dr.B.S.Grewal

18BP008 HUMAN ANATOMY AND PHYSIOLOGY PRACTICAL

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

LABORATORY EXPERIMENTS

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

RECOMMENDED BOOKS (LATEST EDITIONS)

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

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

REFERENCE BOOKS (LATEST EDITIONS)

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MIUSA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vole 1 and 2) by Dr. C.C. Chatterley ,Academic Publishers Kolkata

18BP009 PHARMACEUTICAL ANALYSIS-I PRACTICAL

PRACTICAL **4 HOURS / WEEK**

LABORATORY EXPERIMENTS

I. PREPARATION AND STANDARDIZATION OF

(1) Sodium hydroxide

(2) Sulphuric acid

(3) Sodium thiosulfate

(4) Potassium permanganate

(5) Ceric ammonium sulphate

II. ASSAY OF THE FOLLOWING COMPOUNDS ALONG WITH STANDARDIZATION OF TITRANT

(1) Ammonium chloride by acid base titration

(2) Ferrous sulphate by Cerimetry

(3) Copper sulphate by Iodometry

(4) Calcium glaciate by complexometry

(5) Hydrogen peroxide by Permanganometry

(6) Sodium benzoate by non-aqueous titration

(7) Sodium Chloride by precipitation titration

III. DETERMINATION OF NORMALITY BY ELECTRO-ANALYTICAL METHODS

(1) Conductometric titration of strong acid against strong base

(2) Conductometric titration of strong acid and weak acid against strong base

(3) Potentiometric titration of strong acid against strong base

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. A.H. Beckett & J.B. Senlac's, Practical Pharmaceutical Chemistry Vole I &II, Stallone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundy Rae, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoei

18BP010 PHARMACEUTICS-I PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **3 HOURS / WEEK**

1. SYRUPS

a) SyrupIP'66
b) Compound syrup of Ferrous Phosphate BPC'68

2. ELIXIRS

a) Piperazine citrate elixir
b) Paracetamol pediatric elixir

3. LINCTUS

a) Terpin Hydrate LinctusIP'66
b) Iodine Throat Paint (Mandles Paint)

4. SOLUTIONS

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

5. SUSPENSIONS

a) Calamine lotion
b) Magnesium Hydroxide mixture
c) Aluminimum Hydroxide gel

6. EMULSIONS

a) Turpentine Liniment
b) Liquid paraffin emulsion

7. POWDERS AND GRANULES

a) ORS powder (WHO)
b) Effervescent granules
c) Dusting powder
d) Divded powders

8. SUPPOSITORIES

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

9. SEMISOLIDS

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

10. GARGLES AND MOUTH WASHES

a) Iodine gargle

b) Chlorhexidine mouthwash

RECOMMENDED BOOKS: (LATEST EDITIONS)

H.C. Ansell et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Wilkins, New Delhi.

1. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
2. M.E. Alton, Pharmaceutics, the Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
3. Indian pharmacopoeia.
4. British pharmacopoeia.
5. Bachmann. Theory and Practice of Industrial Pharmacy, Lea& Febiger Publisher, the University of Michigan.
6. Alfonso R. Genera Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
7. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
8. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
9. Isaac Geber Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
10. Deli M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
11. Francoise Myeloid and Gilberto Marti-Mistress: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

18BP011 PHARMACEUTICAL INORGANIC CHEMISTRY PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

1. LIMIT TESTS FOR FOLLOWING IONS

Limit test for Chlorides and Sulphates, Modified limit test for Chlorides and Sulphates, Limit test for Iron, Limit test for Heavy metals, Limit test for Lead, Limit test for Arsenic.

2. IDENTIFICATION TEST

Magnesium hydroxide, ferrous sulphate, Sodium bicarbonate, Calcium gluconate, Copper sulphate

3. TEST FOR PURITY

Swelling power of Bentonite, Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodated and iodine in potassium Iodide.

4. PREPARATION OF INORGANIC PHARMACEUTICALS

Boric acid, Potash alum, ferrous sulphate.

RECOMMENDED BOOKS (LATEST EDITIONS)

1. A.H. Beckett & J.B. Stenlac's, Practical Pharmaceutical Chemistry Vole I & II, Stallone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundy Rao, Inorganic Pharmaceutical Chemistry, 3rd edition
4. M.L Scruff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anad & Catwalk, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

18BP012 COMMUNICATION SKILLS PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **2 HOURS / WEEK**

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

BASIC COMMUNICATION COVERING THE FOLLOWING TOPICS

Meeting People Asking Questions Making Friends What did you do? Dos and Don'ts

PRONUNCIATIONS COVERING THE FOLLOWING TOPICS

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

ADVANCED LEARNING

Listening Comprehension / Direct and Indirect Speech Figures of Speech
Effective Communication Writing Skills.
Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills

RECOMMENDED BOOKS: (LATEST EDITION)

1. Basic communication skills for Technology, and reja. J. Ruther Ford, 2nd Edition, Pearson Education,2011
2. Communication skills, Sanjay Kumar, Pushpalata. 1stEdition, Oxford Press,2011
3. Organizational Behavior, Stephen .P. Robbins, 1stEdition, Pearson,2013
4. Brilliant- Communication skills, Gill Hassan, 1stEdition, Pearson Life,2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Goal Swami Rajesh, 5thEdition, Pearson,2013
6. Developing your influencing skills, Deborah Daley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD,2010
7. Communication skills for professionals, Kona naira, 2ndEdition, New arrivals–PHI, 2011
8. Personality development and soft skills, Baron K MITRE, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Engage Learning India pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Grew Hill Education,2011
11. Effective communication, John Adair, 4thEdition, Pan MacMillan,2009

12 Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Grew Hill,1999

18BP013 REMEDIAL BIOLOGY PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **2 HOURS / WEEK**

1. Introduction to experiments in biology
   a) Study of Microscope
   b) Section cutting techniques
   c) Mounting and staining
   d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

REFERENCE BOOKS

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

TEXT BOOKS

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

REFERENCE BOOKS

A. A Text book of Biology by B.V. Sreenivasa Naidu
B. A Text book of Biology by Naidu and Murthy
C. Botany for Degree students By A.C.Dutta.
D. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
E. A manual for pharmaceutical biology practical by S.B. Go hale and C. K. Kolkata

18BP016 HUMAN ANATOMY AND PHYSIOLOGY -II

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

I Year I Semester

SCOPE:

This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms,anatomy and physiology.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C201.1	To relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves and organization of special senses
C201.2	To illustrate the structure and functions of gastrointestinal tract.
C201.3	To learn about structure and functions of respiratory system and various mechanisms involved in regulation of respiration.
C201.4	To categorize the anatomy of urinary system and physiology of urine formation/micturition.
C201.5	To appraise the essentiality of endocrine glands and their hormones.
C201.6	To predict the physiology of male and female reproductive organs and concepts of genetics.

UNIT - I **10 HOURS**

PERIPHERAL NERVOUS SYSTEM:

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

SPECIAL SENSESAND INTEGUMENTARY SYSTEM

Structure and functions of skin, eye, ear, nose and tongue.

UNIT - II **06 HOURS**

DIGESTIVE SYSTEM

Anatomy of GI Tract with special reference to anatomy, physiology and functions of stomach, small intestine and large intestine, Anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients.

UNIT - III **10 HOURS**

RESPIRATORY SYSTEM

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

URINARYSYSTEM

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

UNIT - IV **10 HOUR**

ENDOCRINE SYSTEM

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

UNIT - V **09 HOUR**

REPRODUCTIVESYSTEM

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

Introduction to genetics

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

18BP017 PHARMACEUTICAL ORGANIC CHEMISTRY - I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C202.1	To explain the nomenclature, properties, reactions and uses of organic compounds.
C202.2	To remember the orientation of reactions and influence products.
C202.3	To apply the knowledge for the identification of organic compounds.
C202.4	To discuss chemistry and reactions of various organic compounds.
C202.5	To elaborate the concepts of hybridization, electronic and steric effects of organic compounds.
C202.6	To appraise the applications of pharmaceutical organic compounds.

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

UNIT-I **07 HOURS**

CLASSIFICATION, NOMENCLATURE AND ISOMERISM: Classification of Organic Compounds, Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carboxylic compounds), Structural isomerisms in organic compounds.

UNIT-II **10 HOURS**

ALKANES*, ALKENES* AND CONJUGATED DIENES*: SP^3 hybridization in Alkanes, Halogenation of Alkanes, uses of paraffin. Stabilities of alkenes, SP^2 hybridization in alkenes. $\underline{E}_1$ and $\underline{E}_2$ reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbo-cations, Saytzeff orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markovnikov's orientation, free radical addition reactions of alkenes, Anti orientation. Stability of conjugated dynes, Dial-Alder, electrophiliic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

UNIT-III **10 HOURS**

ALKYL HALIDES : SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereo chemistry and re-arrangement of carbo-cations. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions. Structure and uses of ethyl chloride, Chloroform, trichloral ethylene, tetra chloro ethylene, dichloromethane, tetrachloro methane and iodo-form.

ALCOHOLS: Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, Chloro butanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol.

UNIT-IV **10 HOURS**

CARBONYL COMPOUNDS* (ALDEHYDE AND KETONE): Nucleophilic addition, Electromeric effect, Aldol condensation, Crossed Aldol condensation, Cannizaro reaction, Crossed Cannizaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin,Cinnamaldehyde.

UNIT-V **08HOURS**

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, Ethylene diamine, Amphetamine.

18BP018 BIO-CHEMISTRY

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C203.1	To remember the properties, significance and metabolic reactions of carbohydrates, lipids, nucleic acids, proteins and amino acids
C203.2	To understand the metabolism of carbohydrates and process of electron transport and ATP formation
C203.3	To apply the concept of catalytic activity and enzyme inhibition in design of new drugs, diagnostic and therapeutic applications of enzyme
C203.4	To distinguish the process of DNA replication, transcription and translation
C203.5	To appraise the causes, manifestations and diagnosis of metabolic disorders
C203.6	To discuss the metabolism of nucleic acids, lipids and amino acids

UNIT - I **08 HOURS**

BIO MOLECULES: Introduction, classification, chemical nature and biological role of carbohydrates, lipids, nucleic acids, amino acids and proteins.

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

UNIT - II **10 HOURS**

CARBOHYDRATE METABOLISM: Glycolysis – Pathway, energetics and significance. Citric acid cycle-Pathway, energetics and significance. HMP shunt and its significance. Glucose-6-Phosphate dehydrogenate (G6PD) deficiency. Glycogen metabolism Pathways and glycogen storage diseases (GSD). Gluconeogenesis - Pathway and its significance. Hormonal regulation of blood glucose level and Diabetes mellitus.

BIOLOGICAL OXIDATION: Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation. Inhibitors ETC and oxidative phosphorylation / Uncouplers.

UNIT - III **10 HOURS**

LIPID METABOLISM: Beta-Oxidation of saturated fatty acid (Palmitic acid). Formation and utilization of ketone bodies; ketoacidosis. De novo synthesis of fatty acids (Palmitic acid). Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D.

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

AMINO ACID METABOLISM: General reactions of amino acid metabolism; Transamination, deamination & decarboxylation, urea cycle and its disorders. Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alkeptonuria, tyrosinemia). Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline. Catabolism of heme. Hyper bilirubinemia and Jaundice.

UNIT - IV **10 HOURS**

NUCLEIC ACID METABOLISM AND GENETIC INFORMATION TRANSFER : Biosynthesis of purines and pyramidine nucleotides; Catabolism of purines nucleotides and hyper uricemia and Gout disease Organization of mammalian genome. Structure of DNA and RNA and their functions. DNA replication (semi conservative model) Transcription or RNA synthesis. Genetic code, Translation or Protein synthesis and inhibitors.

UNIT - V **07 HOURS**

ENZYMES: Introduction, properties, nomenclature and IUB classification of enzymes. Enzyme kinetics (Michaels plot, Line Weaver Burke plot). Enzyme inhibitors with examples.

Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation. Therapeutic and diagnostic applications of enzymes and isoenzymes, Coenzymes - Structure and biochemical functions.

RECOMMENDED BOOKS (LATEST EDITIONS)

1. Vine Kumar, Abu K. Abase, Jon C. Aster; Robbins &Cot ran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jayvee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill;2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Bernard); Best and Taylor's Physiological basis of medical practice; 12th end; united states;
5. William and Wilkins, Baltimore; 1991 [1990printing].
6. Nicky R. College, Brian R. Walker, Stuart H. Ralston; Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph Dipper, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Path physiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cot ran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

RECOMMENDED JOURNALS

1. The Journal of Pathology. ISSN: 1096-9896(Online)
2. The American Journal of Pathology. ISSN:0002-9440
3. Pathology. 1465-3931 (Online)

18BP019 PATHOPHYSIOLOGY

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C204.1	To understand the process of cell injury, morphology of cell injury and cellular adaptations.
C204.2	To understand the etiopathogenesis of cardiovascular, respiratory and renal diseases mentioned.
C204.3	To apply the principles of pathogenesis in understanding symptoms, signs and complications of disease states mentioned.
C204.4	To explain the etiopathogenesis of hematologic, endocrine, nervous, gastrointestinal, musculoskeletol diseases and Immunopathogenesis of infectious diseases.
C204.5	To appraise the principles of physical, chemical and biologic carcinogenesis.
C204.6	To adapt the principles of inflammation in understanding pathogenesis of various disease states.

UNIT - I **10HOURS**

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

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

UNIT - II **10HOURS**

Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis).
Respiratory system: Asthma, Chronic obstructive airways diseases.

Renal system: Acute and chronic renal failure.

UNIT - III **10HOURS**

Haematological Diseases: Iron deficiency, megaloblastic anemia (Vitamin 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, and stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.

Gastrointestinal system: Peptic Ulcer

UNIT - IV **8HOURS**

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.

UNIT - V **7HOURS**

Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections.

Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea.

18BP020 COMPUTER APPLICATIONS IN PHARMACY

Hours Per Week :

L	T	P	CP	CL
3	-	2	1	3

Total Hours :

L	T	P
30	-	30

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C205.1	To understand different types of databases, applications of computers and databases in pharmacy.
C205.2	To illustrate the concept of number system in computers.
C205.3	To make use of web technologies such as HTML, XML, CSS, programming languages, Web servers and pharmacy drug database.
C205.4	To appraise the applications of computers in pharmacy such as drug information services, pharmacokinetics, mathematical model in drug design, hospital and clinical pharmacy etc.,
C205.5	To explain about bioinformatics and its impact in vaccine discovery.
C205.6	To elaborate the applications of computers for data analysis in preclinical development.

UNIT– I **06 HOURS**

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

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

UNIT–II **06 HOURS**

WEB TECHNOLOGIES: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database.

UNIT– III **06 HOURS**

APPLICATION OF COMPUTERS IN PHARMACY: Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring. Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Parma Information System.

UNIT-IV **06 HOURS**

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

UNIT-V **06HOURS**

COMPUTERS AS DATAANALYSIS IN PRECLINICAL DEVELOPMENT: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS).

18BP021 ENVIRONMENTAL SCIENCES

Hours Per Week :

L	T	P	CP	CL
3	-	-	-	3

Total Hours :

L	T	P
30	-	30

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C206.1	To extend basic knowledge on environment and its allied problems.
C206.2	To compare the natural, renewable and non renewable resources and the problems associated with them.
C206.3	To motivate the learners to participate in environment protection and improvement.
C206.4	To analyze the concepts of eco system including structure and functions.
C206.5	To adopt skills in identifying and solving environmental problems.
C206.6	To develop an attitude of concern for the environment.

UNIT-I **10HOURS**

The Multidisciplinary nature of environmental studies Natural Resources.

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

Concept of sustainability and sustainable development.

UNIT-II **10HOURS**

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

Biodiversity, Hotspots of biodiversity; Threats to biodiversity; Conservation of biodiversity

UNIT-III **10HOURS**

ENVIRONMENTAL POLLUTION: Air pollution; Water pollution; Soil pollution Air pollution, Water pollution, Noise pollution, Thermal pollution, Soil pollution Control, Pollution case studies, Nuclear hazards and human health risks, Solid waste Management: control measures of urban and industrial wastes Remote sensing / GIS: Introduction, definitions, applications of the remote sensing, Green technology for Sustainable development.

SOLID WASTE MANAGEMENT: Control measures of urban and industrial wastes./Control measures of urban and industrial wastes; Case Study: Visit to a local polluted site and provide the solution to solve it.

UNIT - IV

ENVIRONMENTAL POLICIES AND PRACTICES: Climate change, Global warming, Acid rain, Ozone layer depletion and impacts on human communities and agriculture. Environmental laws: Wildlife Protection Act – Water (pollution prevention and control) Act - Forest Conservation Act - Air (pollution prevention and control) Act. –Environmental Protection Act, International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity, Nature reserves, tribal populations and rights, and human wild life conflicts in Indian context, EIA: Introduction, definition of E.I.A and E.I.S – scope and objectives – Importance of E.I.A in proposed Projects / Industry / Developmental activity.

Environmental policies.

UNIT- V

HUMAN COMMUNITIES AND THE ENVIRONMENT:

HUMAN POPULATION GROWTH: Impacts on environment, human health and welfare -Resettlement and Rehabilitation of project affected persons: Case Studies. -Disaster Management: floods, earthquake, landslides and cyclones -Environmental movements: Chick movement, Silent valley, Bishops of Rajasthan-Environmental ethics: Role of Indian and other religions and cultures in environmental conservation: Environmental communication and Public awareness, case studies (C.N.G Vehicles in Delhi)

FIELD WORK/ENVIRONMENTAL VISIT: Visit to a local area to document environmental assets – river/ forest/ grassland / hill /mountain: Visit to a local polluted site - Study of local environment - common plants, insects, birds - Study of simple ecosystems –pond, river, hill slopes etc - Visit to industries/ water treatment plants/effluent treatment plants.

Human Communities.

RECOMMENDED BOOKS (LATEST EDITION):

1. Y.K. Sing, Environmental Science, New Age International Put, Publishers, Bangalore.
2. Agawam, K.C. 2001 Environmental Biology, Indi Publ. Ltd.Bikaner.
3. Barouche Erich, The Biodiversity of India, Main Publishing Pvt. Ltd., Ahmadabad – 380 013,India.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
5. Clark R.S., Marine Pollution, Clander son Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorham, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jiao Publ. House, Mumbai,1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment.

18BP022 HUMAN ANATOMY AND PHYSIOLOGY-II PRACTICAL

LABORATORY EXPERIMENTS

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

1. To study the integumentory and special senses using specimens, models, etc.
2. To demonstrate the general neurological examination
3. To demonstrate the function of olfactory nerve
4. To examine the different types of taste.
5. To demonstrate the visual activity
6. To demonstrate the reflex activity
7. Recording of body temperature
8. To demonstrate positive and negative feedback mechanisms.
9. Determination of tidal volume and vital capacity.
10. Demonstration of Cardiopulmonary resuscitation (CPR)
11. Recording of basal mass index
12. Study of family planning devices and pregnancy diagnosis test.
13. Demonstration of total blood count by cell analyzer
14. Permanent slides of vital organs and gonads.

RECOMMENDED BOOKS (LATEST EDITIONS)

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

REFERENCE BOOKS:

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MIUSA.
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vole 1 and 2) by Dr. C.C. Chatterley ,Academic Publishers Kolkata.

18BP023 PHARMACEUTICAL ORGANIC CHEMISTRY-I PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

I. Systematic qualitative analysis of unknown organic compounds like

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

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP024 BIO-CHEMISTRY PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

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

RECOMMENDED BOOKS (LATEST EDITIONS)

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert K. Marry, Daryl K. Grinner and Victor W.Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayana and U. Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S.Bhargavan,
9. Introduction of Practical Biochemistry by David T. Plummer. (3rdEdition)
10. Practical Biochemistry for Medical students by Raja gopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

18BP025 COMPUTER APPLICATIONS IN PHARMACY PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **2 HOURS / WEEK**

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page to show personal information.
3 Retrieve the information of a drug and its adverse effects using online tools.
4 Creating mailing labels Using Label Wizard , generating label in MS - WORD.
5 Create a database in MS Access to store the patient information with the required fields Using access.
6. Design a form in MS Access to view, add, delete and modify the patient record in the data base.
7. Generating report and printing the report from patient data base.
8. Creating invoice table using – MS Access.
9. Drug information storage and retrieval using MS Access.
10. Creating and working with queries in MS Acess.
11. Exporting Tables, Queries, Forms and Reports to web pages.
12. Exporting Tables, Queries, Forms and Reports to XML pages.

RECOMMENDED BOOKS (LATEST EDITION):

1. Computer Application in Pharmacy – William E. Fassett –Lea and Febiger, 600 South Washington Square, USA, (215)922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Eakins– Wiley-Inter science, A John Willey and Sons, INC., Publication, USA.
3. Bioinformatics (Concept, Skills and Applications) – S. C. Rastogi -CBS Publishers and Distributors, 4596/1- A, 11 Darya Gain, New Delhi – 110002(INDIA).
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Info path– Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi -110002.

II

YEAR

B.Pharmacy

B PHARMACY

I SEMESTER

- 18BP031 Pharmaceutical Organic Chemistry II – Theory
- 18BP032 Physical Pharmaceutics I – Theory
- 18BP033 Pharmaceutical Microbiology – Theory
- 18BP034 Pharmaceutical Engineering – Theory
- 18BP035 Pharmaceutical Organic Chemistry II – Practical
- 18BP036 Physical Pharmaceutics I – Practical
- 18BP037 Pharmaceutical Microbiology – Practical
- 18BP038 Pharmaceutical Engineering –Practical

II SEMESTER

- 18BP041 Pharmaceutical Organic Chemistry III- Theory
- 18BP042 Medicinal Chemistry I – Theory
- 18BP043 Physical Pharmaceutics II – Theory
- 18BP044 Pharmacology I – Theory
- 18BP045 Pharmacognosy and Phytochemistry I- Theory
- 18BP046 Medicinal Chemistry I – Practical
- 18BP047 Physical Pharmaceutics II – Practical
- 18BP048 Pharmacology I – Practical
- 18BP049 Pharmacognosy and Phytochemistry I – Practical

COURSE CONTENTS

I SEM AND II SEM

18BP031 PHARMACEUTICAL ORGANIC CHEMISTRY–II

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	1	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C301.1	To understand about aromaticity, chemistry and reactions of benzene.
C301.2	To understand the concept of hydrolysis, hydrogenation, saponification and rancidity of oils.
C301.3	To gain knowledge on structure and medicinal uses of pharmaceutical organic compounds.
C301.4	To understand the concept of Baeyer's theory and Sachse Mohr's theory.
C301.5	To gain knowledge on chemistry of phenols, aromatic amines and aromatic acids.
C301.6	To estimate the analytical constants of fats and oils.

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

UNIT - I **10HOURS**

BENZENE AND ITS DERIVATIVES:

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

B. Reactions of benzene - nitration, sulphonation, Halogenation- reactivity, Friedel crafts alkylation-reactivity, limitations, Friedel crafts acieration.

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

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

UNIT - II **10HOURS**

PHENOLS: Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols.

AROMATIC AMINES: Basicity of amines, effect of substituents on Basicity, and synthetic uses of aryl diazonium salts.

AROMATIC ACIDS: Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT - III **10 HOURS**

Fats and Oils : Fatty acids–reactions; Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils; Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meisl (RM) value – significance and principle involved in their determination.

UNIT-IV **08HOURS**

Poly nuclear hydrocarbons: Synthesis, reactions; Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenyl methane, Triphenylmethane and their derivatives.

UNIT-V **07HOURS**

CYCLE ALKANES: Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Cousin and Moffitt's modification, Sachsen Mohr's theory (Theory of strain less rings), reactions of cyclopropane and cyclobutane only.

18BP032 PHYSICAL PHARMACEUTICS–I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C302.1	To recollect the states of matter and understand the cpncepts of various physiochemical properties to design dosage forms.
C302.2	To gain knowledge of pH and buffers and their use in the stabilization of pharmaceutical formulations.
C302.3	To understand the principle of interfacial tension and the applications of surface active agents in drug solubilization.
C302.4	To describe the principles of diffusion in biological systems.
C302.5	To perceive and apply the concepts of complexation and protein binding in pharmacy.
C302.6	To explain the importance of solubility in designing of dosage forms.

UNIT-I **10HOURS**

SOLUBILITY OF DRUGS: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, salvation & 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.

Solubility determination and approaches/Techniques used for solubility enhancement.

UNIT-II **10HOURS**

STATES OF MATTER AND PROPERTIES OF MATTER: State of matter, changes in the state of matter, latent heats, vapor 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 **08HOURS**

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

UNIT-IV **08HOURS**

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

UNIT-V **07HOURS**

P^H, 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.

18BP033 PHARMACEUTICAL MICROBIOLOGY

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

Study of all categories of microorganisims especially for the production of all antibiotics, vaccines, vitamins, enzymes etc.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C303.1	To remember the scope of microbiology and its branches, methods of classification.
C303.2	To understand the importance and implementation of sterilization in pharmaceutical processing atnd industry.
C303.3	To utilize the knowledge in identification, cultivation and preservation of various microorganisms.
C303.4	To test for the microbiological standardization of pharmaceuticals.
C303.5	To choose the cell culture technology and microbial characters for the pharmaceutical industry.
C303.6	To compile the microbiological testing protocols.

UNIT-I **10HOURS**

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

UNIT - II **10 HOURS**

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

UNIT - III **10 HOURS**

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

UNIT - IV **08 HOURS**

Designing of aseptic area, laminar air 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 assays. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotics.

UNIT - V **07 HOURS**

Types of spoilage, Factors affecting the microbial spoilage of pharmaceutical products. Sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

Epidemiology of diseases -Study of etiology, diagnosis, source of infection, mode of transmission, immunization methods, prevention and control of the diseases.

18BP034 PHARMACEUTICAL ENGINEERING

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C304.1	To classify and explain various unit operations involved in manufacturing of pharmaceuticals.
C304.2	To understand the concepts of flow of fluids, size reduction and size separation.
C304.3	To summarize different mechanisms of heat transfer.
C304.4	To compare and contrast different types of evaporation and distillation process.
C304.5	To determine the factors influencing mixing, filtration and centrifugation.
C304.6	To elaborate various preventive methods used for corrosion control in pharmaceutical industries.

UNIT-I **10HOURS**

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 **10HOURS**

HEAT TRANSFER: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat inter changers & 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 **08HOURS**

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 semi solids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silver son Emulsifier, Hand Homogeniser ,High pressure Homogeniser, Colloidal mill, triple roller mill.

UNIT-IV **08HOURS**

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 Seitz 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 **07HOURS**

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.

18BP035 PHARMACEUTICAL ORGANIC CHEMISTRY–II PRACTICAL

LABORATORY EXPERIMENTS

I Experiments involving laboratory techniques

- Recrystallization.
- Steam distillation.

II Determination of following oil values (including standardization of reagents)

- Acid value.
- Saponification value.
- Iodine value.

III Preparation of compounds

- Benzanilide /Phenyl benzoate/Acetanilide from Aniline/Phenol /Aniline by acieration reaction.
- 2,4,6-Tribromo aniline/Para broom acetanilide from Aniline.
- Acetanilide by Halogenation (Bromination) reaction.
- 5-Nitro salicylic acid/Meta did nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
- Benzoic acid from Benzyl chloride by oxidation reaction.
- Benzoic acid/ Salicylic acid from alkyl benzoate / alkyl salicylate by hydrolysis reaction.
- 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
- Benzyl from Benzoic by oxidation reaction.
- Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction.
- Cinnamic acid from Benzaldehyde by Perkin reaction.
- *P*-Iodole benzoic acid from *P*-amino benzoic acid.

RECOMMENDED BOOKS (LATEST EDITIONS)

1. Organic Chemistry by Morrison and Boyd.
2. Organic Chemistry by I.L. Finer, Volume-I.
3. Textbook of Organic Chemistry by B.S. Bah & Arum Bah.
4. Organic Chemistry by P.L.Soni.
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry.
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lamp man and Kris.

18BP036 PHYSICAL PHARMACEUTICS-I PRACTICAL

LABORATORY EXPERIMENTS

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

RECOMMENDED BOOKS: (LATEST EDITIONS)

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

18BP037 PHARMACEUTICAL MICROBIOLOGY PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

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

RECOMMENDED BOOKS (LATEST EDITION)

1. W.B. Hugo and A.D. Russell: Pharmaceutical Microbiology, Black well scientific publications, Oxford London.
2. Prescott and Dunn. Industrial Microbiology, 4th edition, CBS Publishers &Distributors, Delhi.
3. Pelzer, Chan Krieg, Microbiology, Tata McGraw Hill end.
4. Malcolm Harris, Balkier Tindal and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Frobisher, Hinsdale et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Pepper: Microbial Technology.
9. I.P., B.P., U.S.P. - latest editions.
10. Ananthnarayana : Text Book of Microbiology, Orient- Longmann, Chennai.
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi.
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company.

18BP038 PHARMACEUTICAL ENGINEERING PRACTICAL

LABORATORY EXPERIMENTS

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

RECOMMENDED BOOKS (LATEST EDITION)

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

18BP041 PHARMACEUTICAL ORGANIC CHEMISTRY–III

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C401.1	To understand the nomenclature, properties and methods of preparation of heterocyclic compounds.
C401.2	To understand the fundamentals of stereo chemical aspects.
C401.3	To identify medicinal uses and other applications of organic compounds.
C401.4	To explain stereo isomerism in biphenyl compounds (atropisomerism) and conditions for optical activity.
C401.5	To elaborate the reactions and synthetic importance of metal hydride reduction (NaBH4 & LiAlH4), Clemmensen reduction, Oppenauer oxidation and Beckmann rearrangement.
C401.6	To discuss optical isomerism-optical activity, enantiomerism, diastereoisomerism and meso compounds.

UNIT-I **10 HOURS**

STEREO ISOMERISM: Optical isomerism–Optical activity, enantiomerism, diastereoisomerism, meson compounds Elements of symmetry, choral and archival molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers; Reactions of choral molecules; Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute.

UNIT-II **10 HOURS**

GEOMETRICAL ISOMERISM: Nomenclature of geometrical isomers (Cist Trans, EZ, Sin Anti systems); Methods of determination of configuration of geometrical isomers; Conformational isomerism in Ethane, n-Butane and Cyclo hexane; Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereo specific and stereo selective reactions.

UNIT-III **10 HOUR**

HETEROCYCLIC COMPOUNDS: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Parole, Furan, and Thiophene. Relative aromaticity and reactivity of Parole, Furan and Thiophene.

UNIT - IV **08 HOURS**

SYNTHESIS: Reactions and medicinal uses of following compounds/derivatives; Parasol, Imidazole, Oxazol and Thiazole; Pyridine, Quinoline, Iso quinoline, Acridine . Basicity of pyridine; Synthesis and medicinal uses of Pyrimidine, Purine, azepine, indole and their Derivatives.

UNIT - V **07 HOURS**

REACTIONS OF SYNTHETIC IMPORTANCE: Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemensen reduction, Birch reduction, Wolff Kishner's reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation.

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP042 MEDICINAL CHEMISTRY – I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C402.1	To recall the various classes of medicinal compounds
C402.2	To explain the physicochemical properties, steric aspects of drugs and their metabolic pathways
C402.3	To identify the structural requirements of drugs to elicit biological response
C402.4	To categorize the drugs based on their mechanism of action and clinical uses
C402.5	To design the synthetic routes for medicinal compounds.
C402.6	To choose the appropriate medicinal compound for treatment of disease or disorder

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.*

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

UNIT-I **10 HOURS**

INTRODUCTION TO MEDICINAL CHEMISTRY: History and development of medicinal chemistry physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bio isosterism, Optical and Geometrical isomerism.

DRUG METABOLISM: Drug metabolism principles - Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 HOURS**

DRUGS ACTING ON AUTONOMIC NERVOUS SYSTEM, ADRENERGIC NEUROTRANSMITTERS: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.

SYMPATHOMIMETIC AGENTS: SAR of Sympathomimetic agents: Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol.

ADRENERGIC ANTAGONISTS:

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

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

UNIT-III **10HOURS**

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 RE ACTIVATOR: 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 **10 HOURS**

DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

A. SEDATIVES AND HYPNOTICS:

BENZODIAZEPINES: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

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

MISCELLENEOUS: Amides & imides: Glutethmide, Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Tricolors sodium, Paraldehyde.

II Year II Semester

B. ANTIPSYCHOTICS PHENOTHIAZEINES: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piper acetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

RING ANALOGUES OF PHENOTHIAZEINES: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketone: Molindone hydrochloride.

Benz amides: 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 **07 HOURS**

DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

GENERAL ANESTHETICS:

INHALATION ANESTHETICS: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

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

Dissociative anesthetics: Examine 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 tartar ate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartar ate, Naloxone hydrochloride.

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

18BP043 PHYSICAL PHARMACEUTICS-II

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C403.1	To introduce and categorize the dispersed systems and understand the properties and applications of colloidal dispersions.
C403.2	To To discuss the importance of zeta potential in the stabilization of dispersed systems.
C403.3	To interpret the rheological behavior of fluids and illustrate the physics of tablet compression.
C403.4	To determine the properties of powders and apply them in formulation development.
C403.5	To formulate and evaluate coarse dispersions making use of rheological and electrical properties.
C403.6	To dtermine the order of reaction and assess the shelf life of pharmaceuticals..

UNIT - I **07 HOURS**

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

UNIT - II **10 HOURS**

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

DEFORMATION OF SOLIDS: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.

UNIT - III **10 HOURS**

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

Compounding and types of suspending, Emulsified agents.

UNIT - IV **10 HOURS**

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

UNIT - V **10 HOURS**

DRUG STABILITY: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order.

Physical and chemical factors influencing the chemical degradation of pharmaceutical product: Temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

18BP044 PHARMACOLOGY – I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C404.1	To define the fundamental concepts of pharmacology and pharmacokinetics.
C404.2	To understand the basics of pharmacodynamics, adverse reactions, drug interactions and drug discovery
C404.3	To identify the role of neurohumoral transmission and drugs acting on peripheral nervous system.
C404.4	To analyze the functions of neurotransmitters and drugs acting on central nervous system.
C404.5	To appraise the pharmacology of Psychopharmacological agents.
C404.6	To predict the effects of drugs against neurodegenerative disorders and to elaborate the concepts of drug addiction/abuse/tolerance/ dependence

UNIT - I **08HOURS**

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 **12HOURS**

GENERAL PHARMACOLOGY

a. Pharmacodynamic: 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, trans membrane enzyme linked receptors, trans membrane 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 **10HOURS**

PHARMACOLOGY OF DRUGS ACTING ON PERIPHERAL NERVOUS SYSTEM

a. Organization and function of ANS.

b. Neuro humoral transmission, co-transmission and classification of neurotransmitters.

c. Para sympathomimetics, Para sympatholytics, Sympathomimetic, sympatholytics.

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

e. Local anesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma

UNIT - IV **08HOURS**

PHARMACOLOGY OF DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

a. Neuro humoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters 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 **07HOURS**

Pharmacology of drugs acting on central nervous system

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

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

c. CNS stimulants and nootropics.

d. Opioid analgesics and antagonists

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

18BP045 PHARMACOGNOSY AND PHYTOCHEMISTRY – I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C405.1	To recall the history, scope and development of pharmacognosy.
C405.2	To remember different sources of crude drugs and also classify them accordingly.
C405.3	To illustrate students about cultivation, collection, processing and storage of crude drugs.
C405.4	To plan systematic pharmacognostic study of primary metabolites, ayurvedic drugs, marine drugs and teratogens.
C405.5	To analyze quality of crude drugs.
C405.6	To elaborate the applications of advanced technologies like polyploidy, mutation and hybridization in medicinal plants.

UNIT - I **10 HOURS**

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

CLASSIFICATION OF DRUGS: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and serotaxonomical classification of drugs.

QUALITY CONTROL OF DRUGS OF NATURAL ORIGIN: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT - II **10 HOURS**

CULTIVATION, COLLECTION, PROCESSING AND STORAGE OF DRUGS OF NATURAL ORIGIN: Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants. Conservation of medicinal plants.

UNIT - III **07 HOURS**

PLANT TISSUE CULTURE: Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines

UNIT - IV **10 HOURS**

PHARMACOGNOSY IN VARIOUS SYSTEMS OF MEDICINE: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

INTRODUCTION TO SECONDARY METABOLITES: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT - V **08 HOURS**

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

PLANT PRODUCTS: Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens.

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

CARBOHYDRATES: Acacia, Agar, Tragacanth, Honey

PROTEINS AND ENZYMES: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

LIPIDS(WAXES, FATS, FIXED OILS): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

MARINE DRUGS: Novel medicinal agents from marine sources.

NUTRACEUTICALS: Current trends and future scope of Inorganic mineral supplements, Vitamin supplements, Digestive enzymes, Dietary fibres, Cereals and grains, Health drinks of natural origin, Antioxidants, and Polyunsaturated fatty acids.

18BP046 MEDICINAL CHEMISTRY-I PRACTICAL

LABORATORY EXPERIMENTS

I. PREPARATION OF DRUGS/INTERMEDIATES

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

II. ASSAY OF DRUGS

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

III. DETERMINATION OF PARTITION COEFFICIENT FOR ANY TWO DRUGS

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP047 PHYSICAL PHARMACEUTICS-II PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

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

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Physical Pharmacy by Alfred Martin, Sixth edition.
2. Experimental pharmaceutics by Eugene, Parot.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Libermann H.A, Bachmann C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Libermann H.A, Bachmann C, Pharmaceutical dosage forms. Disperse systems, volume1, 2, and 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy. C and Manavalan R.

18BP048 PHARMACOLOGY-I PRACTICAL

LABORATORY EXPERIMENTS

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

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

RECOMMENDED BOOKS (LATEST EDITIONS)

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

b. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, TataMc Grew-Hill

2. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

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

b. Mice M.J, Genet S.B and Per M.M. Lippincott's Illustrated Reviews- Pharmacology

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

d. Sharma H. L., Sharma K. K., Principles of Pharmacology, Pares medical publisher

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

f. Ghost MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

g. Kulkarni SK. Handbook of experimental pharmacology.Vallabh Prakashan,

18BP049 PHARMACOGNOSY AND PHYTOCHEMISTRY – I PRACTICAL

LABORATORY EXPERIMENTS

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

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders &Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn. Lea and Febiger, Philadelphia,1988.
3. Text Book of Pharmacognosy by T.E.Wallis.
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers& Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhale (2007),37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D.Choudhary (1996), IST Edn, Eastern Publisher, New Delhi.
7. EssentialsofPharmacognosy,Dr.SH.Ansari,IIndedition,Birlapublications,New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae.
9. Anatomy of Crude Drugs by M.A.Iyengar.

III

YEAR

B PHARMACY

B.Pharmacy

I SEMESTER

- 18BP056 Medicinal Chemistry II – Theory
- 18BP057 Industrial PharmacyI– Theory
- 18BP058 Pharmacology II – Theory
- 18BP059 Pharmacognosy and Phytochemistry II– Theory
- 18BP060 Pharmaceutical Jurisprudence – Theory
- 18BP061 Industrial PharmacyI – Practical
- 18BP062 Pharmacology II – Practical
- 18BP063 Pharmacognosy and Phytochemistry II –Practical

II SEMESTER

- 18BP066 Medicinal Chemistry III – Theory
- 18BP067 Pharmacology III – Theory
- 18BP068 Herbal Drug Technology – Theory
- 18BP069 Biopharmaceutics and Pharmacokinetics –Theory
- 18BP070 Pharmaceutical Biotechnology – Theory
- 18BP071 Quality Assurance –Theory
- 18BP072 Medicinal chemistry III – Practical
- 18BP073 Pharmacology III – Practical
- 18BP074 Herbal Drug Technology – Practical

COURSE CONTENTS

I SEM AND II SEM

18BP056 MEDICINAL CHEMISTRY – II

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C501.1	To recall the classification of drugs obtained by natural and synthetic route
C501.2	To explain the biological targets for medicinal compounds
C501.3	To apply the knowledge of biochemical processes to understand the mechanism of action and therapeutic uses of drugs
C501.4	To understand the relationships between structure of compound and its activity
C501.5	To choose the synthetic route for selected category of drugs
C501.6	To discuss the significance, advantages and limitations of drugs

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

UNIT - I **10 HOURS**

ANTIHISTAMINIC AGENTS: Histamine, receptors and their distribution in the human body

H_1–ANTAGONISTS: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamine scuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrizine Cromolyn sodium

H_2-ANTAGONISTS: Cimetidine*, Famotidine, Ranitidine.

GASTRIC PROTON PUMP INHIBITORS: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents:

ALKYLATING AGENTS: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa.

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

ANTIBIOTICS: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 HOURS**

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

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

DIURETICS: Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide. THIAZIDES: Chlorthiazide*, Hydrochlorothiazide, Hydro flumethiazide, Cyclothiazide, **Blood diuretics:** Furosemide*, Bumetanide, Ethacrynic acid. **Potassium sparing Diuretics:** Spironolactone, Triamterene, Amiloride. **Osmotic Diuretics:** Mannitol

ANTI-HYPERTENSIVE AGENTS: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT - III **10 HOURS**

ANTI-ARRHYTHMIC DRUGS: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, 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, Propyl thiouracil, Methimazole.

UNIT – V 07HOURS

Antidiabetic agents: Insulin and its preparations Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

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

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

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

Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

RECOMMENDED BOOKS (LATEST EDITIONS)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vole I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Valhi.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry-A.I.Vogel.

18BP057 INDUSTRIAL PHARMACY - I

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C502.1	To outline the objectives and applications of preformulation studies in the development and stability of dosage forms.
C502.2	To discuss the formulation, manufacturing, coating and quality control tests of tablets.
C502.3	To review the formulation and manufacturing considerations of liquid orals.
C502.4	To illustrate the pharmaceutical aspects of capsules and pellets.
C502.5	To describe the preparation and quality control of parenterals and ophthalmic preparations.
C502.6	To summarize formulation, manufacturing and evaluation of cosmetic preparations, pharmaceutical aerosols and appraise the science of packaging materials.

UNIT - I **07HOURS**

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

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

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 **10HOURS**

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

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

Quality control tests: In process and finished product tests

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

UNIT - III **08HOURS**

CAPSULES:

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

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

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

UNIT - IV **10 HOURS**

PARENTERAL PRODUCTS: Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity Production procedure, production facilities and controls, aseptic processing Formulation of injections, sterile powders, large volume Parenteral and lyophilized products. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

OPHTHALMIC PREPARATIONS: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations.

UNIT - V **10HOURS**

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.

18BP058 PHARMACOLOGY-II

Hours Per Week :

L	T	P	CP	CL
3	1	2	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C503.1	To relate the relative pros and cons in the use of drugs for various cardiac complications.
C503.2	To illustrate the drugs acting on hematopoietic system, shock, diuretics and anti-diuretics.
C503.3	To identify the role of autocoids and related drugs.
C503.4	To analyze and summarize the drugs acting on endocrine system.
C503.5	To appraise the physiological role of sex hormones and to assess the effects of oral contraceptives and drugs acting on the uterus.
C503.6	To predict principles of bioassay and to construct the bioassay methods of various compounds.

UNIT - I **10HOURS**

1. Pharmacology of drugs acting on cardio vascular system

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

UNIT - II **10HOURS**

1. Pharmacology of drugs acting on cardio vascular system

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

2. Pharmacology of drugs acting on urinary system

a. Diuretics
b. Anti-diuretics.

UNIT - III **10HOURS**

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. Anti-rheumatic drugs

UNIT-IV **08HOURS**

4. 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 **07HOURS**

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

18BP059 PHARMACOGNOSY AND PHYTOCHEMISTRY-II

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C504.1	To outline the metabolic pathway in higher plants and their biogenetic studies.
C504.2	To the pharmacognistic study of secondary metabolites like alkaloids, glycosides, tannins, volatile oils etc,
C504.3	To demonstrate the different types and steps involved in isolation, identification and analysis of Phytoconstituents like terpenoids, glycosides, alkaloids and resins.
C504.4	To plan the industrial production, estimation and utilization of Phytoconstituents.
C504.5	To assess the crude drug by modern methods of extraction, spectroscopy, chromatography, isolation and purification.

UNIT - I **7 HOURS**

METABOLIC PATHWAYS IN HIGHER PLANTS AND THEIR DETERMINATION

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

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

UNIT - II **14 HOURS**

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

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

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

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

Tannins: Catechu, Pterocarpus

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

Glycosides: Senna, Aloes, Bitter Almond

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

UNIT - III **06 HOURS**

ISOLATION, IDENTIFICATION AND ANALYSIS OF PHYTO CONSTITUENTS

a) Terpenoids: Menthol, Citral, Artemisin

b) Glycosides: Glycyrhetinic acid & Rutin

c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine

d) Resins: Podophyllotoxin, Curcumin

UNIT - IV **10 HOURS**

INDUSTRIAL PRODUCTION: Estimation and utilization of the following phyto constituents: Forskolin, Sennoside,Artemisinin,Diosgenin,Digoxin,Atropine,Podophyllotoxin,Caffeine, Texel, Vincristine and Vinblastine

UNIT - V **8HOURS**

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.

18BP060 PHARMACEUTICAL JURISPRUDENCE

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C505.1	To Discuss the pharmaceutical legislations, ethics, right to information, medical termination of pregnancy and intellectual property rights
C505.2	To relate the significance of Drugs and cosmetics act 1940 and its rules 1945 in relation to import and manufacture of drugs
C505.3	To apply the knowledge on schedules pertaining to Drugs and cosmetics act 1940 and its rules 1945 and also administration of the act and rules
C505.4	To understand the functions of pharmacy councils and implementation of education regulations in pharmacy
C505.5	To appraise the importance of medicinal and toilet preparations act and narcotic drugs and psychotropic substances act and rules
C505.6	To discuss the salient features of drugs and magic remedies act, prevention of cruelty to animals act and drugs price control order

UNIT - I **10HOURS**

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 **10HOURS**

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, Licencing authorities, controlling authorities, Drugs Inspectors.

UNIT - III **10HOURS**

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 **08HOURS**

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 **07HOURS**

PHARMACEUTICAL LEGISLATIONS: A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

CODE OF PHARMACEUTICAL ETHICS: D efinition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath Medical Termination of Pregnancy Act Right to Information Act Introduction to Intellectual Property Rights(IPR).

RECOMMENDED BOOKS: (LATEST EDITION)

1. Forensic Pharmacy by B.Suresh
2. Text book of Forensic Pharmacy by B.M.Mithal
3. Hand book of drug law-by M.L.Mehra
4. A text book of Forensic Pharmacy by N.K.Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government. Reference books(Theory)

18BP061 INDUSTRIAL PHARMACY - I PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

1. Preformulation studies on paracetamol/aspirin/or any other drug
2. Preparation and evaluation of paracetamol tablets
3. Preparation and evaluation of aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of tetracycline capsules
6. Preparation of calcium gluconak injection
7. Preparation of ascorbic acid injection
8. Quality control test of (as per IP) marketed tablets and capsules
9. Preparation of eye drops/ and eye ointments
10. Preparation of creams (Cold / Vanishing cream)
11. Evaluation of glass containers (as per IP)

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Libermann, LeonLachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vole- 1&2 by Libermann & Lachlan
3. Pharmaceutical dosage form disperse system VOL-1 by Libermann & Bachmann
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rdEdition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science(RPS)
6. Theory and Practice of Industrial Pharmacy by Libermann &Bachmann
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill living stone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. Cancel, Lea &Febiger, Philadelphia, 5thedition,2005
9. Drug stability - Principles and practice by Carotenes & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol107.

18BP062 PHARMACOLOGY-II PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdomenus muscle.
6. Effect of Physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12. Determination of PD_2 value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carragee nan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

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

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP063 PHARMACOGNOSY AND PHYTOCHEMISTRY-II PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

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

RECOMMENDED BOOKS: (LATEST EDITIONS)

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

18BP066 MEDICINAL CHEMISTRY – III

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C601.1	To recall the classification and nomenclature of drugs of natural and synthetic origin
C601.2	To explain the concept of prodrugs and their importance
C601.3	To identify the mechanism of action and therapeutic uses of drugs
C601.4	To understand the relationship between structure of compound and its biological activity
C601.5	To choose the synthetic route for selected category of drugs
C601.6	To discuss the approaches in drug design including QSAR,pharmacophore modeling, docking and combinatorial chemistry

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

UNIT – I **10 HOURS**

Anti-biotics : Historical background, Nomenclature, Stereo chemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

Lactic anti-biotics: Penicillin, Cephalosporins, Alpha Lactamase inhibitors, Monobactams.

Aminoglycosides: Streptomycin, Neomycin, Kanamycin.

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline.

UNIT – II **10 HOURS**

Anti-biotics : 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, and Atovoquone.

UNIT – III **10 HOURS**

ANTI-TUBERCULAR AGENTS

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

Anti-tubercular anti biotics: 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: Furazolidone, Nitrofurantoin*, Methanamine.

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

UNIT – IV **08 HOURS**

ANTIFUNGAL AGENTS

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

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

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

Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin. Sulphonamides and SulfonesHistorical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **07 HOURS**

INTRODUCTION TO DRUG DESIGN: Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Taft's steric parameter and Hanch analysis. Pharmacophore modeling and docking techniques.

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

18BP067 PHARMACOLOGY-III

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C602.1	To list the drugs used in respiratory and gastrointestinal complications
C602.2	To understand the principles of chemotherapy and illustrate the mechanism of action of antibiotics.
C602.3	To explain and compare the mechanism of anti-mycobacterial, anti-fungal, anti-viral drugs.
C602.4	To analyze the chemotherapy of UTI's, STD's, anti-cancer drugs and to categorize the immunopharmacology.
C602.5	To assess the various types of toxicity studies, principles of treatment of poisoning and management of various poisoned conditions.
C602.6	To compile the biological clock and its significance in to chronotherapy.

UNIT - I **10HOURS**

1. Pharmacology of drugs acting on Respiratory system

1. Anti –asthmatic drugs
2. Drugs used in the management of COPD
3. Expectorants and anti tussives
4. Nasal decongestants
5. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastro intestinal Tract

1. Anti-ulcer agents.
2. Drugs for constipation and diarrhoea.
3. Appetite stimulants and suppressants.
4. Digestants and carminatives.
5. Emetics and anti-emetics.

UNIT - II **10HOURS**

3. Chemotherapy

1. General principles of chemotherapy.
2. Sulfonamides and Cotrimoxazole.
3. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolines, tetracycline and amino glycosides

UNIT-III **10HOURS**

3. Chemotherapy

a. Anti tubercular agents
b. Anti leprotic agents
c. Anti fungal agents
d. Antiviral drugs
e. Anthelmintics
f. Anti malarial drugs
g. Anti-amoebic agents

UNIT - IV **08HOURS**

3. Chemotherapy

l. Urinary tract infections and sexually transmitted diseases, Chemotherapy of malignancy.

4. Immuno pharmacology

a. Immuno stimulants
b. Immunosuppressants

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

UNIT-V **07HOURS**

5. Principles of toxicology

a. Definition and basic knowledge of acute, sub acute 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, and organo phosphorus compound and lead, mercury and arsenic poisoning.

6. Chrono pharmacology

a. Definition of rhythm and cycles.
b. Biological clock and their significance leading to chronotherapy.

18BP068 HERBAL DRUG TECHNOLOGY

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C603.1	To recall the fundamental concepts of herbal raw materials and biodynamic agriculture techniques
C603.2	To understand the concept of neutraceuticals and herbal food interactions.
C603.3	To apply the knowledge for evaluation and preparation of herbal formulations.
C603.4	To remember the regulatory guidelines for the assessment of herbal drugs and patenting.
C603.5	To illustrate the scope and future prospects of the herbal drug industry.
C603.6	To establish and follow the SOP's, infrastructure of industries as per GMP

UNIT - I **11 HOURS**

HERBS AS RAW MATERIALS : Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials processing of herbal raw material

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

INDIAN SYSTEMS OF MEDICINE: Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy. Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.

UNIT - II **7 HOURS**

NUTRACEUTICALS: General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfa, 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 **10HOURS**

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

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

HERBAL FORMULATIONS : Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes.

UNIT-IV **10 HOURS**

EVALUATION OF DRUGS: WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.

PATENTING AND REGULATORY REQUIREMENTS OF NATURAL PRODUCTS: Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bio prospecting and Biopiracy. Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma &Neem.

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

UNIT - V **07 HOURS**

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

S**CHEDULE T – GOOD MANUFACTURING PRACTICE OF INDIAN SYSTEMS OF MEDICINE:** Components of GMP (Schedule – T) and its objectives Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

18BP069 BIOPHARMACEUTICS AND PHARMACOKINETICS

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C604.1	To recall and understand basic concepts of absorption, distribution, metabolism and excretion of drugs.
C604.2	To understand the mechanisms, interpret various factors affecting drug absorption, distribution, metabolism and excretion of drugs.
C604.3	To utilize the pharmacokinetic models for the determination of pharmacokinetic parameters.
C604.4	To analyze the bioavailability of a drug and to compare the bioequivalence between drug products.
C604.5	To evaluate various pharmacokinetic parameters for the drugs exhibiting saturation kinetics.
C604.6	To design multiple dosage regimens based on pharmacokinetic parameters for maximizing patient compliance and therapeutic effectiveness.

UNIT - I **10 HOURS**

INTRODUCTION TO BIOPHARMACEUTICS

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

UNIT - II **10 HOURS**

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

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

UNIT - III **10HOURS**

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 **08HOURS**

MULTI COMPARTMENT MODELS: Two compartment open model. IV bolus. Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.

UNIT - V **07HOURS**

NONLINEAR PHARMACOKINETICS: Introduction, Factors causing Non-linearity. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition, Prentice-Hall Inernationaledition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal, Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Marcel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Glbaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and
9. Thomas, N. Tozen, Lea and Febiger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdu H.M, Mack, Publishing Company, Pennsylvania1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Report F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvania

18BP070 PHARMACEUTICAL BIOTECHNOLOGY

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C605.1	To remember the basic concepts of biotechnology with respect to enzyme technology, immunology, microbial technology, genetic engineering and protein engineering.
C605.2	To understand the steps involved in development of biosensors, recombinant products and concepts of immunology.
C605.3	To outline the production parameters important in pharmaceutical product development using principles of biotechnology.
C605.4	To compare the genetic organization of different types of cells and to list detection methods at genomic level, gene transfer methods and mutagens.
C605.5	To explain general requirements of fermentative production and biotechnological production of pharmaceuticals.
C605.6	To elaborate on microbial genetics, biotransformation and various immunological products.

UNIT - I **10 HOURS**

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

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

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

d) Brief introduction to Protein Engineering.

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

f) Basic principles of genetic engineering.

UNIT - II **10HOURS**

STUDY OF CLONING VECTORS, RESTRICTION ENDO NUCLEASES AND DNA LIGASE.

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

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

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

c) Brief introduction to PCR

UNIT - III **10HOURS**

TYPES OF IMMUNITY- HUMORAL IMMUNITY, CELLULAR IMMUNITY

a) Structure of Immuno globulins

b) Structure and Function of MHC

c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.

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

e) Storage conditions and stability of official vaccines

f) Hybridoma technology- Production, Purification and Applications

g) Blood products and Plasma Substitutes.

UNIT - IV **08HOURS**

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

b) Genetic organization of Eukaryotes and Prokaryotes

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

d) Introduction to Microbial biotransformation and applications.

e) Mutation: Types of mutation/mutants.

UNIT - V **07HOURS**

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

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

c) Study of the production of - penicillin's, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,

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

RECOMMENDED BOOKS (LATEST EDITION):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
2. RA Gold shies ET. al., Kuby Immunology.
3. J.W. Gooding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gin gold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5. Zagorsk: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.Stan bury F., P., Whitaker A., and Hall J., S., Principles of fermentation technology, 2nd edition, Adyta books Ltd., New Delhi.

18BP071 PHARMACEUTICAL QUALITY ASSURANCE

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C606.1	To remember the concepts of quality assurance, quality management and ICH guidelines.
C606.2	To explain the ISO, NABL and QbD concepts in pharmaceutical industry.
C606.3	To identify the organization and personnel responsibilities.
C606.4	To analyze quality control parameters and good laboratory practices in pharmaceutical industry.
C606.5	To evaluate the complaints and documents maintenance in industry with required regulatory guidelines.
C606.6	To elaborate the calibration, validation procedures and good warehousing practices.

UNIT – I **10HOURS**

QUALITY ASSURANCE AND QUALITY MANAGEMENT CONCEPTS: Definition and concept of Quality control, Quality assurance and GMP

TOTAL QUALITY MANAGEMENT (TQM): Definition, elements, philosophies

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

QUALITY BY DESIGN (QBD): Definition, overview, elements of QBD program, tools **ISO 9000 & ISO14000**: Overview, Benefits, Elements, steps for registration **NABL accreditation:** Principles and procedures

UNIT - II **10 HOURS**

ORGANIZATION AND PERSONNEL: Personnel responsibilities, training, hygiene and personal RECORDS. **PREMISES:** Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

EQUIPMENTS AND RAW MATERIALS: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT – III **10 HOURS**

QUALITY CONTROL: Quality control test for containers, rubber closures and secondary packing Materials.

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

UNIT – IV **08 HOURS**

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

DOCUMENT MAINTENANCE IN PHARMACEUTICAL INDUSTRY: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT – V **07HOURS**

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

WAREHOUSING: Good warehousing practice, materials management.

RECOMMENDED BOOKS: (LATEST EDITION)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol.69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and related materials Vole I WHO Publications.
4. A guide to Total Quality Management- Koushik Maître and Sedan K Ghosh.
5. How to Practice GMP's – P Sharma.
6. ISO 9000 and Total Quality Management – Sad hank G Ghosh.
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms.
8. Good laboratory Practices – Marcel Deckker Series.
9. ICH guidelines, ISO 9000 and 14000 guidelines.

18BP072 MEDICINAL CHEMISTRY–III PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

I. Preparation of Compounds:

1 Sulphanilamide
2 7-Hydroxy, 4-methylcoumarin
3 Chlorobutanol
4 Triphenylimidazole
5 Tolbutamide
6 Hexamine

II. Assay ofdrugs

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

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

IV Drawing structures and reactions using chemdraw ®

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

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP073 PHARMACOLOGY-III PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

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

*Experiments are demonstrated by simulated experiments/videos

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP074 HERBAL DRUG TECHNOLOGY PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

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

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Textbook of Pharmacognosy by Trease &Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale.
4. Essential of Pharmacognosy by Dr.S.H.Ansari.
5. Pharmacognosy & Phyto chemistry by V.D.Rangari.
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian. Medicine &Homeopathy).
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

IV

YEAR

B.Pharmacy

B PHARMACY

I SEMESTER

- 18BP076 Instrumental Methods of Analysis - Theory
- 18BP077 Industrial PharmacyII - Theory
- 18BP078 Pharmacy Practice - Theory
- 18BP079 Novel Drug Delivery System - Theory
- 18BP080 Instrumental Methods of Analysis -Practical
- 18BP081 Practice School*

II SEMESTER

- 18BP086 Biostatistics and Research Methodology
- 18BP087 Social and Preventive Pharmacy
- 18BP088 Pharma Marketing Management
- 18BP089 Pharmaceutical Regulatory Science
- 18BP090 Pharmacovigilance
- 18BP091 Quality Control and Standardization of Herbals
- 18BP092 Computer Aided Drug Design
- 18BP093 Cell and Molecular Biology
- 18BP094 Cosmetic Science
- 18BP095 Experimental Pharmacology
- 18BP096 Advanced Instrumentation Techniques
- 18BP097 Dietary Supplements and Nutraceuticals
- 18BP098 Project Work

COURSE CONTENTS

I SEM AND II SEM

18BP076 INSTRUMENTAL METHODS OF ANALYSIS

Hours Per Week :

L	T	P	CP	CL
3	1	4	2	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C701.1	To understand selected instrumental analytical techniques (spectroscopic and chromatographic methods) and differentiate with volumetric analysis.
C701.2	To gain knowledge on interaction of EMR with matter and to build the analytical understanding at the level of atom, group and molecular structure of organic and inorganic compounds with different functional groups and their applications in pharmacy.
C701.3	To maximize knowledge on characterization and estimation of ions by spectroscopical techniques
C701.4	To simplify affinity of matter with stationary phase and mobile phase, physical and chemical properties of matter
C701.5	To elaborate various principles, theory and instruments employed for the characterization and analysis of drugs.
C701.6	To categorize different organic and inorganic compounds using suitable spectroscopic and chromatographic techniques.

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 **10HOURS**

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 **10HOURS**

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 **10HOURS**

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 **08HOURS**

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 **07HOURS**

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.

18BP077 INDUSTRIAL PHARMACY - II

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C702.1	To explains pilot plant scale up techniques and SUPAC guidelines.
C702.2	To outline various aspects of technology transfer involved from R & D to productions.
C702.3	To choose and to apply various responsibilities and regulatory requirements for drug approval.
C702.4	To analyze and study various quality management systems in pharmacy field.
C702.5	To determine the requirements and approval procedures for new drugs by Indian Regulatory.
C702.6	To discuss about approval process and regulatory requirements for drug products.

UNIT - I **10HOURS**

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 **10HOURS**

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, MOU'S legal issues.

UNIT - III **10HOURS**

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 / ARE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

UNIT - IV **08HOURS**

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 **07HOURS**

INDIAN REGULATORY REQUIREMENTS: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for new Drugs.

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/ Regulatory Affairs.
2. International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/ about.php.
3. Douglas J Pisano and David S. Mantas. Text book of FDA Regulatory Affairs a Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm.

18BP078 PHARMACY PRACTICE

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C703.1	To acquire the knowledge on organization of hospitals, various methods of distribution and hospital formulary in hospitals and apply it in the practice of pharmacy
C703.2	To outline the concepts of formulation and evaluation of oral, mucosal and implantable drug delivery system.
C703.3	To develop and study oral, mucosal, dermal, pulmonary and Nasal drug delivery systems over conventional dosage forms for prolonged action.
C703.4	To categorize and evaluate the role of hospital pharmacist in pharmacy and therapeutic committee, drug information services, patient counseling, education and training programmes in hospitals.
C703.5	To explain the principles of drug store management and inventory control methods during practice.
C703.6	To interpret clinical laboratory tests of specific disease states to provide better patient centered service.

UNIT - I **10HOURS**

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

HOSPITAL PHARMACY AND ITS ORGANIZATION: Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

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

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

UNIT - II **10HOURS**

DRUG DISTRIBUTION SYSTEM IN A HOSPITAL: Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labeling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.

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

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

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

PATIENT MEDICATION HISTORY INTERVIEW: Need for the patient medication history interview, medication interview forms.

COMMUNITY PHARMACY MANAGEMENT: Financial, materials, staff, and infrastructure requirements.

UNIT - III **10HOURS**

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

DRUG INFORMATION SERVICES: Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

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

EDUCATION AND TRAINING PROGRAM IN THE HOSPITAL: Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

PRESCRIBED MEDICATION ORDER AND COMMUNICATION SKILLS: Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

UNIT - IV **8HOURS**

BUDGET PREPARATION AND IMPLEMENTATION: Budget preparation and implementation

CLINICAL PHARMACY: Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

OVER THE COUNTER (OTC) SALES: Introduction and sale of over the counter, and rational use of common over the counter medications.

UNIT - V **7HOURS**

DRUG STORE MANAGEMENT AND INVENTORY CONTROL: Organization of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

INVESTIGATIONAL USE OF DRUGS: Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

INTERPRETATION OF CLINICAL LABORATORY TESTS: Blood chemistry, hematology, and urinalysis

RECOMMENDED BOOKS (LATEST EDITION):

1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4thed. Ahmadabad: B.S. Shah Prakakshan;2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of Clinical Pharmacy Practice- essential concepts and skills,* 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications;2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health System Pharmacists Inc;2009.
6. Parmar N.S. *Health Education and Community Pharmacy,* 18th ed. India: CBS Publishers & Distributers; 2008.

JOURNALS:

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

18BP079 NOVEL DRUG DELIVERY SYSTEMS

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C704.1	To understand and rationalize fundamentals and polymers used in the design of controlled drug delivery systems.
C704.2	To develop and study oral, mucosal, dermal, pulmonary and Nasal drug delivery systems over conventional dosage forms for prolonged action.
C704.3	To illustrate the principles and fundamentals of drug targeting in the design of site specific drug delivery system.
C704.4	To study the importance of site specific drug delivery systems or devices for ocular and intra uterine routes
C704.5	To predict the rate and maximize therapeutic compliance of site specific drug delivery systems by modifying conventional dosage forms.

UNIT - I **10HOURS**

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 **10HOURS**

MICROENCAPSULATION: Definition, advantages and disadvantages, microspheres/microcapsules, micro particles, methods of microencapsulation, applications.

MUCOSAL DRUG DELIVERY SYSTEM: Introduction, Principles of bio adhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems.

IMPLANTABLE DRUG DELIVERY SYSTEMS: Introduction, advantages and disadvantages, concept of implants and osmotic pump.

UNIT - III **10HOURS**

TRANSDERMAL DRUG DELIVERY SYSTEMS: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches.

GASTRO RETENTIVE DRUG DELIVERY SYSTEMS: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastro adhesive systems and their applications.

NASO PULMONARY 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 **08HOURS**

TARGETED DRUG DELIVERY: Concepts and approaches advantages and disadvantages, introduction to liposome's, noisome, nanoparticles, monoclonal antibodies and their applications

UNIT - V **07HOURS**

OCULAR DRUG DELIVERY SYSTEMS: Introduction, intra ocular barriers and methods to overcome – Preliminary study, ocular formulations and ousters.

INTRAUTERINE DRUG DELIVERY SYSTEMS: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications.

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York,1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York,1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz Published by Wiley Inter science Publication, John Wiley and Sons, Inc, New York. Chichester / Weinheim.
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in2001).
5. S.P. Vyas and R.K. Char, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

JOURNALS

1. Indian Journal of Pharmaceutical Sciences(IPA).
2. Indian Drugs(IDMA).
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel &Decker).
5. International Journal of Pharmaceutics (Elsevier Sciences).

18BP080 INSTRUMENTAL METHODS OF ANALYSIS PRACTICAL

LABORATORY EXPERIMENTS

PRACTICAL **4 HOURS / WEEK**

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

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP086 BIOSTATISITCS AND RESEARCH METHODOLOGY

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C801.1	To understand the basic aspects of statistics such as central tendency, dispersion and correlation.
C801.2	To make use of regression and probability while analyzing data by statistical methods.
C801.3	To explain the need of research, research designs and their applications and to explain methodological designs.
C801.4	To assess the need of regression modeling and to build up the ability to use various statistical problems.
C801.5	To elaborate design and analysis of experiments and response surface methodology.
C801.6	To build the ability to perform various parametric and non parametric statistical tests and to draw graphs and plots based on type of data.

UNIT - I **10HOURS**

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 correlations - Pharmaceuticals examples

UNIT - II **10HOURS**

REGRESSION: Curve fitting by the method of least squares, fitting the lines y= a + bx and x= a + by, multiple regressions, standard error of regression– Pharmaceutical Examples **PROBABILITY:** Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, and 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 **10HOURS**

NON PARAMETRIC TESTS: Wilcox and 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 **8HOURS**

BLOCKING AND CONFOUNDING SYSTEM FOR TWO-LEVEL FACTORIALS

REGRESSION MODELING: Hypothesis testing in Simple and Multiple regression models Introduction To practical components of industrial and clinical trials problems: Statistical Analysis Using Excel, SPSS, MINITAB®, Design of experiments, R - Online Statistical Software's to Industrial and Clinical trial approach

UNIT - V **7HOURS**

DESIGN AND ANALYSIS OF EXPERIMENTS:

FACTORIAL DESIGN: Definition, 2^2, 2^3design. Advantage of factorial design **Response Surface METHODOLOGY**: Central composite design, Historical design, Optimization Techniques

RECOMMENDED BOOKS (LATEST EDITION):

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. New York.
2. Fundamental of Statistics – Himalaya Publishing House-S. C. Guptha.
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Panner selvam.
4. Design and Analysis of Experiments –Wiley Students Edition, Douglas and C. Montgomery.

18BP087 SOCIAL AND PREVENTIVE PHARMCAY

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C802.1	To understand the concept of health and health education.
C802.2	To create awareness about various preventive measures of stated communicable and non communicable diseases.
C802.3	To apply the knowledge of national health programmes mentioned in real world to serve the society.
C802.4	To elaborate various vaccines under national immunization programme and their schedule.
C802.5	To demonstrate the impact of socio-cultural factors and urbanization on health.
C802.6	To evaluate the health and pharmacy related problems in societal perspective.

UNIT - I **10HOURS**

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 **10HOURS**

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 **10HOURS**

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 **08HOURS**

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 **07HOURS**

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

RECOMMENDED BOOKS (LATEST EDITION)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications.
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications.
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications.
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications.
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOTPUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad.

RECOMMENDED JOURNALS:

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

18BP088 PHARMA MARKETING MANAGEMENT

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	-

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C803.1	To understand different concepts of marketing.
C803.2	To identify marketing mix for pharmaceutical products.
C803.3	To classify different types of sales promotion.
C803.4	To examine pharmaceutical marketing channels.
C803.5	To compare pricing of the pharmaceutical products.
C803.6	To adapt to emerging concepts of marketing.

UNIT - I **10HOURS**

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

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 **10HOURS**

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 **10HOURS**

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 **10HOURS**

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

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

UNIT - V **10HOURS**

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

EMERGING CONCEPTS IN MARKETING: Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata MC Graw Hill, New Delhi.
3. Drub Growl and Michael Levy: Marketing, Tata MC Graw Hill
4. Arum Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajang Sabena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramasamy.C, U.S & Nanakamari, S: Marketing Management: Global Perspective, Indian Context, Macmillan India, And New Delhi.
7. Shankar, Ravi: Service Marketing, Excel Books, New Delhi
8. Scuba Rae Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publication.

18BP089 PHARMACEUTICAL REGULATORY SCIENCE

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	-

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C804.1	To recall the concepts of Drug discovery, development process, clinical studies and generic drug product development.
C804.2	To perceive the regulatory approval process and timelines for IND, NDA and ANDA and to know about changes to an approved NDA/ANDA.
C804.3	To familiar with Regulatory authorities and agencies like India, USA, Europe, Australia, Japan and Canada.
C804.4	To know the regulatory registration process of Indian drugs in overseas market which include to understand about technical documents like DMF, CTD, eCTD and ACTD.
C804.5	To assimilate the process of clinical trials and pharmacovigilance as well as to understand obligations of GCP in clinical trials.
C804.6	To understand the concepts of Regulatory science in pharmaceutical industry as well as to make use of regulatory guidelines, laws, acts, orange and purple book.

UNIT - I **10HOURS**

NEW DRUG DISCOVERY AND DEVELOPMENT: Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

UNIT - II **10HOURS**

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

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

UNIT - III **10HOURS**

REGISTRATION OF INDIAN DRUG PRODUCT IN OVERSEAS MARKET: Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical; Document (etch), ASEAN Common Technical Document (ACTD) research.

UNIT - IV **08HOURS**

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

UNIT - V **07HOURS**

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

RECOMMENDED BOOKS (LATEST EDITION):

1. Drug Regulatory Affairs by Sachem Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informal Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations by Richard a Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons.Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics / edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series,Vol.143.
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance ByFayA. Rozovsky and Rodney K.Adams.
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P.Ognibene.
9. Drugs: From Discovery to Approval, Second Edition By RickNg.

18BP090 PHARMACOVIGILANCE

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C805.1	To understand the history of pharmacoivigilance, adverse drug reactions and basic terminologies in Pharmacovigilance.
C805.2	To make use of various drug disease classifications, drug dictionaries and drug information resources in pharmacovigilance.
C805.3	To explain various methods of pharmacovigilance and communication process during ADR reporting.
C805.4	To appraise safety data generation and ICH guidelines in pharmacovigilance.
C805.5	To evaluate drug and vaccine safety in special population and to appraise the process of haemovigilance and materiovigilance.
C805.6	To build the ability to report adverse drug reactions through various ADR reporting forms.

UNIT - I **10HOURS**

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 **10 HOURS**

DRUG AND DISEASE CLASSIFICATION

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

DRUG DICTIONARIES AND CODING IN PHARMACOVIGILANCE

- WHO adverse reaction terminologies
- Med DRA and Standardized Med DRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

INFORMATION RESOURCES IN PHARMACOVIGILANCE

- Basic drug information resources
- Specialized resources for ADRs

ESTABLISHING PHARMACOVIGILANCE PROGRAMME

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

UNIT - III **10HOURS**

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, Health care facilities & Media

UNIT - IV **8HOURS**

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 **7HOURS**

PHARMACOGENOMICS OF ADVERSE DRUG REACTIONS

- Genetics related ADR with example focusing PK parameters.

DRUG SAFETY EVALUATION IN SPECIAL POPULATION

- Pediatrics
- Pregnancy and lactation

CIOMS

- CIOMS Working Groups
- CIOMS Form

CDSCO (INDIA) AND PHARMACOVIGILANCE

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

RECOMMENDED BOOKS (LATEST EDITION):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z by Barton Colbert, Pierre Byron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance: Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Wale, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller, Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Colbert, Jones& Bartlett Publishers.
7. Textbook of Pharmacoepidemiology edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy, and Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills'. Parthasarathi, Karin NyfortHansen, Milap C.Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
12. http://www.ich.org/
13. http://www.cioms.ch/
14. http://cdsco.nic.in/
15. http://www.who.int/vaccine_safety/en/
16. http://www.ipc.gov.in/PvPI/pv_home.html

18BP091 QUALITY CONTROL AND STANDARDIZATION OF HERBALS

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C806.1	To recall the WHO guidelines for the quality control of herbal drugs.
C806.2	To illustrate and outline the quality assurance in traditional system of medicine including CGMP, GAP, GMP and GLP.
C806.3	To compare the quality control parameters of drugs according to European union and ICH guidelines.
C806.4	To make use of research guidelines for evaluation of safety and effiency of herbal medicine.
C806.5	To apply the knowledge of chromatography in standardization of herbal drugs and to perform the stability studies.
C806.6	To improve the knowledge on regulatory issues for herbal medicine including GMP, WHO guidelines on safety monitoring of herbal medicine in Pharmacovigilance.

UNIT - I **10 HOURS**

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 **10 HOURS**

QUALITY ASSURANCE IN HERBAL DRUG INDUSTRY: 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 **10 HOURS**

EU AND ICH: Guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

UNIT - IV **08 HOURS**

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 **07 HOURS**

REGULATORY REQUIREMENTS FOR HERBAL MEDICINES: WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias. Role of chemical and biological markers in standardization of herbal products

RECOMMENDED BOOKS: (LATEST EDITIONS)

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub.,2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Chatwal K., Potter K., Monadic K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p.4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila,1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rdedn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva,1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

18BP092 COMPUTER AIDED DRUG DESIGN

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C807.1	To recall the approaches in drug discovery, drug development, lead discovery based on metabolism and clinical observation and also analog based drug design
C807.2	To explain the development, approaches of QSAR, importance and determination of physicochemical parameters
C807.3	To make use of molecular modeling and virtual screening techniques
C807.4	To apply the molecular docking techniques to examine the binding interactions of ligand with molecular targets
C807.5	To explain the applications of bioinformatics, chemo informatics,ADME databases, chemical, biochemical and pharmaceutical databases relevant to drug design.
C807.6	To discuss the conformational analysis of molecules using molecular and quantum mechanics approach and also determine the global conformational minima

UNIT - I **10HOURS**

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: Bio isosterism, Classification, Bio isosteric replacement. Any three case studies

UNIT - II **10HOURS**

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 **10HOURS**

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. *Denovo* drug design.

UNIT - IV **08HOURS**

INFORMATICS & METHODS IN DRUG DESIGN: Introduction to Bioinformatics, chemo informatics. ADME databases, chemical, biochemical and pharmaceutical databases.

UNIT - V **07HOURS**

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

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP093 CELL AND MOLECULAR BIOLOGY (Elective Subject)

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function. This is done both on a microscopic and molecular level.Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C808.1	To relate the basic structure, properties of cells (prokaryotic and eukaryotic) and cell membranes / cellular reproduction.
C808.2	To illustrate DNA structure and functioning, RNA and protein synthesis (transcription/translation).
C808.3	To organize protein structure, pathways, cellular processes and significance of protein synthesis.
C808.4	To distinguish the science of genetics, transgenics, genomic and cell cycle analysis.
C808.5	To interpret mitosis / meiosis, cellular activities and checkpoints.
C808.6	To elaborate how cell communication occur and discuss mechanisms of receptors for cell signaling/signaling pathways/Protein kinase

UNIT – I **10HOURS**

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 **10HOURS**

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 **10HOURS**

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 **08HOURS**

a) Science of Genetics
b) Transgenic and Genomic Analysis
c) Cell Cycle analysis
d) Mitosis and Meiosis
e) Cellular Activities and Check points

UNIT – V **07HOURS**

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

RECOMMENDED BOOKS (LATEST EDITION):

1. W.B. Hugo and A.D. Russell: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn. Industrial Microbiology, 4th edition, CBS Publishers& Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hilledn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed.Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
13. RA Gold shy et. al.

18BP094 COSMETIC SCIENCE

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

This subject is designed to impart the basic knowledge of cosmetics and evaluation of cosmetic studies including design, conduct and interpretations of results.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C809.1	To remember classification and historical evolution of cosmetics, cosmeceutical products, cosmetic excipients and recall the basic structure, functions and common problems associated with skin, hair and oral cavity
C809.2	To understand the principles of formulation and building blocks of various skin care products and hair care products.
C809.3	To describe the role of herbs in cosmetics and analytical methods for cosmetics.
C809.4	To evaluate various cosmetics using analytical instruments.
C809.5	To apply the knowledge gained and develop cosmetics to solve problems associated with skin, hair and scalp.

UNIT-I **10HOURS**

CLASSIFICATION OF COSMETIC AND COSMECEUTICAL PRODUCTS: Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

COSMETIC EXCIPIENTS: Surfactants, Rheology modifiers, humectants, emollients, preservatives. Classification and application

SKIN: Basic structure and function of skin.

HAIR: Basic structure of hair. Hair growth cycle.

ORAL CAVITY: Common problem associated with teeth and gums**.**

UNIT - II **10HOURS**

PRINCIPLES OF FORMULATION AND BUILDING BLOCKS OF SKIN CARE PRODUCTS: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmecuticals.

ANTIPERSPANTS & DEODORANTS: Actives & mechanism of action. Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, and anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouth wash.

UNIT - III **10HOURS**

Sun protection, Classification of Sunscreens and SPF.

ROLE OF HERBS IN COSMETICS: Skin Care: Aloe and turmeric Hair care: Henna and amla.

Oral care: Neem and clove

ANALYTICAL COSMETICS: BIS specification and analytical methods for shampoo, skin- cream and toothpaste**.**

UNIT - IV **08HOURS**.

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

UNIT - V **07HOURS**

Oily and dry skin causes leading to dry skin, skin moisturisation. Basic understanding of the terms Come do genic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odour. Antiperspirants and Deodorants- Actives and mechanism of action

REFERENCES

1. Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, GeorgeGodwin.
2. Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3. Text book of Cosmeticology by Sonja Nanda & Roop K. Char, Tata Publishers.

18BP095 PHARMACOLOGICAL SCREENING METHODS

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C810.1	Describe the applications of common laboratory animals, explain CPCSEA and OECD guidelines governing the for maintenance, breeding and conduct of experiments on laboratory animals.
C810.2	Explain dose, dose calculations grouping of animals, species selection, sex in conducting the animal experimentation.
C810.3	Describe the research Study of screening animal models for Diuretics, no-tropics, anti-Parkinson's, anti asthmatics.
C810.4	Explain screening methods of CNS activity- analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, anti parkinsonism, alzheimer's disease
C810.5	Explain screening methods of for CVS activity- anti hypertensives, diuretics, anti arrhythmic, anti dyslepidemic,
C810.6	Explain screening methods of antiulcer, antidiabetic, anticancer and antiasthmatics
C810.7	Explain s creening methods of Research methodology and Bio-statistics

UNIT- I 8 HOURS

LABORATORY ANIMALS: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

UNIT – II **10 HOURS**

PRECLINICAL SCREENING MODELS:

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.

STUDY OF SCREENING ANIMAL MODELS: Diuretics, nootropics, anti-Parkinson's, anti asthmatics, **PRECLINICAL SCREENING MODELS:** for CNS activity- analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, anti-parkinsonism, Alzheimer's disease.

UNIT – III **7 HOURS**

PRECLINICAL SCREENING MODELS: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics.

UNIT – IV **10 HOURS**

PRECLINICAL SCREENING MODELS: for CVS activity- anti-hypertensives, diuretics, anti-arrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants. Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and anti-asthmatics.

UNIT – V **10 HOURS**

Research methodology and Bio-statistics: Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students't' test And One-way ANOVA. Graphical representation of data

RECOMMENDED BOOKS (LATEST EDITION):

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K.Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rae and J Richard

18BP096 ADVANCED INSTRUMENTATION TECHNIQUES

Hours Per Week :

L	T	P	CP	CL
3	1	-	-	4

Total Hours :

L	T	P
45	15	60

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

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

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C811.1	Select the required instruments for spectroscopic analysis.
C811.2	Understand the effects of different constituent in a process outcome and analysis the performance of various on-line or off-line instruments.
C811.3	Apply the knowledge of chromatography to Separates the constituents from a complex mixture.
C811.4	Describe and differentiate between online and offline process and Identifies suitable instruments for analysis gaseous, liquid or solid substance.

UNIT - I **10HOURS**

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 Quadrapole, instrumentation, applications

UNIT - II **10HOURS**

THERMAL METHODS OF ANALYSIS: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC).

X-RAY DIFFRACTION METHODS: Origin of X-rays, basic aspects of crystals, X- ray

Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT - III **10HOURS**

CALIBRATION AND VALIDATION: ICH and USFDA guidelines Calibration of following Instruments Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

UNIT - IV **08HOURS**

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 **07HOURS**

HYPHENATED TECHNIQUES: LC-MS/MS, GC-MS/MS, HPTLC-MS.

RECOMMENDED BOOKS (LATEST EDITIONS)

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

18BP097 DIETARY SUPPLEMENTS AND NUTRACEUTICALS

Hours Per Week :

L	T	P	CP	CL
-	-	-	-	-

Total Hours :

L	T	P
-	1	-

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
C812.1	To define, classify and understand the functional foods, Nutraceuticals and dietary supplements.
C812.2	To remember the sources, chemical nature, medicinal uses and health benefits of Nutraceuticals and functional foods.
C812.3	To interprete the applications of phytochemicals as Nutraceuticals like sulfies, phytochemicals as Nutraceuticals like sulfides, polyphenolics, flavonoids, probiotics, Tocopherols, proteins, minerals etc.
C812.4	To examine (to identify the damaging reactions of free radicals on tepids, carbohydrates. Proteins and nucleic acids. Role of functional foods in various disease conditions.
C812.5	To analyse the role of dietary fibres and complex carbohydrates as functional food ingredients
C812.6	To discuss the regulatory aspects, adultration of dietary fibres and Nutraceuticals and their pharmacopoeal specifications.

UNIT - I **07 HOURS**

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.

PUBLIC HEALTH NUTRITION: maternal and child nutrition, nutrition and ageing, nutrition education in community.

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 **15 HOURS**

PHYTOCHEMICALS AS NUTRACEUTICALS: Occurrence and characteristic features (chemical nature medicinal benefits) of following

a) Carotenoids- á and â-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, Lactobacillus

f) Phyto estrogens : Iso flavones, 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 **07 HOURS**

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 **10 HOURS**

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 non enzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, á-Lipoic acid,melatonin. Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

c) Functional foods for chronic disease prevention

UNIT - V **06 HOURS**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

REFERENCES:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and nutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BS Publication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn. Avery Publishing Group, NY (1997).
6. G. Gibson and C.williams Editors *2000 Functional foods* Wood head Publ.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shills, ME, Olson, JA, Shake, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger

18BP098 ELECTIVE COURSE ON PHARMACEUTICAL PRODUCT DEVELOPMENT

Hours Per Week :

L	T	P	CP	CL
-	-	-	-	-

Total Hours :

L	T	P
-	1	-

WA/RA	SSH/HSH	CS	SA	S	BS

SCOPE:

- - - - - - - - - - - - - - -

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

UNIT - I **10HOURS**

INTRODUCTION: To pharmaceutical product development, objectives, and regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosageforms

UNIT - II **10HOURS**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Solvents and solubilizers

ii. Cyclodextrins and their applications

iii. Non - ionic surfactants and their applications

iv. Polyethylene glycols and sorbitols

v. Suspending and emulsifying agents

vi. Semi solid excipients

UNIT - III **10HOURS**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Tablet and capsule excipients

ii. Directly compressible vehicles

iii. Coat materials

iv. Excipients in Parenteral and aerosols products

v. Excipients for formulation of NDDS

Selection and application of excipients in pharmaceutical formulations with specific industrial applications

UNIT - IV **08HOURS**

Optimization techniques in pharmaceutical product development. A study of various optimization techniques for pharmaceutical product development with specific examples. Optimization by factorial designs and their applications. A study of QBD and its application in pharmaceutical product development.

UNIT - V **07HOURS**

Selection and quality control testing of packaging materials for pharmaceutical product development-regulatory considerations.

RECOMMENDED BOOKS (LATEST EDITIONS)

1. Pharmaceutical Statistics Practical and Clinical Applications by Stanford Bolton, Charles Bon; Marcel Dekker Inc.
2. Encyclopedia of Pharmaceutical Technology, edited by James swarbrick, Third Edition, Informa Health care publishers.
3. Pharmaceutical Dosage Forms, Tablets, Volume II, edited by Herbert A.Liebermann and Leon Bachmann; Marcel Dekker, Inc.
4. The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by Roop Khar, S P Vyas, Farhan J Ahmad, Gaurav K Jain; CBS Publishers and Distributors Pvt.Ltd.2013.
5. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, edited by Patrick J. Sinko, BI Publications Pvt.Ltd.
6. Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyas and R. K.Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012.
7. Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V. Allen Jr., Nicholas B.Popovich, Howard C. Ansell, 9th Ed.40
8. Aulton's Pharmaceutics – The Design and Manufacture of Medicines, MichaelE. Aulton,3rdEd.
9. Remington – The Science and Practice of Pharmacy, 20thEd.
10. Pharmaceutical Dosage Forms – Tablets Vole 1 to 3, A. Libermann, Leon Bachmann and Joseph B. Schwartz
11. Pharmaceutical Dosage Forms – Disperse Systems Vole 1 to 3, H.A. Libermann, Martin, M.R and Gilbert S. Banker.
12. Pharmaceutical Dosage Forms – Parenteral Medication Vole 1 & 2, Kenneth E. Avis and H.A.Libermann.
13. Advanced Review Articles related to the topics.

ELECTIVE COURSES

S. No	Sub Code	Sub Name
1.	16BI250	Biopharmaceutical technology
2.	16BI350	Molecular modeling
3.	19BT332	Handling of animals for experiments
4.	19BT433	Medicinal plants and ethnobotany
5.	17BT010	Immunotechnology
6.	19BI331	Molecular interaction
7.	19BT334	Plant tissue culture
8.	16BT251	Physiology and histology
9.	16BT451	Drug toxicity evaluation
10.	19BI335	Metabolic pathway
11.	19BM314	Python programming for medical applications
12.	16EL103	Professional communication laboratory
13.	19BM213	Biomedical equipment
14.	16BM308	Medical imaging technique
15.	19CS101	Programming for problem solving
16.	18BP101	GXP
17.	18BP102	Supply chain management
18.	18BP103	Scale up and tech transfer
19.	18BP104	Method transfer, quality control and assurance
20.	18BP105	Clinical data management
21.	18BP106	Health care management

16BI250 BIOPHARMACEUTICAL TECHNOLOGY

UNIT - I

INTRODUCTION TO PHARMACEUTICALS: History and definition of drugs; Sources of drugs, plant, animals, microbes and minerals; Routes of drug administration; Different dosage forms.

UNIT-II

STRUCTURE PREDICTION AND DRUG DESIGN Protein structure prediction; Introduction to comparative modeling; Sequence alignment; Constructing and evaluating a comparative mode Predicting protein structures by 'threading'; Molecular docking - AUTODOCK/EASYMODELLER and HEX; Structure based *de novo* ligand design; Drug discovery; Chemo informatics; QSAR.

UNIT-III

PHARMACODYNAMICS AND PHARMACOKINETICS: Physico-chemical principles; Pharmacodynamics - mechanism of drug action, drug receptors, physiological receptors, structural and functional families; Pharmacokinetics - drug absorption, factors that affect the absorption of drugs, distribution of drugs, biotransformation of drugs, bioavailability of drugs.

UNIT-IV

PRODUCTION AND APPLICATIONS OF BIOPHARMACEUTICALS: Manufacturing facilities, production and analysis of biopharmaceuticals; Recent advances in the manufacture of drugs using r-DNA technology; Production of therapeutic proteins, hormones, cytokines - interferons, interleukins 1 and 11, tumor necrosis factor (TNF) and nucleic acids; Role of biopharmaceuticals in treatment of various health disorders.

UNIT – V

DRUG DELIVERY SYSTEMS, BIOMATERIALS AND THEIR APPLICATIONS: Controlled and sustained delivery of drugs; Biomaterial for the sustained drug delivery; Liposome mediated drug delivery; Drug delivery methods for therapeutic proteins.

16BI350 MOLECULAR MODELING

UNIT - I

INTRODUCTION TO MOLECULAR MODELLING: Introduction Useful Concepts in Molecular Modelling,Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. computer; Hardware and Software.

UNIT- II

FORCE FIELDS: Force Fields. Bond Stretching. Angle Bending. Introduction to Nonbonded Interactions. Electrostatic Interactions. Van der Waals Interactions. Hydrogen Bonding i_n Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

UNIT - III

ENERGY MINIMISATION AND COMPUTER SIMULATION : Energy Minimization and Related Methods for Exploring the Energy Surface. Non Derivative method, 1^{st} and 2^{nd} order minimization methods. Computer Simulation Methods. Simple Thermodynamic Properties and Phase Space. Boundaries. Analyzing the Results of a Simulation and Estimating Errors. GROMACS.

UNIT - IV

Molecular Dynamics & Monte Carlo Simulation : Molecular Dynamics Simulation Methods.

Molecular Dynamics Using Simple Models. Molecular Dynamics with Continuous Potentials.

Molecular Dynamics at Constant Temperature and Pressure. Metropolis Method. Monte Carlo Simulation of Molecules.

UNIT- V

STRUCTURE PREDICTION AND DRUG DESIGN: Protein Structure Prediction Introduction to Comparative Modeling. Constructing and Evaluating a Comparative Model. Molecular Docking (AUTODOCK). Drug design: Structure based, De NOVO ligand design

19BT332 HANDLING OF ANIMALS FOR EXPERIMENTS

UNIT-I

ANIMAL EXPERIMENTATION IN INDIA: History, Animals used in India in scientific and industrial research; Ethical issue in use of animals for scientific research - categories of animals used in scientific research, necessity of the animal in studies, scale of studies and related ethical issues and regulations; Legal issues related to animal experimentation - national and international legal regulations in scientific studies and development studies and its implications in pharmaceutical industries; Guidelines for care and use of animals in scientific research - basic guidelines for housing, maintenance of hygiene and health, regulatory approvals from statutory body and basic guidelines.

UNIT - II

ANIMAL MODELS IN MEDICAL EDUCATION AND RESEARCH: Basic animal models in medical education to understand anatomy and physiology of human body, Animal models used in medical research - guinea pigs, murine /rodent and primate models; Animal models in pharmaceutical Research - animal models used in pharmaceuticals studies for evaluation of toxicity and tolerance of novel drugs and drug derivatives, animal models in drug development; Animal models - murine, rodents and guinea pigs, dogs, horse, primates in drug development studies in evaluation of drug tolerance, efficacy and toxicity; Animal models in preclinical studies/trials - prerequisites of planning, pre-clinical studies and trials, animal models such as rodents, dogs, guinea pigs and horse used in preclinical studies.

UNIT-III

PRIMATES IN BIOMEDICAL RESEARCH: Primates in biomedical research, Drug development, Biometry and biosensor development and evaluation of physiological parameters in living organism; Product efficacy evaluation; Primates use in brain function and structure evaluation research; Imaging and biochemical quantification of vital parameters; Psychedelic and neurotrophic drug assessment studies.

UNIT-IV

LABORATORY ANIMALS IN DEVELOPMENT OF VETERINARY BIOLOGICALS AND PHARMACEUTICALS: Models like chicken, guinea pig, horse in development of live-stock biologics, vaccines and evaluation of efficacy, toxicity of small molecules and drugs.

UNIT-V

ANIMALS FOR TEACHING AND RESEARCH IN EDUCATIONAL INSTITUTIONS: Animal models like rodents (rats/mouse), drosophila, daphnia, cockroach, dogs, bovines etc in teaching and education; Alternatives to the experimental animals in biomedical research and testing - optimizing animal use-refinement and reduction; Development of animal free artificial bio-mimicking culture and tissue systems, 3D-cultures.

19BT433 MEDICINAL PLANTS AND ETHNO BOTANY

UNIT -I

INTRODUCTION TO MEDICINAL PLANTS: Introduction to medicinally important plant parts - fruits, leaves, stem and its modifications (underground and aerial), roots; Study of some medicinally important families with reference to systematic position; Diagnostic features and medicinal uses of Meliaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Zingiberaceae.

UNIT -II

GENERAL METHODS OF PROCESSING OF HERBS: Identification and authentication of herbs; Different methods of processing of herbs like collection, harvesting, garbling, packing and storage; Methods of drying - natural and artificial drying methods with their merits and demerits; Methods of preparation of extracts - principles of extraction and selection of suitable extraction method; Different methods of extraction including maceration, percolation, hot continuous extraction, pilot scale extraction and supercritical fluid extraction with their merits and demerits; Purification and recovery of solvents.

UNIT - III

MEDICINAL PLANT CULTIVATION: Medicinal plant cultivation, Origin, Evolution and cultivation methods of medicinal plants - *Aloe vera,* Ashwagandha, Daruhaldi, Isapgol, Brahmi, Kalmegh, *Andrographis paniculata,* Moringa, *Tinispora cordifolia,* Shankhpushpi, Thyme (Mint), Tulsi and Turmeric; Storage and protection, Marketing and utilization - export of medicinally important plants.

UNIT - IV

HERBAL COSMETICS: Cosmetics preparations - incorporating the herbal extracts in various cosmetic formulations like skin care preparations (creams and lotions), sunscreens and sunburn applications, hair care preparations (Hair oils and Hair shampoos) and beautifying preparations (lipsticks, face powders and nail polish); Skin care herbs - a) Lipids - Apricot, Ranolin, Beesay, Olive oil, Sesame oil (cleansing & emollient); b) Glycosides - Almond, Aloe, Ambi Holds, Rhubers, (emollient & skin pigmentation); c) Alkaloids - Black pepper, Vinca, Cinchona, Withania (anti pimples & ant cellulite).

UNIT- V

QUALITY CONTROL FOR MEDICINAL PLANTS: Quality Assurance: Concept of quality control, quality assurance & total quality controls; Sources of variation; Quality control of raw materials, pharmaceutical process & finished products; Documentation concepts of statistical quality control; Validation of pharmaceutical process (at least one case study of a process & analytical method); Contribution of National research laboratories (CDR!, CIMAP,RRC and NBRI) in medicinal plant research

17BT010 IMMUNOTECHNOLOGY

UNIT- I

METHODS USED IN IMMUNOLOGY: Preparation of antigens and antibodies, Purification of antibodies, Analysis of antibodies and antigens, Antigen-antibody reactions, Preparation and uses of various types of vaccines.

UNIT- II

IMMUNOLOGICAL TECHNIQUES: Immunodiffusion, One and two dimensional, Single radial immunodiffusion, Ouchterlonyimmuno double diffusion; Immuno-electrophoresis - rocket immuno-electrophoresis, CIE, Graber and William technique, electrophoresis and western blotting; Agglutination - direct and indirect, widal test, VDRL test; Radioimmunoassay - ELISA-principle, methodology and applications; Immunohistochemistry and immunofluorescence.

UNIT- III

HYBRIDOMA TECHNOLOGY: Production of polyclonal and monoclonal antibodies, Myeloma cell lines, Fusion of myeloma cells, Selection of hybridomas; Screening, Purification and application (biochemical research, clinical diagnosis and treatment) of monoclonal antibodies; Catalytic antibodies, Antibody immunotherapy, Productions of drugs to manage allergies, Antibody engineering.

UNIT - IV

ANIMAL CELL CULTURE: Importance, Sterilization methods, Media preparation - RPMI, DMEM; Cell lines - primary and established cell lines; Cell counting, Viability and ploidy using microscopy and flow cytometry; Staining techniques; Cryopreservation of primary cell lines, virus culture in chick embryo.

UNIT - V

TYPES OF VACCINES: Vaccines and subunit vaccines - against herpes simplex virus; Foot and mouth disease, Live recombinant vaccines-attenuated (Cholera, Salmonella), Vector vaccines directed against viruses and bacteria; Purified vaccines; DNA vaccines; Anti-fertility vaccines and anti-ovarian cancer vaccine.

19BI331 MOLECULAR INTERACTION

UNIT- I

PROTEIN-PROTEIN INTERACTIONS: Database for Protein-Protein interactions (DIP), Structural analysis, Solvent accessibility interactions of protein-protein interactions, Hydrogen bonds and salt bridges across PPI, Prediction of binding sites in protein-protein complexes, Energy-based approach for understanding the recognition mechanism of protein-protein complexes, Prediction of PPI pairs.

UNIT- II

PROTEIN-DNA INTERACTIONS: Structural analysis of interactions, DNA stiffness and protein-DNA binding specificity, Inter-and Intramolecular interactions, Discrimination of DNA-binding domains/ proteins, Prediction of DNA-binding sites, Databases for protein-DNA interactions.

UNIT - III

PROTEIN-RNA INTERACTIONS: Prediction of RNA-binding sites, Structural analysis, Methods for detecting Protein-RNA interactions, Databases for predicting protein-DNA interactions.

UNIT- IV

PROTEIN-LIGAND INTERACTIONS: Prediction of ligand-binding sites, Protein-ligand docking, Estimation of protein-ligand binding free energy, Scoring functions, Validation ligand and active site residues in protein structures, Protein-ligand databases.

UNIT- V

TOOLS AND SOFTWARES: Cytoscape for visualizing molecular interaction networks and biological pathways, SAPIN / Structural Analysis of Protein Interaction Networks, BindML, AutoDOCK, PatchDOCK, RPISeq, NUCPLOT, CAD-score, LigPlot.

19BT334 PLANT TISSUE CULTURE

UNIT - I

INTRODUCTION TO PLANT TISSUE CULTURE: introduction to plant tissue culture- terms and definitions, historical background, laboratory organization, tools and techniques, methods of sterilization; laboratory contaminants- their control and measures; micropropagation- micropropagation and its applications, types, stages, establishment of propagated plants, micropropagation for large scale multiplication of crop plants, forest trees, medicinal plants and ornamentals.

UNIT-II

MEDIA AND CULTURE PREPARATION: Role of micro and macro nutrients, vitamins and carbon source in tissue culture; Media preparation pH, temperature, solidifying agents and slant preparations, etc. Maintenance of cultures, environmental conditions and explants characteristics.

UNIT - III

CULTURE TECHNIQUES: Explants selection, sterilization, and inoculation; Various media preparations- MS, B5, SH and PC-L2; Callus and cell suspension culture; Hardening- hardening stages, the role of polyhouse, net house, compost, chemical fertilizer, cocopit and soil in hardening.

UNIT - IV

ACCLIMATIZATION: Role of ovary and ovule in *in vitro* fertilization in production of agricultural and horticultural crops; Techniques and significance of androgenesis and gynogenesis (ovary, ovule, egg and synergids culture); Propagation of commercial crops by tissue culture techniques such as banana, sugarcane, papaya, mango, some medicinal and aromatic plants.

UNIT - V

MICROPROPAGATION AND GERMPLASM PRESERVATION: Induction and growth parameters; Culture initiation, callus culture and micropropagation through various explants (leaf, stem, axillary bud, tuber, corms and bulbils); Floriculture - commercial floriculture, production of cut flowers and home floriculture; Disease and pest control in gardening-fungicides and pesticides; Germplasm preservation- definition, importance and methods, in-situ and ex-situ conservation, centers of germplasm presentation in India.

16BT251 PHYSIOLOGY AND HISTOLOGY

UNIT-I

DIGESTIVE, HEPATIC AND RESPIRATORY SYSTEMS: Digestive glands and tract- structure and functions, brief study of the organization of the digestion, absorption, and assimilation of food; Liver,pancreas and their functions.

Respiratory system - basic anatomy of the respiratory system, process of respiration, transport and exchange of oxygen and carbon dioxide in the body; Bohr effect; Haldane effect

UNIT - II

CIRCULATORY AND NERVOUS SYSTEM: Blood, RBC, WBC, platelets and lymph; Blood coagulation; Blond grouping and Rh factor; Circulatory system, heart structure and functions; Cardiac cycle, arterial And venous circulation; Central nervous system (CNS) - parts of the CNS; Neuron - structure and function.

UNIT -III

REPRODUCTIVE SYSTEM AND SENSE ORGANS: Reproductive system - anatomy of the male and female reproductive organs, menstrual cycle; Sense organs- structure and function of eye, ear, nose, tongue and skin.

UNIT - IV

HISTOLOGY- I: Introduction - secretory tissues; Endocrine glands; Structure and function of pituitary, thyroid, islets of Langerhans and adrenal gland; Exocrine glands.

UNIT - V

HISTOLOGY - II: Gross anatomy of kidney tissues, bone marrow, muscle, bone, cartilage, lung, and spinal cord.

16BT451 DRUG TOXICITY EVALUATION

UNIT- I

BASIC PRINCIPLES OF TOXICOLOGY: Introduction to toxicology; Pharmacological principle, mechanisms- receptor mediated vs. reactive intermediate mediated toxicity; Reactive oxygen species; modulators of toxicity- pharmacological factors, physiological factors and pathophysiological factors; ,toxicological evaluation.

UNIT - II

Toxins: Chemical carcinogens/radiation; Alcohols/analgesics; Pulmonary/Inhalation toxicants; health risk of tobacco and marijuana; Pychostimulants/antidepressants; Pesticides; Bacterial, insect and snake toxins; Heavy metals; Ozone and nanoparticles.

UNIT-III

EFFECTS OF TOXINS: Biotransformation of xenobiotics; Chemical carcinogenesis, genetic toxicology, neurotoxicology, molecular toxicology, reproductive toxicology, teratology and toxicogenomics; Understanding the role of cytochrome P450.

UNIT - IV

EVALUATION OF TOXINS: Dose-response and toxicity testing; Toxicokinetics; Risk assessment; Biomarkers of exposure and susceptibility factors; Food safety; Methods of evaluation-animal cell tines, *Caenorhabditis elegans* and animal models (mice, rabbit).

UNIT - V

REGULATIONS: Central Pollution Control Board (CPCB), Food and Drug Administration (FDA), Environmental Protection Agency (EPA); Impact of toxins on environment, biodiversity and population; Drug regulatory affairs- National and international regulatory aspects; Total quality management; QC and QA.

19BI335 METABOLIC PATHWAY

UNIT- I

OVERVIEW OF METABOLISM: High energy compounds; Oxidation-reduction reactions; The reactions of glycolysis; Termentation; Control of glycolysis; The pentose phosphate pathway, Glycogen breakdown and synthesis, Control of glycogen metabolism, Gluconeogenesis; Citric acid cycle - enzymes of the citric acid cycle, regulation of the citric acid cycle.

UNIT-II

PROTEIN METABOLISM: Amino acid deamination; Urea cycle; Breakdown of amino acids; Amino acid biosynthesis; The signal recognition particle targets.

UNIT-III

FATTY ACID METABOLISM: Lipid digestion - absorption and transport; Fatty acid oxidation; Ketone bodies; Fatty acid biosynthesis; Regulation of fatty acid metabolism.

UNIT-IV

NUCLEIC ACID METABOLISM: Synthesis of purine ribonucleotides; Synthesis of pyrimidine ribonucleotides; Formation of deoxyribonucleotides; Heme biosynthesis and degradation.

UNIT-V

REGULATION OF MAMMALIAN FUEL METABOLISM: Integration of fuel metabolism; The intestinal microbiome contributes to metabolism; Insulin promotes fuel use and storage; Glucagon and epinephrine trigger fuel mobilization; Additional hormones influence fuel metabolism (Adiponectin, Leptin, Resistin, Neuropeptide a, Cholecystokinin), AMP-dependent protein kinase acts as a fuel sensor; Diabetes is characterized by hyperglycemia; The metabolic syndrome links obesity and diabetes.

19BM314 PYTHON PROGRAMMING FOR MEDICAL APPLICATIONS

UNIT - I

BASICS OF PYTHON: Entering and storing data, Binding values to names, More python syntax Basics, Reading and converting user Input; Making decisions, Conditions in python, Making decisions simple if statements, multiple choice decisions.

UNIT-II

ITERATION AND LISTS: Iteration - for and while loops, terminating the current Iteration, sequence; Containers - lists and tuples, writing lists and tuples; Accessing sequence values - manipulatinglists and tuples.

UNIT-III

SETS AND DICTS: Sets and dicts, Creating sets, Working with wets, Working with dicts, Applying dicts - counting words.

UNIT-IV

FORMATTING: String Formatting, The format() method, Function arguments, Format field names, More about looping, Fun with the range() function, While loops and user input validation.

UNIT - V

READING AND WRITING FILES: Creating a new file, Writing to a file, Reading files as text, python's built-in functions, abs(x), bool(x), chr(i), The python standard library, Namespaces, python modules.

16EL103 16EL103 PROFESSIONAL COMMUNICATION LABORATORY

UNIT - I

Business English Vocabulary: Glossary of most *commonly* used words (formal and Informal usage).

Elements of Technical Writing: Sentence structure, reducing verbosity, arrangingIdeas logically, building coherence, cohesive devices and transitional words.

Mechanics of Writing: Stylistic elements, the purpose, the reader's viewpoint (audience), elementary rules of grammar, choice of diction, elementary principles of composition, matters of form, punctuation conventions of business communication, language and professional tone, code of conduct (not sending illegal, offensive, disparaging personal remarks or comments) in written business communication.

Activity: Basic grammar practice, framing paragraphs on topics allocated, paraphrasing an article or a video, finding topic sentences in newspaper articles, finding out new words from a professional viewpoint and understanding the meaning and its usage.

UNIT- II

Business Correspondence: E-mail: nature and scope, email etiquette, clear call for action, common errors in composing emails, office communication such as meeting agenda and minutes of the meeting, notice, circular and memo.

Letter-Writing: Formal and informal letters, structure of formal letters, expressions of salutations,different types of letters (such as sales letter, complaint letter, response to the complaint letter (dispute resolution), letter of permission, letter of enquiry, claim leer — letter of apology], introductory and concluding paragraphs and clear call for action.

Professional Proposal/Report: Differentiating proposals and reports, Drafting formal business proposals, types of reports such as factual reports, feasibility reports and survey reports, parts of a report (such as title page, declaration, acknowledgements, table of contents, abstract, introduction, findings, conclusion and recommendations).

Activity: Perusing samples of well-prepared business E-mails, memo, letter writing and short proposals and reports; Students will draft business correspondence writing tasks and different proposals/reports on topics assigned.

UNIT- III

Speaking: Speaking in business context, assertiveness, politeness, making requests, queries and questions, negotiations, asking for information, offering suggestions, conflict resolution, contacting clients, initiating, addressing delegates (in public), features of *a* good power-point presentation (making PPT), delivering the presentation effectively, telephone etiquettes, delivering seminar/ proposal/report effectively, team meeting etiquettes (face to face and conference call), making effective one minute presentations.

Activity: watching videos/listening to audios of business presentations, classroom activities of team and individual presentations, using PPTs, mock exercises for BEC speaking, presenting (speaking) the written components completed in Unit 1.

UNIT- IV

Reading: Reading and comprehending business documents, learning business register, regularizing the habit, speed reading business news, suitable vocabulary, skimming and scanning text for effective and speed reading and dealing with ideas from different sectors of the corporate world in different business contexts.

Activity: Hand-outs; matching the statements with texts, finding missing appropriate sentences in the text from multiple choice, using right vocabulary as per the given context and editing a paragraph.

UNIT -V

Listening: specific information in business context, listening to telephonic conversations/messages and Understanding the intended meaning, understanding the questions asked in interviews or in Professional settings, summarizing speaker's opinion or suggestion.

Activity: Working out BEC/TOEFL/IELTS listening exercises with hand-outs; matching the statements with texts finding missing appropriate sentence in the text from multiple choices, using right vocabulary in context -editing a paragraph, listening to a long conversation such as an interview and answer MCQs based on listening.

19BM213 BIOMEDICAL EQUIPMENTS

UNIT - I

Introduction to Medical Instrumentation: Block diagram of a medical instrumentation system; Bio-signals: Origin and characteristics of Bio potentials-ECG, EEG, EGG, EMG, ENG, EOG, and ERG; Problems encountered with measurements from human beings; Generalized medical instrument specifications, Electrode-Electrolyte Interface. Half-cell potential, Off set Voltage; Types of Electrodes-External, Internal and Microelectrodes; mathematical Treatment of Electrodes- Equivalent circuits and Applications.

UNIT - II

Medical Display Devices and Recorders: Display Devices- Basic requirements for the dis-play and recording of Bio-signals. Types of medical display devices; Medical recorders: Classification of recorders, PMMC writing systems; General features of ink-jet, thermo sensitive and optical recorders; Oscilloscopes: Basic description, Cathode Ray Oscilloscope (CRO), Dual beam oscilloscope. Analog storage oscilloscope, Digital storage oscilloscope, Medical, Multi Heme and Non-fade display systems; Liquid crystal displays- Introduction, Passive-matrix and active, matrix addressed LCDs.

UNIT - III

Cardiac Instrumentation: Electrocardiography, Block diagram. Circuits, electrodes and their placement; Lead configuration and general ECG waveforms; ECG monitors: Single channel and multi-channel ECG systems, Holier monitors, Stress test systems; Blood Pressure measurement-Introduction to blood pressure. Direct and indirect methods of Blood Pressure measurements. Blood How measurement: Introduction to hcmodynrunics. Electromagnetic and Ultrasonic techniques of Blood flow measurement; Heart sounds- Origin of Heart Sounds, Types of microphones for bean sound measurement, Contact and non-contact type of measurement, Phonocardiography.

16BM308 MEDICAL IMAGING TECHNIQUES

UNIT - I

BASIC MEDICAL IMAGING MODALITIES: X-ray, CT, Ultrasound, MRI, PET-CT, SPECT-CT, Gamma Camera, Catheterization Lab. Aspects of light imaging, convolutions and transforms, photometry lenses and depth of field, Image perception and 3D Imaging, Image acquisition, Display, Image processing operations, scanning & segmentation.

UNIT - II

BASIC CONCEPTS OF CT: Non-Spiral CT technology, Concepts of Spiral CT Scanner, Multi-Slice spiral technology, Various Peripheral devices. Applications: Multiplanar Reconstruction, Maximum Intensity Projection, 3D, CT Angio, Osteo, Dental, Perfusion (Body & Neuro), Virtual Endoscopy, Cardiac CT (Calcium scoring, Coronary Angiography, Lesion Quantification).

UNIT - III

MAGNETIC RESONANCE IMAGING: Permanent & Superconducting magnets, Signal generation, and detection, signal characteristics, signal localization, Fourier transforms in MRI, Imaging Reconstruction. Image artifacts. Coil technology, Parallel acquisition techniques, Various peripheral devices. Applications: Functional Imaging, Perfusion & Diffusion imaging (Echo planar imaging), Multi direction diffusion tensor imaging, Single & Multi Voxel Spectroscopy, MR Angiography, MRCP, Cardiac MRI (Myocardium viability, Valve function, etc.,), Flow Quantification.

UNIT - IV

ULTRASOUND SCANNER: Principles of Ultrasound, Basic Ultrasound instrumentation, Imaging techniques (A mode, B Mode, 2B, B/M, 4B, Gated Mode, 3D, 4D, M-Mode, Echocardiography), Image recording devices, Image artifact, Biological effects.

UNIT - V

GAMMA CAMERA: Physics of Gamma camera, basic Instrumentation, Imaging techniques, SPECT &Whole Body studies; Applications of Gamma camera in Cardiology, Nephrology, Neurology, etc., PET: Fundamentals of PET scanner & PET- CT, Crystal technology, Cyclotron principle, Hot Lab Equipment, Applications of PET; Cardiology, Neurology & Cardiology.

19CS101 PROGRAMMING FOR PROBLEM SOLVING

UNIT - I

INTRODUCTION TO C: Structure of a C program; pre-processor statement, inline comments, Variable declaration statement, Executable statement; C Tokens: C Character set, Identifiers and keywords, Type qualifiers and Type modifiers, Variables and constants, Punctuations, and operators. Data Types: Basic data types; Storage classes; scope of a variable; Formatted I/O; Reading and writing characters;

UNIT - II

OPERATORS AND CONTROL STATEMENTS: Operators - assignment, arithmetic, relational, logical, bitwise, ternary, address, indirection, sizeof, dot, arrow, parentheses operators; Expressions - operator precedence, associative rules; Control statements - category of statements, selection, iteration, jump, label, expression and block.

UNIT - III

ARRAYS AND FUNCTIONS: Array - declaration, initialization, reading, writing, accessing and passing as a parameter to functions, 2D-arrays, multidimensional arrays; Function - declaration, prototype, definition, calling by value and call by address, standard library functions and recursive functions.

UNIT - IV

STRINGS AND POINTERS: Strings - declaration, string library functions, array of strings, command line arguments; Pointers - declaration, initializing pointers, multiple indirection, relationship between arrays and pointers; Dynamic memory allocation functions.

UNIT - V

STRUCTURES AND UNIONS: Structures - defining a structure, declaration of a structure objects, operations on structures; Pointers to a structure; Array of structures; Nested structures; Unions; Bit – Fields.

18BP101 GOOD PRACTICE QUALITY GUIDELINES AND REGULATIONS

UNIT – I

Good Laboratory Practice: Fundamentals, WHO guidelines, Role of OECD, Responsibilities of Management, Sponsor, Study director, Principal Investigator, Study and quality assurance personnel.

UNIT – II

Facilities: Testing, Building, Materials, Equipments, test systems and study performance.

UNIT – III

Quality assurance: Review of Protocol, SOP, Master Schedule, Inspection Plan, Audits, and Inspections, functions and advantages

UNIT – IV

Quality Assurance: statements, inspection of material suppliers, reporting of results, Archiving, Indexing, Maintenance of files and records.

UNIT – V

Quality standards: Concept of Quality Control, quality of chemicals, drugs, role of Regulatory agencies and good laboratory practices.

18BP102 SUPPLY CHAIN MANAGEMENT

UNIT- I

Introduction, Definitions, Components of supply chain, Elements and Flow of Supply chain, Strategy, importance of supply chain visibility, coordination, and collaboration

UNIT- II

Importance of supply chain visibility, coordination, and collaboration,executing supply chain trade-offs in balancing supply with demand, Understanding and executing supply chain decisions.

UNIT- III

Types of inventory, their costs, and their relationships to inventory decision, Economic Order Quantity approach to inventory decision, solving problems using the model

UNIT- IV

Classification of inventory, Principle of Postponement and it's supporting inventory concepts. Characterize demand Management and the Sales & Operations Process balancing supply and demand in uncertainty, Role of supply chain design in firm's success, forecasting methods

UNIT-V

role of transportation in Supply Chain, characteristics of primary transportation modes, carrier selection and evaluation, cost metrics to analyze transportation performance and sourcing

18BP103 SCALE UP AND TECH TRANSFER

1. Pilot plant design:

Basic requirements for design, facility, equipment selection, for tablets, capsules, liquid orals, parenterals and semisolid preparations.

2. Scale up:

Importance, Technology transfer from R & D to pilot plant to plant scale, process scale up for tablets, capsules, liquid orals, semisolids, parenterals, NDDS products - formula, equipments, product uniformity, stability, raw materials, physical layout, input, in-process and finished product specifications, problems encountered during transfer of technology.

3. Validation:

General concepts, types, procedures & protocols, documentation, VMF. Analytical method validation, cleaning validation and vender qualification.

4. Equipment Qualification:

Importance, IQ, OQ, PQ for equipment - autoclave, DHS, membrane filter, rapid mixer granulator, cone blender, FBD, tablet compression machine, liquid filling and sealing machine.

5.Process validation:

Importance, validation of mixing, granulation, drying, compression, tablet coating, liquid filling and sealing, sterilization, water process systems, environmental control.

18BP104 METHOD TRANSFER, QUALITY CONTROL AND ASSURANCE

UNIT- I

INTRODUCTION: Concept and evolution of Quality Control and Quality Assurance, GLP, GMP, Overview of ICH Guidelines, QSEM-with special emphasis on Q-series guidelines.

UNIT- II

CGMP GUIDELINES: ICH, Pharmaceutical Inspection Convention(PIC), WHO and EMEA emphasizing on Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

UNIT-III

ICH GUIDELINES: Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), developing specifications according to ICH for raw materials stores. In process quality control of finished products - tablets, capsules and parenterals in Pharmaceutical industry according to pharmacopoeia, Quality control test for containers, closures and secondary packing materials.

UNIT- IV

DOCUMENTATION IN PHARMACEUTICAL INDUSTRY: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles of document maintenance, retention and retrieval etc. Standard operating procedures for preparing Master Formula Record, Batch Formula Record, Quality audit plan and reports. Specifications and test procedures, Protocols and reports. Distribution records and Electronic data.

UNIT-V

MANUFACTURING OPERATIONS AND CONTROLS: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, chargein of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging.

18BP105 CLINICAL DATA MANAGEMENT

UNIT – I

INTRODUCTION: Process, work flow, steps in CDM, Data entry, data tracking, code of ethics

UNIT – II

STANDARD OPERATING PROCEDURES: Study set-up, data entry, CRF tracking and corrections, laboratory management, ADR data, guidelines

UNIT – III

DATA MANAGEMENT PLANNING: Data coding (significance, quality, dictionaries, symbols, problems, adverse effect), software handling, overcoming challenges

UNIT –IV

DATA COLLECTION AND PROCESSING : Types of data collection procedures (capture) i.e. paper and electronic, data flow procedures, data capture tools, advantages and disadvantages, data processing methods

UNIT – V

AUDIT AND VALIDATION: Design validation, process validation, system validation, Discrepancy management system, edit check specifications, query management, cleaning data checklist, SAE reconciliation, managing laboratory data, data locking/freezing

18BP106 HEALTH CARE MANAGEMENT

UNIT- I

Introduction: overview, leadership, management and motivation, communicating & directing, team work, health administration in India,

UNIT- II

Fundamentals : organizational behavior, strategic planning, national health policy and health programmes, health care delivery, marketing, management and thinking, medical ethics

UNIT- III

Hospital : health care professional and human resource management, clinical and non clinical services,

UNIT- IV

medical terminology: fundamentals, common diseases and procedures of various systems (gastrointestinal, renal, respiratory, circulatory, nervous)

UNIT- V

information technology: Importance, overview and handling of softwares and databases, maintenance of hospital and patient records,

RECOMMENDED BOOKS (LATEST EDITIONS)

1. Vine Kumar, Abu K. Abase, Jon C. Aster; Robbins &Cot ran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6thedition; India; Jayvee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill;2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Bernard); Best and Taylor's Physiological basis of medical practice; 12th end; united states;
5. William and Wilkins, Baltimore; 1991 [1990printing].
6. Nicky R. College, Brian R. Walker, Stuart H. Ralston; Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph Dipper, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Path physiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cot ran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

RECOMMENDED JOURNALS

1. The Journal of Pathology. ISSN: 1096-9896(Online)
2. The American Journal of Pathology. ISSN:0002-9440
3. Pathology. 1465-3931 (Online)