BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

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

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

Course Content:

Unit I **10 hours**

- **Introduction to human body**
  Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.
- **Cellular level of organization**
  Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine
- **Tissue level of organization**
  Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II **10 hours**

- **Integumentary system**
  Structure and functions of skin
- **Skeletal system**
  Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system
  Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

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

Unit III **10 hours**

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

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

Unit IV **08 hours**

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

- **Special senses**
  Structure and functions of eye, ear, nose and tongue and their disorders.

Unit V **07 hours**

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

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones

6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of blood pressure.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books (Latest Editions)

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

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **10 Hours**

(a) Pharmaceutical analysis- Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

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

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

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

UNIT-II **10 Hours**

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

UNIT-III **10 Hours**

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

- Basic Principles,methods and application of diazotisation titration.

UNIT-IV **08 Hours**

Redox titrations

(a) Concepts of oxidation and reduction

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

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

UNIT-V **07 Hours**

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

BP108P. PHARMACEUTICAL ANALYSIS (Practical)

4 Hours / Week

I **Limit Test of the following**
- (1) Chloride
- (2) Sulphate
- (3) Iron
- (4) Arsenic

II **Preparation and standardization of**
- (1) Sodium hydroxide
- (2) Sulphuric acid
- (3) Sodium thiosulfate
- (4) Potassium permanganate
- (5) Ceric ammonium sulphate

III **Assay of the following compounds along with Standardization of Titrant**
- (1) Ammonium chloride by acid base titration
- (2) Ferrous sulphate by Cerimetry
- (3) Copper sulphate by Iodometry
- (4) Calcium gluconate by complexometry
- (5) Hydrogen peroxide by Permanganometry
- (6) Sodium benzoate by non-aqueous titration
- (7) Sodium Chloride by precipitation titration

IV **Determination of Normality by electro-analytical methods**
- (1) Conductometric titration of strong acid against strong base
- (2) Conductometric titration of strong acid and weak acid against strong base
- (3) Potentiometric titration of strong acid against strong base

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

BP103T. PHARMACEUTICS- I (Theory)

45 Hours

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

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

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

Course Content:

UNIT – I **10 Hours**

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

UNIT – II **10 Hours**

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

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

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

UNIT – III **08 Hours**

- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type ofEmulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV **08 Hours**

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

UNIV – V **07 Hours**

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

BP109P. PHARMACEUTICSI (Practical)

3 Hours / week

1 . Syrups

a) Syrup IP'66

b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs a) Piperazine citrate elixir

b) Paracetamol pediatric elixir

3.Linctus a) Terpin Hydrate Linctus IP'66

b) Iodine Throat Paint (Mandles Paint)

4. Solutions

a) Strong solution of ammonium acetate

b) Cresol with soap solution

c) Lugol's solution

5. Suspensions

a) Calamine lotion

b) Magnesium Hydroxide mixture

c) 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

8. Semisolids

a) Sulphur ointment

b) Non staining-iodine ointment with methyl salicylate

c) Carbopal gel

9. Gargles and Mouthwashes

a) Iodine gargle

b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

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

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

45 Hours

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

Objectives: Upon completion of course student shall be able to

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

Course Content:

UNIT I **10 Hours**

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

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

UNIT II **10 Hours**

- **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.
- **Major extra and intracellular electrolytes**: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.
- **Dental products**: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

UNIT III **10 Hours**

- **Gastrointestinal agents**

  Acidifiers: Ammonium chloride* and Dil. HCl

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

Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

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

UNIT IV **08 Hours**

- **Miscellaneous compounds**

  Expectorants: Potassium iodide, Ammonium chloride*.

  Emetics: Copper sulphate*, Sodium potassium tartarate

  Haematinics: Ferrous sulphate*, Ferrous gluconate

  Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333

  Astringents: Zinc Sulphate, Potash Alum

UNIT V **07 Hours**

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

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

I **Limit tests for following ions**

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

II **Identification test**

Magnesium hydroxide
Ferrous sulphate
Sodium bicarbonate
Calcium gluconate
Copper sulphate

III **Test for purity**

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

IV **Preparation of inorganic pharmaceuticals**

Boric acid
Potash alum
Ferrous sulphate

Recommended Books (Latest Editions)

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

BP105T.COMMUNICATION SKILLS (Theory)

30 Hours

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

Objectives:

Upon completion of the course the student shall be able to

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

Course content:

UNIT – I **07 Hours**

- **Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

- **Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

- **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT – II **07 Hours**

- **Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

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

UNIT – III **07 Hours**

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

UNIT – IV **05 Hours**

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

UNIT – V **04 Hours**

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

BP111P.COMMUNICATION SKILLS (Practical)

2 Hours / week

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

Basic communication covering the following topics

Meeting People

Asking Questions

Making Friends

What did you do?

Do's and Dont's

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)

Pronunciation and Nouns

Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech

Figures of Speech

Effective Communication

Writing Skills

Effective Writing

Interview Handling Skills

E-Mail etiquette

Presentation Skills

Recommended Books: (Latest Edition)

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

BP 106RBT.REMEDIAL BIOLOGY (Theory)

30 Hours

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

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

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

UNIT I 07 Hours

Living world:

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

Morphology of Flowering plants

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

UNIT II 07 Hours

Body fluids and circulation

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

Digestion and Absorption

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

Breathing and respiration

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

UNIT III **07 Hours**

Excretory products and their elimination

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

Neural control and coordination

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

Chemical coordination and regulation

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

Human reproduction

- Parts of female reproductive system
- Parts of male reproductive system
- Spermatogenesis and Oogenesis
- Menstrual cycle

UNIT IV **05 Hours**

Plants and mineral nutrition:

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

Photosynthesis

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

UNIT V **04 Hours**

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

Plant growth and development

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

Cell - The unit of life

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

Tissues

- Definition, types of tissues, location and functions.

Text Books

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

Reference Books

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

BP112RBP.REMEDIAL BIOLOGY (Practical)

30 Hours

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

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

BP 106RMT.REMEDIAL MATHEMATICS (Theory)

30 Hours

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

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

1. Know the theory and their application in Pharmacy
2. Solve the different types of problems by applying theory
3. Appreciate the important application of mathematics in Pharmacy

Course Content:

UNIT – I **06 Hours**

- **Partial fraction**

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

- **Logarithms**

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

- **Function***:*

Real Valued function, Classification of real valued functions,

- **Limits and continuity** :

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

UNIT –II **06 Hours**

- **Matrices and Determinant:**

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

UNIT – III **06 Hours**

- **Calculus**

Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n *w.r.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 **06 Hours**

- **Analytical Geometry**

Introduction: Signs of the Coordinates, Distance formula,

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

Integration:

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

UNIT-V **06 Hours**

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

Recommended Books (Latest Edition)

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

Semester II

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

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

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

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

Course Content:

Unit I **10 hours**

- **Nervous system**

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

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

Unit II **06 hours**

- **Digestive system**

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

and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

- **Energetics**

  Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III

- **Respiratory system** **10 hours**

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

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

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

Unit IV **10 hours**

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

Unit V **09 hours**

- **Reproductive system**

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

- **Introduction to genetics**

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

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

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

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA

4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books:

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

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

45 Hours

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

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

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

Course Content:

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

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

UNIT-I **07 Hours**

- **Classification, nomenclature and isomerism**

  Classification of Organic Compounds

  Common and IUPAC systems of nomenclature of organic compounds

  (up to 10 Carbons open chain and carbocyclic compounds)

Structural isomerisms in organic compounds

UNIT-II10 Hours

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

  SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

  Stabilities of alkenes, SP^2 hybridization in alkenes

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

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

UNIT-III10 Hours

- **Alkyl halides***

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

  SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions

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

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

UNIT-IV10 Hours

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

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

UNIT-V **08 Hours**

- **Carboxylic acids***

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

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

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

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours / week

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

Recommended Books (Latest Editions)

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

BP203 T. BIOCHEMISTRY (Theory)

45 Hours

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

Objectives: Upon completion of course student shell able to

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

Course Content:

UNIT I **08 Hours**

- **Biomolecules**

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

- **Bioenergetics**

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

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

UNIT II **10 Hours**

- **Carbohydrate metabolism**

  Glycolysis – Pathway, energetics and significance

  Citric acid cycle- Pathway, energetics and significance

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

  Glycogen metabolism Pathways and glycogen storage diseases (GSD)

  Gluconeogenesis- Pathway and its significance

  Hormonal regulation of blood glucose level and Diabetes mellitus

- **Biological oxidation**

  Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation

Inhibitors ETC and oxidative phosphorylation/Uncouplers

UNIT III **10 Hours**

- **Lipid metabolism**

  β-Oxidation of saturated fatty acid (Palmitic acid)

Formation and utilization of ketone bodies; ketoacidosis

De novo synthesis of fatty acids (Palmitic acid)

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

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

- **Amino acid metabolism**

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

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

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

  Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV **10 Hours**

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

  Biosynthesis of purine and pyrimidine nucleotides

  Catabolism of purine nucleotides and Hyperuricemia and Gout disease

  Organization of mammalian genome

  Structure of DNA and RNA and their functions

  DNA replication (semi conservative model)

  Transcription or RNA synthesis

  Genetic code, Translation or Protein synthesis and inhibitors

UNIT V **07 Hours**

- **Enzymes**

  Introduction, properties, nomenclature and IUB classification of enzymes

  Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)

  Enzyme inhibitors with examples

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

  Therapeutic and diagnostic applications of enzymes and isoenzymes

  Coenzymes –Structure and biochemical functions

BP 209 P. BIOCHEMISTRY (Practical)

4 Hours / Week

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. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayan and U.Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

BP 204T.PATHOPHYSIOLOGY (THEORY)

45Hours

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

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

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

Course content:

Unit I **10Hours**

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

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

Unit II **10Hours**

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

Unit II **10Hours**

- **Haematological Diseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
- **Gastrointestinal system:** Peptic Ulcer
-

Unit IV **8 Hours**

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Principles of cancer:** classification, etiology and pathogenesis of cancer
- **Diseases of bones and joints:**Rheumatoid Arthritis, Osteoporosis,Gout

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

Unit V **7 Hours**

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

Urinary tract infections

- **Sexually transmitted diseases:**AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
5. William and Wilkins, Baltimore;1991 [1990 printing].
6. Nicki R. Colledge, 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 DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran 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)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

30 Hrs (2 Hrs/Week)

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

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

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

Course content:

UNIT – I **06 hours**

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

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

UNIT –II **06 hours**

Web technologies:Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products

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

UNIT – III **06 hours**

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring

Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System

UNIT – IV **06 hours**

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

UNIT-V **06 hours**

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

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

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

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

30 hours

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

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

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

Course content:

Unit-I **10hours**

The Multidisciplinary nature of environmental studies

Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

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

Unit-II **10hours**

Ecosystems

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

Unit- III **10hours**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

SEMESTER III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

45 Hours

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

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

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

Course Content:

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

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

UNIT I **10 Hours**

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

UNIT II **10 Hours**

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

UNIT III

10 Hours

- **Fats and Oils**

a. Fatty acids – reactions.

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

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

UNIT IV **08 Hours**

- **Polynuclear hydrocarbons:**

a. Synthesis, reactions

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

UNIT V **07 Hours**

- **Cyclo alkanes***

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

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 Hrs/week

I Experiments involving laboratory techniques

- Recrystallization
- Steam distillation

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

- Acid value
- Saponification value
- Iodine value

III **Preparation of compounds**

- Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
- 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
- Acetanilide by halogenation (Bromination) reaction.
- 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
- Benzoic acid from Benzyl chloride by oxidation reaction.
- Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
- 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
- Benzil from Benzoin by oxidation reaction.
- Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
- Cinnammic acid from Benzaldehyde by Perkin reaction
- *P*-Iodo benzoic acid from *P*-amino benzoic acid

Recommended Books (Latest Editions)

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

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

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45Hours

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

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

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

Course Content:

UNIT-I **10 Hours**

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

UNIT-II **10Hours**

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

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

UNIT-III **08 Hours**

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

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

UNIT-IV **08Hours**

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

UNIT-V **07 Hours**

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

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

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

Recommended Books: (Latest Editions)

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

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45Hours

Scope:

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

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

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

Course content:

Unit I **10 Hours**

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

Unit II **10 Hours**

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

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

Evaluation of the efficiency of sterilization methods.

Equipments employed in large scale sterilization.

Sterility indicators.

Unit III **10 Hours**

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

Classification and mode of action of disinfectants

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

Evaluation of bactericidal & Bacteriostatic.

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

Unit IV **08 Hours**

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

Unit V **07Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research.

BP 307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

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

Recommended Books (Latest edition)

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

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

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

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

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

Course content:

UNIT-I **10 Hours**

- **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 **10 Hours**

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

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

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

UNIT- III **08 Hours**

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

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

UNIT-IV **08 Hours**

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

UNIT- V **07 Hours**

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

Recommended Books: (Latest Editions)

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

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

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

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

Note: Emphasize on definition, types, mechanisms, examples, uses/applications

UNIT-I

Stereo isomerism

Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules. DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers

Reactions of chiral molecules

Racemic modification and resolution of racemic mixture.

Asymmetric synthesis: partial and absolute

UNIT-II

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

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

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

UNIT-III

Heterocyclic compounds:

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

UNIT-IV

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

UNIT-V

Reactions of synthetic importance

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

Recommended Books (Latest Editions)

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

BP402T. MEDICINAL CHEMISTRY – I (Theory)

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

Introduction to Medicinal Chemistry. History and development of medicinal chemistry

Physicochemical properties in relation to biological action

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

Drug metabolism

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

UNIT- II

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

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

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

Adrenergic Antagonists:

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

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

UNIT-III

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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

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

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

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

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

UNIT- IV

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:
Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem. **Barbiturtes:** SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital. **Miscelleneous:** Amides & imides: Glutethmide, Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol, Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

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

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

Recommended Books (Latest Editions)
Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
Foye's Principles of Medicinal Chemistry.
Burger's Medicinal Chemistry, Vol I to IV.
Introduction to principles of drug design- Smith and Williams.
Remington's Pharmaceutical Sciences.
Martindale's extra pharmacopoeia.
Organic Chemistry by I.L. Finar, Vol. II.
The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
Indian Pharmacopoeia.
Text book of practical organic chemistry- A.I.Vogel.

BP406P. MEDICINAL CHEMISTRY – I (Practical)

I.Preparation of drugs/ intermediates

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

II.Assay of drugs

Chlorpromazine, Phenobarbitone, Atropine, Ibuprofen, Aspirin, Furosemide

III.Determination of Partition coefficient for any two drugs

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

UNIT-I

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

UNIT-II

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

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Recommended Books: (Latest Editions)

Physical Pharmacy by Alfred Martin, Sixth edition
Experimental pharmaceutics by Eugene, Parott.
Tutorial pharmacy by Cooper and Gunn.
Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3,
Marcel Dekkar Inc.
Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3.
Marcel Dekkar Inc.
Physical Pharmaceutics by Ramasamy C, and Manavalan R.

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

Determination of particle size, particle size distribution using sieving method

Determination of particle size, particle size distribution using Microscopic method

Determination of bulk density, true density and porosity

Determine the angle of repose and influence of lubricant on angle of repose

Determination of viscosity of liquid using Ostwald's viscometer

Determination sedimentation volume with effect of different suspending agent

Determination sedimentation volume with effect of different concentration of single suspending agent

Determination of viscosity of semisolid by using Brookfield viscometer

Determination of reaction rate constant first order.

Determination of reaction rate constant second order

Accelerated stability studies

BP 404 T. PHARMACOLOGY-I (Theory)

UNIT-I

General Pharmacology

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.

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

UNIT-II

General Pharmacology

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

Adverse drug reactions. Drug interactions (pharmacokinetic and pharmacodynamic)

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

Pharmacology of drugs acting on peripheral nervous system

Organization and function of ANS.

Neurohumoral transmission,co-transmission and classification of neurotransmitters.

Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).

Local anesthetic agents.

Drugs used in myasthenia gravis and glaucoma

UNIT-IV

Pharmacology of drugs acting on central nervous system

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

General anesthetics and pre-anesthetics**.**

Sedatives, hypnotics and centrally acting muscle relaxants.

Anti-epileptics

Alcohols and disulfiram

UNIT-V

Pharmacology of drugs acting on central nervous system

Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
Drugs used in Parkinsons disease and Alzheimer's disease.
CNS stimulants and nootropics.
Opioid analgesics and antagonists
Drug addiction, drug abuse, tolerance and dependence.

Recommended Books (Latest Editions)

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

BP 408 P.PHARMACOLOGY-I (Practical)

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

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

BP 405 T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

UNIT-I

Introduction to Pharmacognosy:
Definition, history, scope and development of Pharmacognosy
Sources of Drugs – Plants, Animals, Marine & Tissue culture
Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).
Classification of drugs:
Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs
Quality control of Drugs of Natural Origin:
Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.
Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II

Cultivation, Collection, Processing and storage of drugs of natural origin:
Cultivation and Collection of drugs of natural origin
Factors influencing cultivation of medicinal plants.
Plant hormones and their applications.Polyploidy, mutation and hybridization with reference to medicinal plants
Conservation of medicinal plants

UNIT-III

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

UNIT IV

Pharmacognosy in various systems of medicine:
Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.
Introduction to secondary metabolites:
Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT V

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs
Plant Products:
Fibers - Cotton, Jute, Hemp
Hallucinogens, Teratogens, Natural allergens

Primary metabolites:
General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey **Proteins and Enzymes :** Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).**Lipids(Waxes, fats, fixed oils)** : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax **Marine Drugs:** Novel medicinal agents from marine sources

Recommended Books: (Latest Editions)

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

BP409 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

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

SEMESTER V

BP501T. MEDICINAL CHEMISTRY – II (Theory)

45 Hours

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

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

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

Course Content:

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

UNIT- I **10 Hours**

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

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

H_2-antagonists: Cimetidine*, Famotidine, Ranitidin.

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

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan,

Chlorambucil, Busulfan, Thiotepa

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

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

Anti-anginal:

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

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

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

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

UNIT- III **10 Hours**

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

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

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

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

UNIT- IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.
Drugs for erectile dysfunction: Sildenafil, Tadalafil.
Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol
Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone
Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT – V **07 Hours**

Antidiabetic agents:

Insulin and its preparations

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

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

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

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

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

Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

Recommended Books (Latest Editions)

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

BP 502 T. Industrial PharmacyI (Theory)

45 Hours

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

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

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

Course content:

3 hours/ week

UNIT-I **07 Hours**

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

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

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

BCS classification of drugs & its significant

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

UNIT-II **10 Hours**

Tablets:

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

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

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

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

UNIT-III **08 Hours**

Capsules:

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

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

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

UNIT-IV **10 Hours**

Parenteral Products:

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

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

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

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

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

UNIT-V **10 Hours**

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

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

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

BP 506 P. Industrial PharmacyI (Practical)

4 Hours/week

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

Recommended Books: (Latest Editions)

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

BP503.T. PHARMACOLOGY-II (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **10hours**

1. Pharmacology of drugs acting on cardio vascular system

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

UNIT-II **10hours**

1. Pharmacology of drugs acting on cardio vascular system

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

2. Pharmacology of drugs acting on urinary system

a. Diuretics
b. Anti-diuretics.

UNIT-III **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. Antirheumatic drugs

UNIT-IV **08hours**

5. Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitary hormones- analogues and their inhibitors.
c. Thyroid hormones- analogues and their inhibitors.
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and 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

BP 507 P. PHARMACOLOGY-II (Practical)

4Hrs/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 abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of 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 carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

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

Recommended Books (Latest Editions)

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

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

45Hours

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

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

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

Course Content:

UNIT-I **7 Hours**

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **14 Hours**

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

secondary metabolites:

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

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

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

UNIT-IV **10 Hours**

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

UNIT V **8 Hours**

Basics of Phytochemistry

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

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

4 Hours/Week

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

Recommended Books: (Latest Editions)

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

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

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

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

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

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

UNIT-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

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

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

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

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

UNIT-III **10 Hours**

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

Penalties

- **Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.
- **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV **08 Hours**

- **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties
- **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties
- **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V **07 Hours**

- **Pharmaceutical Legislations –** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee
- **Code of Pharmaceutical ethics** D efinition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath
- **Medical Termination of Pregnancy Act**
- **Right to Information Act**
- **Introduction to Intellectual Property Rights (IPR)**

Recommended books: (Latest Edition)

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)

SEMESTER VI

BP601T. MEDICINAL CHEMISTRY – III (Theory)

45 Hours

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

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

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

Course Content:

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

UNIT – I **10 Hours**

Antibiotics

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

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II **10 Hours**

Antibiotics

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

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

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

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III **10 Hours**

Anti-tubercular Agents

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

Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate.

Urinary tract anti-infective agents

Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

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

UNIT – IV **08 Hours**

Antifungal agents:

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

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

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

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

Sulphonamides and Sulfones

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

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **07 Hours**

Introduction to Drug Design

Various approaches used in drug design.

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

Pharmacophore modeling and docking techniques.

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

BP607P. MEDICINAL CHEMISTRY- III (Practical)

4 Hours / week

I Preparation of drugs and intermediates

1 Sulphanilamide

2 7-Hydroxy, 4-methyl coumarin

3 Chlorobutanol

4 Triphenyl imidazole

5 Tolbutamide

6 Hexamine

II Assay of drugs

1 Isonicotinic acid hydrazide

2 Chloroquine

3 Metronidazole

4 Dapsone

5 Chlorpheniramine maleate

6 Benzyl penicillin

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

IV Drawing structures and reactions using chem draw®

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

Recommended Books (Latest Editions)

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

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

BP602 T. PHARMACOLOGY-III (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **10hours**

1. Pharmacology of drugs acting on Respiratory system

a. Anti -asthmatic drugs
b. Drugs used in the management of COPD
c. Expectorants and antitussives
d. Nasal decongestants
e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhoea.
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics.

UNIT-II **10hours**

3. Chemotherapy

a. General principles of chemotherapy.

b. Sulfonamides and cotrimoxazole.

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

UNIT-III **10hours**

3. Chemotherapy

a. Antitubercular agents

b. Antileprotic agents

c. Antifungal agents

d. Antiviral drugs

e.Anthelmintics

f. Antimalarial drugs

g. Antiamoebic agents

UNIT-IV **08hours**

3. Chemotherapy

l. Urinary tract infections and sexually transmitted diseases.

m. Chemotherapy of malignancy.

4. Immunopharmacology

a. Immunostimulants

b. Immunosuppressant

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

UNIT-V **07hours**

5. Principles of toxicology

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

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

c. General principles of treatment of poisoning

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

6. Chronopharmacology

a. Definition of rhythm and cycles.

b. Biological clock and their significance leading to chronotherapy.

BP 608 P. PHARMACOLOGY-III (Practical)

4Hrs/Week

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

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

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

BP 603 T. HERBAL DRUG TECHNOLOGY (Theory)

45 hours

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

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

1. understand raw material as source of herbal drugs from cultivation to herbal drug product
2. know the WHO and ICH guidelines for evaluation of herbal drugs
3. know the herbal cosmetics, natural sweeteners, nutraceuticals
4. appreciate patenting of herbal drugs, GMP .

Course content:

UNIT-I **11 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation
Source of Herbs
Selection, identification and authentication of herbal materials
Processing of herbal raw material

Biodynamic Agriculture

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

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy
b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

UNIT-II **7 Hours**

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.
Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

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

UNIT-III **10 Hours**

Herbal Cosmetics

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:
a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy
b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

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

UNIT-V **07 Hours**

General Introduction to Herbal Industry
Herbal drugs industry: Present scope and future prospects.
A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine
Components of GMP (Schedule – T) and its objectives
Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

BP 609 P. HERBAL DRUG TECHNOLOGY (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 & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **10 Hours**

Introduction to Biopharmaceutics

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

UNIT- II **10 Hours**

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

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

UNIT- III **10 Hours**

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

UNIT- IV **08 Hours**

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

UNIT- V **07 Hours**

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity.
c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Recommended Books: (Latest Editions)

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 Inernational edition.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. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi 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 Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)

45 Hours

Scope:

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

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

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

Unit I **10 Hours**

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

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

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

d) Brief introduction to Protein Engineering.

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

f) Basic principles of genetic engineering.

Unit II **10 Hours**

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

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

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

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

d) Brief introduction to PCR

Unit III **10 Hours**

Types of immunity- humoral immunity, cellular immunity

a) Structure of Immunoglobulins
b) Structure and Function of MHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines
f) Hybridoma technology- Production, Purification and Applications
g) Blood products and Plasma Substituties.

Unit IV **08Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
b) Genetic organization of Eukaryotes and Prokaryotes
c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
d) Introduction to Microbial biotransformation and applications.
e) Mutation: Types of mutation/mutants.

Unit V **07 Hours**

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
b) Large scale production fermenter design and its various controls.
c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
2. RA Goldshy et. al., : Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal

Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

BP606TPHARMACEUTICAL QUALITY ASSURANCE (Theory)

45 Hours

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

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

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

Course content:

UNIT – I **10 Hours**

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

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

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

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

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

NABL accreditation : Principles and procedures

UNIT - II **10 Hours**

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

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

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

UNIT – III **10 Hours**

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

materials.

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

UNIT – IV **08 Hours**

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

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

UNIT – V **07 Hours**

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

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

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

SEMESTER VII

BP701T.INSTRUMENTALMETHODSOFANALYSIS(Theory)

45Hours

Scope: This subject deals with the application of instrumental methods in qualitative andquantitativeanalysisofdrugs.Thissubjectisdesignedtoimpartafundamentalknowledge on the principles and instrumentation of spectroscopic and chromatographictechnique.Thisalsoemphasizesontheoreticalandpracticalknowledgeonmodernanalyticalinstruments that areusedfordrugtesting.

Objectives: Upon completionofthecoursethestudentshallbe ableto

1. Understandtheinteractionofmatterwithelectromagneticradiationsanditsapplications indruganalysis
2. Understandthechromatographicseparationandanalysis ofdrugs.
3. Performquantitative&qualitativeanalysisofdrugsusingvariousanalyticalinstruments .

CourseContent:

UNIT–I **10Hours**

UVVisiblespectroscopy

Electronictransitions,chromophores,auxochromes,spectralshifts,solventeffectonabsorptionspectra,BeerandLambert'slaw,Derivationanddeviations.

Instrumentation-Sourcesofradiation,wavelengthselectors,samplecells,detectors-Phototube,Photomultipliertube,Photovoltaiccell,SiliconPhotodiode.

Applications-Spectrophotometrictitrations,Singlecomponentandmulticomponentanalysis

Fluorimetry

Theory, Concepts of singlet, doublet and triplet electronic states, internal and externalconversions,factorsaffectingfluorescence,quenching,instrumentationandapplications

UNIT–II **10Hours**

IRspectroscopy

Introduction,fundamentalmodesofvibrationsinpolyatomicmolecules,samplehandling,factorsaffectingvibrations

Instrumentation-Sourcesofradiation,wavelengthselectors,detectors-Golaycell,Bolometer,Thermocouple,Thermister,Pyroelectricdetector andapplications

FlamePhotometry-Principle,interferences,instrumentationandapplications

Atomicabsorptionspectroscopy-
Principle,interferences,instrumentationandapplications

Nepheloturbidometry- Principle,instrumentationandapplications

UNIT–III **10Hours**

Introductiontochromatography

Adsorptionandpartitioncolumnchromatography-
Methodology,advantages,disadvantagesandapplications.

Thinlayerchromatography-
Introduction,Principle,Methodology,Rfvalues,advantages,disadvantages and applications.

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

Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniquesofpaper,gel,capillaryelectrophoresis, applications

UNIT–IV **08Hours**

Gas chromatography - Introduction, theory, instrumentation, derivatization,temperatureprogramming,advantages,disadvantagesandapplications

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

UNIT–V **07Hours**

Ionexchange chromatography-Introduction,classification, ionexchange resins,properties,mechanismofionexchangeprocess,factorsaffectingionexchange,methodologyandapplications

Gelchromatography-Introduction,theory,instrumentationandapplications

Affinitychromatography- Introduction,theory,instrumentationandapplications

BP702T.INDUSTRIAL PHARMACYII(Theory)

45Hours

Scope: Thiscourseisdesignedtoimpartfundamentalknowledgeonpharmaceuticalproductdevelopment andtranslationfromlaboratoryto market

Objectives: Upon completionofthecourse,thestudentshallbeableto:

1. Knowtheprocessof pilotplantandscaleupofpharmaceuticaldosageforms
2. Understand theprocess oftechnologytransferfrom lab scaleto commercial batch
3. KnowdifferentLawsandActsthatregulatepharmaceuticalindustry
4. Understandthe approvalprocessandregulatoryrequirementsfordrugproducts

CourseContent:

UNIT-I **10Hours**

Pilotplantscaleuptechniques: Generalconsiderations-including significanceofpersonnelrequirements,spacerequirements,rawmaterials,Pilotplantscaleupconsiderations for solids, liquid orals, semi solids and relevant documentation, SUPACguidelines,Introduction toplatformtechnology

UNIT-II **10Hours**

Technologydevelopmentandtransfer:WHOguidelinesforTechnologyTransfer(TT):Terminology,Technologytransferprotocol,Qualityriskmanagement,TransferfromR&Dtoproduction(Process,packagingandcleaning),GranularityofTTProcess(API,excipients,finishedproducts,packagingmaterials)Documentation,Premisesandequipments,qualificationandvalidation, qualitycontrol,analyticalmethodtransfer,Approvedregulatorybodiesandagencies,Commercialization-practicalaspectsandproblems(casestudies),TTagenciesinIndia-APCTD,NRDC,TIFAC,BCIL,TBSE/SIDBI; TT related documentation-confidentialityagreement,licensing,MoUs,legalissues

UNIT-III **10Hours**

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

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

UNIT-IV **08Hours**

Qualitymanagementsystems: Quality management&Certifications:ConceptofQuality,TotalQualityManagement,QualitybyDesign(QbD),SixSigmaconcept,Outof Specifications(OOS), Change control,IntroductiontoISO9000seriesofqualitysystemsstandards,ISO14000, NABL,GLP

UNIT-V **07Hours**

IndianRegulatoryRequirements: CentralDrugStandardControlOrganization(CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate ofPharmaceutical Product (COPP), Regulatory requirements and approval procedures forNewDrugs.

Recommended Books:(LatestEditions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April availableathttp,//en.wikipedia.org/wiki/Regulatory_ Affairs.
2. InternationalRegulatoryAffairsUpdates,2005.availableathttp ://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A GuideforPrescriptionDrugs,MedicalDevices,andBiologics'SecondEdition.
4. RegulatoryAffairs broughtbylearningplus,inc.availableathttp.//www.cgmp.com/ ra.htm.

BP703T.PHARMACYPRACTICE(Theory)

45Hours

Scope: In the changing scenario of pharmacy practice in India, for successful practice ofHospital Pharmacy, the students are required to learn various skills like drug distribution,druginformation,andtherapeuticdrugmonitoringforimprovedpatientcare.Incommunity
pharmacy,studentswillbelearningvariousskillssuchasdispensingofdrugs,respondingtominorailmentsbyprovidingsuitablesafemedication,patientcounsellingfor improvedpatient carein thecommunityset up.

Objectives: Upon completionofthecourse,thestudentshallbeableto

1. knowvarious drugdistributionmethodsinahospital
2. appreciate the pharmacystoresmanagementand inventorycontrol
3. monitordrugtherapyofpatientthroughmedicationchartreviewandclinicalreview
4. obtainmedicationhistoryinterviewandcounsel thepatients
5. identifydrugrelatedproblems
6. detectandassessadversedrugreactions
7. interpretselectedlaboratoryresults(asmonitoringparametersintherapeutics)ofspecificdiseasestates
8. knowpharmaceuticalcareservices
9. dopatientcounselingincommunitypharmacy;
10. appreciatetheconceptofRationaldrugtherapy.

UnitI: **10Hours**

a) Hospitalandit'sorganization

Definition,Classificationofhospital-Primary,SecondaryandTertiaryhospitals,Classification based on clinical and non-clinical basis, Organization Structure of aHospital,andMedicalstaffs involvedinthehospitalandtheirfunctions.

b) Hospitalpharmacyanditsorganization

Definition, functions of hospital pharmacy, Organization structure, Location, Layoutandstaffrequirements,andResponsibilitiesandfunctionsofhospitalpharmacists.

c) Adversedrugreaction

Classifications-Excessivepharmacologicaleffects,secondarypharmacologicaleffects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicityfollowingsuddenwithdrawalofdrugs,Druginteraction-beneficialinteractions,adverseinteractions,andpharmacokineticdruginteractions,Methods fordetecting

drug interactions, spontaneous case reports and record linkage studies, and Adversedrugreactionreportingand management.

d) Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legalrequirementsforestablishmentandmaintenanceofadrugstore,Dispensingofproprietaryproducts, maintenanceof records ofretailandwholesaledrugstore.

UnitII: 10Hours

a) Drugdistribution systemin ahospital

Dispensingofdrugstoinpatients,typesofdrugdistributionsystems,chargingpolicyandlabelling,Dispensingofdrugstoambulatorypatients,andDispensingofcontrolleddrugs.

b) Hospitalformulary

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

c) Therapeuticdrugmonitoring

NeedforTherapeuticDrugMonitoring,FactorstobeconsideredduringtheTherapeuticDrug Monitoring,andIndianscenarioforTherapeuticDrugMonitoring.

d) Medicationadherence

Causesofmedicationnon-adherence,pharmacistroleinthemedicationadherence,andmonitoringofpatientmedication adherence.

e) Patientmedicationhistoryinterview

Needfor the patient medicationhistoryinterview,medicationinterviewforms.

f) Communitypharmacymanagement

Financial,materials,staff,andinfrastructurerequirements.

UnitIII: 10Hours

a) Pharmacyandtherapeuticcommittee

Organization,functions,Policiesofthepharmacyandtherapeuticcommitteeinincludingdrugsintoformulary,inpatientandoutpatientprescription,automaticstoporder,andemergencydruglist preparation

Drug**informationservice:**

DrugandPoisoninformationcentre,Sourcesofdruginformation,Computerisedservices,and storageandretrievalofinformation.

Patientcounseling

Definitionofpatientcounseling;stepsinvolvedinpatientcounseling,andSpecialcasesthatrequirethepharmacist

b) Educationandtrainingprogramin thehospital

Roleofpharmacistintheeducationandtrainingprogram,Internalandexternaltraining program, Services to the nursing homes/clinics, Code of ethics for communitypharmacy,andRoleofpharmacistintheinterdepartmentalcommunicationandcommunityhealth education.

c) Prescribedmedicationorderandcommunicationskills

Prescribedmedicationorder-interpretationandlegalrequirements,andCommunicationskills-communicationwithprescribersandpatients.

UnitIV **8Hours**

a) Budgetpreparationandimplementation

Budgetpreparationandimplementation

b) ClinicalPharmacy

IntroductiontoClinicalPharmacy,Conceptofclinicalpharmacy,functionsandresponsibilitiesofclinicalpharmacist,Drug therapy monitoring-medicationchartreview, clinical review, pharmacist intervention, Ward round participation, Medicationhistoryand Pharmaceutical care.

DosingpatternanddrugtherapybasedonPharmacokinetic &diseasepattern.

c) Overthecounter(OTC)sales

Introductionandsaleofoverthecounter,andRationaluseofcommonoverthecountermedications.

UnitV **7Hours**

a) Drugstore managementandinventorycontrol

Organisation of drug store, types of materials stocked and storage conditions, Purchaseand inventory control:principles, purchase procedure, purchase order,procurementand stocking, Economic order quantity, Reorder quantity level, and Methods used fortheanalysisofthedrugexpenditure

b) Investigationaluseofdrugs

Description,principlesinvolved,classification,control,identification,roleofhospitalpharmacist, advisorycommittee.

c) InterpretationofClinicalLaboratoryTests

Bloodchemistry,hematology,andurinalysis

Recommended Books(LatestEdition):

1. MerchantS.H.and Dr.J.S.Quadry. *Atextbookof hospitalpharmacy*,4thed.Ahmadabad:B.S.ShahPrakakshan; 2001.
2. ParthasarathiG,KarinNyfort-Hansen,Milap CNahata.*AtextbookofClinicalPharmacy Practice- essential concepts and skills,* 1st ed. Chennai: OrientLongmanPrivateLimited; 2004.
3. WilliamE.Hassan.*Hospitalpharmacy*,5thed.Philadelphia:Lea&Febiger;1986.
4. TipnisBajaj.*HospitalPharmacy*,1sted.Maharashtra:CareerPublications;2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society ofHealthSystemPharmacistsInc; 2009.
6. ParmarN.S.*Health EducationandCommunityPharmacy*,18thed.India:CBSPublishers&Distributers ; 2008.

Journals:

1. Therapeuticdrugmonitoring.ISSN:0163-4356
2. Journalofpharmacypractice.ISSN:0974-8326
3. Americanjournalofhealthsystempharmacy.ISSN:1535-2900(online)
4. Pharmacytimes(Monthlymagazine)

BP704T:NOVEL DRUGDELIVERYSYSTEMS(Theory)

45Hours

Scope: Thissubjectisdesignedtoimpartbasicknowledgeonthe areaofnoveldrugdeliverysystems.

Objectives: Upon completionofthecoursestudentshallbeable

1. To understand various approachesfordevelopmentofnovel drugdeliverysystems.
2. To understand the criteria for selection of drugs and polymers for the development ofNovel drugdeliverysystems, theirformulation and evaluation

Coursecontent:

Unit-I **10Hours**

Controlled drug delivery systems: Introduction, terminology/definitions and rationale,advantages, disadvantages, selection of drug candidates.Approaches to design controlledreleaseformulationsbasedondiffusion,dissolutionandionexchangeprinciples.Physicochemicalandbiologicalpropertiesofdrugsrelevanttocontrolledreleaseformulations

Polymers: Introduction,classification,properties,advantagesandapplicationofpolymersin formulationofcontrolledrelease drugdeliverysystems.

Unit-II **10Hours**

Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules,microparticles,methodsofmicroencapsulation,applications

MucosalDrugDeliverysystem: Introduction,Principlesofbioadhesion/mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability andformulation considerations ofbuccal deliverysystems

ImplantableDrugDeliverySystems: Introduction,advantagesanddisadvantages,conceptofimplantsand osmoticpump

Unit-III **10Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factorsaffecting permeation,permeationenhancers,basic componentsof TDDS,formulationapproaches

Gastroretentivedrugdeliverysystems: Introduction,advantages,disadvantages,approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesivesystemsandtheirapplications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes ofdrug delivery,FormulationofInhalers(dry powder andmetereddose),nasalsprays,nebulizers

Unit-IV **08Hours**

TargeteddrugDelivery: Conceptsandapproachesadvantagesanddisadvantages,introduction toliposomes,niosomes,nanoparticles,monoclonalantibodiesandtheirapplications

Unit-V **07Hours**

OcularDrugDeliverySystems: Introduction,intraocularbarriersandmethodstoovercome – Preliminarystudy,ocularformulationsandocuserts

IntrauterineDrugDeliverySystems: Introduction,advantagesanddisadvantages,developme ntofintrauterinedevices (IUDs) andapplications

Recommended Books:(LatestEditions)

1. YW.Chien,NovelDrugDeliverySystems,2nd edition,revisedandexpanded,MarcelDe kker,Inc., NewYork,1992.
2. Robinson,J.R.,LeeV.H.L,ControlledDrugDeliverySystems,MarcelDekker,Inc.,Ne wYork,1992.
3. EncyclopediaofControlledDelivery.EdithMathiowitz,PublishedbyWileyInterscien ce Publication,JohnWileyandSons,Inc,New York.Chichester/Weinheim
4. N.K.Jain,ControlledandNovelDrugDelivery,CBSPublishers&Distributors,NewDel hi,First edition1997(reprintin2001).
5. S.P.VyasandR.K.Khar,ControlledDrugDelivery-conceptsandadvances,VallabhPrakashan,NewDelhi,First edition2002.

Journals

1. IndianJournalofPharmaceuticalSciences(IPA)
2. IndianDrugs (IDMA)
3. JournalofControlledRelease(ElsevierSciences)
4. DrugDevelopment andIndustrial Pharmacy(Marcel&Decker)
5. InternationalJournalofPharmaceutics(ElsevierSciences)

BP705P.INSTRUMENTALMETHODSOFANALYSIS(Practical)

4Hours/Week

2 Determinationofabsorptionmaximaandeffectofsolventsonabsorptionmaximaofor ganiccompounds
3 Estimation ofdextrosebycolorimetry
4 Estimation ofsulfanilamide bycolorimetry
5 SimultaneousestimationofibuprofenandparacetamolbyUVspectroscopy
6 AssayofparacetamolbyUV-Spectrophotometry
7 Estimation of quinine sulfate byfluorimetry
8 Studyof quenchingof fluorescence
9 Determinationof sodiumbyflame photometry
10 Determination ofpotassiumbyflame photometry
11 Determinationofchloridesandsulphatesbynepheloturbidometry
12 Separationof amino acidsbypaperchromatography
13 Separation of sugarsbythin layerchromatography
14 Separation of plantpigmentsbycolumnchromatography
15 DemonstrationexperimentonHPLC
16 DemonstrationexperimentonGasChromatography

Recommended Books(LatestEditions)

1. InstrumentalMethodsofChemicalAnalysisbyB.KSharma
2. Organic spectroscopybyY.RSharma
3. TextbookofPharmaceutical AnalysisbyKennethA.Connors
4. Vogel'sTextbookofQuantitativeChemicalAnalysisbyA.I. Vogel
5. Practical PharmaceuticalChemistrybyA.H.Beckett andJ.B. Stenlake
6. Organic ChemistrybyI.L.Finar
7. Organic spectroscopybyWilliamKemp
8. QuantitativeAnalysisofDrugsbyD.C.Garrett
9. Quantitative AnalysisofDrugsinPharmaceuticalFormulationsbyP.D.Sethi
10. Spectrophotometric identificationof OrganicCompoundsbySilverstein

SEMESTERVIII

BP801T.BIOSTATISITCSANDRESEARCHMETHODOLOGY(Theory)

45Hours

Scope: To understand the applications of Biostatics in Pharmacy. This subject deals withdescriptive statistics,Graphics, Correlation,Regression, logistic regression Probabilitytheory,Samplingtechnique,Parametrictests,NonParametrictests,ANOVA,Introduction to Design of Experiments, Phases of Clinical trials and Observational andExperimentalstudies,SPSS,RandMINITABstatisticalsoftware's,analyzingthestatistical datausingExcel**.**

Objectives: Upon completionofthecoursethestudentshallbeableto

- KnowtheoperationofM.S.Excel,SPSS,RandMINITAB®, DoE(DesignofExperiment)
- Knowthevariousstatisticaltechniquestosolvestatisticalproblems
- Appreciatestatisticaltechniquesinsolvingtheproblems**.**

Coursecontent:

Unit-I **10Hours**

Introduction: Statistics,Biostatistics,Frequencydistribution

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

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

Unit-II **10Hours**

Regression: Curve fittingbythe methodof leastsquares, fittingthelines y=a+bxandx =a+by,Multipleregression,standarderrorofregression– PharmaceuticalExamples**Probability:**Definition of probability, Binomial distribution, Normal distribution,Poisson'sdistribution,properties -problems

Sample,Population,largesample,smallsample,

Nullhypothesis,alternativehypothesis,sampling, essence of sampling, types of sampling, Error-I type,Error-II type, Standarderrorofmean(SEM)-Pharmaceutical examples

Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One wayandTwoway),Least Significancedifference

Unit-III **10Hours**

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallistest,FriedmanTest

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

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph**Designingthemethodology:**SamplesizedeterminationandPowerofastudy,Reportwritingandpresentationofdata,Protocol,Cohorts studies, Observational studies,Experimental studies,Designingclinical trial,various phases.

Unit-IV **8Hours**

Blockingandconfoundingsystem forTwo-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels**IntroductiontoPracticalcomponentsofIndustrialandClinicalTrialsProblems**:StatisticalAnalysisUsingExcel,SPSS,MINITAB®,DESIGNOFEXPERIMENTS,R-OnlineStatisticalSoftware'stoIndustrialandClinical trialapproach

Unit-V **7Hours**

Design andAnalysisofexperiments:

Factorial Design: Definition, 2^2, 2^3design. Advantage of factorial design**ResponseSurfacemethodology**:Centralcompositedesign,Historicaldesign, OptimizationTechniques

RecommendedBooks(Latestedition):

1. Pharmaceuticalstatistics-Practicalandclinicalapplications,SanfordBolton,publisherMarcel DekkerInc.NewYork.
2. FundamentalofStatistics –HimalayaPublishingHouse-S.C.Guptha
3. DesignandAnalysisofExperiments–PHI LearningPrivateLimited, R.Pannerselvam,
4. Design and AnalysisofExperiments–WileyStudentsEdition,DouglasandC.Montgomery

BP802TSOCIALAND PREVENTIVEPHARMACY **(Theory)**

Hours:45

Scope:
The purpose of this course is to introduce to students a number of health issues and theirchallenges. This course also introduced a number of national health programmes. Therolesofthe pharmacistinthesecontextsarealso discussed.

Objectives:
Afterthesuccessfulcompletionofthiscourse,thestudentshallbeableto:

- Acquirehighconsciousness/realizationofcurrentissuesrelatedtohealthandpharmaceuticalproblemswithinthe countryandworldwide.
- Have a critical wayofthinkingbasedon current healthcaredevelopment.
- Evaluate alternative ways of solving problems related tohealth andpharmaceuticalissues

Coursecontent:

UnitI: 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 diseasesandsocial problems of thesick.

Social and health education: Food in relation to nutrition and health, Balanced diet,Nutritionaldeficiencies,Vitamindeficiencies,Malnutrition anditsprevention.

Sociology and health: Socio cultural factors related to health and disease, Impact ofurbanization onhealth anddisease, Povertyand health

Hygieneandhealth:personalhygieneandhealthcare; avoidablehabits

UnitII: 10Hours

Preventive medicine: General principles of prevention and control of diseases such ascholera,SARS,Ebolavirus,influenza,acuterespiratory infections,malaria,chickenguinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer,drugaddiction-drugsubstanceabuse

UnitIII: 10Hours

National health programs, its objectives, functioning and outcome of the following:HIVANDAIDScontrolprogramme,TB,Integrateddiseasesurveillanceprogram(IDSP),Nationalleprosycontrolprogramme,Nationalmentalhealthprogram,National

programme for prevention and control of deafness, Universal immunization programme,Nationalprogrammeforcontrolofblindness,Pulsepolioprogramme.

UnitIV: 08Hours

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

UnitV: 07Hours

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

RecommendedBooks(Latestedition)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition,2010,ISBN: 9789380704104, JAYPEEPublications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by RoyRabindra Nath, Saha Indranil, 4thEdition, 2013, ISBN: 9789350901878, JAYPEEPublications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6thEdition,2014,ISBN: 9789351522331, JAYPEEPublications
4. EssentialsofCommunity Medicine—APracticalApproach,HiremathLalitaD,HiremathDhananjayaA,2ndEdition,2012,ISBN :9789350250440,JAYPEEPublications
5. ParkTextbook ofPreventiveandSocialMedicine,KPark,21stEdition,2011,ISBN-14:9788190128285,BANARSIDASBHANOTPUBLISHERS.
6. CommunityPharmacyPractice,RameshAdepu,BSPpublishers, Hyderabad

Recommended Journals:

1.ResearchinSocialandAdministrativePharmacy,Elsevier,Ireland

BP803ET. Pharmaceutical Marketing Management (Theory)

45Hours

Scope:

The pharmaceutical industry not only needs highly qualified researchers, chemists and,technicalpeople, butalsorequires skilled managers who cantake the industry forwardby managing and taking the complex decisions which are imperative for the growth of theindustry. The KnowledgeandKnow-how ofmarketing managementgroomthe peoplefortakingachallenging rolein Sales and Productmanagement.

Course Objective: The course aims to provide an understanding of marketing conceptsandtechniques andtheirapplicationsinthepharmaceuticalindustry.

UnitI **10Hours**

Marketing:

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

Pharmaceuticalmarket:

Quantitative and qualitative aspects; size and composition of the market; demographicdescriptionsandsocio-psychologicalcharacteristicsoftheconsumer;marketsegmentation&targeting.Consumerprofile;Motivationandprescribinghabitsofthephysician;patients' choice of physicianand retailpharmacist.Analyzing the Market;Roleofmarket research.

UnitII **10Hours**

Productdecision:

Classification, product line and product mix decisions, product lifecycle,productportfolioanalysis;productpositioning;New productdecisions;Productbranding,packagingandlabelingdecisions,Productmanagementinpharmaceuticalindustry.

UnitIII **10Hours**

Promotion:

Methods,determinantsofpromotionalmix,promotionalbudget;Anoverviewofpersonalselling,advertising,directmail,journals,sampling,retailing, medicalexhibition,publicrelations,onlinepromotionaltechniques forOTCProducts.

UnitIV **10Hours**

Pharmaceuticalmarketingchannels:

Designingchannel,channelmembers,selectingtheappropriatechannel,conflictinchannels,physicaldistributionmanagement:Strategicimportance,tasksinphysicaldistributionmanagement.

Professionalsalesrepresentative(PSR):

DutiesofPSR,purposeofdetailing,selectionandtraining,supervising,normsforcustomercalls, motivating,evaluating,compensationandfutureprospectsofthePSR.

UnitV **10Hours**

Pricing:

Meaning, importance, objectives, determinants of price; pricing methods and strategies,issuesinpricemanagementinpharmaceuticalindustry.AnoverviewofDPCO(DrugPriceControlOrder)andNPPA(NationalPharmaceuticalPricingAuthority).

Emergingconceptsinmarketing:

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

Recommended Books:(LatestEditions)

1. PhilipKotlerandKevinLaneKeller:MarketingManagement,PrenticeHallofIndia,NewDelhi
2. Walker,BoydandLarreche:MarketingStrategy-PlanningandImplementation,TataMCGrawHill,NewDelhi.
3. DhruvGrewalandMichaelLevy:Marketing,TataMCGrawHill
4. ArunKumarandNMenakshi:MarketingManagement,VikasPublishing,India
5. RajanSaxena:MarketingManagement; TataMC Graw-Hill(IndiaEdition)
6. Ramaswamy,U.S&Nanakamari,S:MarketingManagemnt:GlobalPerspective,IndianContext,MacmilanIndia,NewDelhi.
7. Shanker,Ravi:ServiceMarketing,ExcellBooks,NewDelhi
8. SubbaRaoChanganti,PharmaceuticalMarketinginIndia(GIFT–Excelseries)ExcelPublications.

BP804ET:PHARMACEUTICALREGULATORYSCIENCE(Theory)

45Hours

Scope: This course is designed to impart the fundamental knowledge on the regulatoryrequirementsforapprovalofnewdrugs, anddrugproductsinregulatedmarkets ofIndia & other countries like US, EU,Japan,Australia,UK etc.Itpreparesthestudentstolearnindetailonthe regulatoryrequirements,documentationrequirements,andregistrationprocedures formarketingthedrugproducts.

Objectives: Upon completionofthesubjectstudentshallbeableto;

1. Know about the processof drugdiscoveryanddevelopment
2. Knowtheregulatoryauthoritiesandagenciesgoverningthemanufactureandsaleofpha rmaceuticals
3. Knowtheregulatoryapprovalprocessandtheirregistrationin Indianandintern ationalmarkets

Coursecontent:

UnitI **10Hours**

NewDrugDiscoveryanddevelopment

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinicalactivities, clinical studies,Innovator andgenerics, Concept of generics, Generic drugproductdevelopment.

UnitII **10Hours**

RegulatoryApprovalProcess

Approvalprocessesandtimelines involved inInvestigationalNew Drug (IND),NewDrug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to anapprovedNDA/ ANDA.

Regulatoryauthorities andagencies

Overview of regulatory authorities of India, United States, European Union,Australia,Japan,Canada(Organizationstructureand typesofapplications)

UnitIII **10Hours**

RegistrationofIndiandrugproductinoverseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug MasterFiles(DMF),CommonTechnicalDocument(CTD),electronicCommonTechnical

Document(eCTD),ASEANCommonTechnicalDocument(ACTD)research.

UnitIV **08Hours**

Clinicaltrials

DevelopingclinicaltrialprotocolsInstitutionalReviewBoard/IndependentEthicscommittee-formationandworkingprocedures,Informedconsentprocessandprocedures,GCPobligationsofInvestigators,sponsors&Monitors,Managing andMonitoringclinical trials,Pharmacovigilance-safetymonitoringinclinical trials

UnitV **07Hours**

RegulatoryConcepts

Basicterminology,guidance,guidelines,regulations,LawsandActs,Orangebook,FederalRegister,CodeofFederalRegulatory, Purplebook

Recommended books(Latestedition):

1. DrugRegulatoryAffairsbySachinItkar,Dr.N.S.Vyawahare,Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry andRobertP. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa HealthcarePublishers.
3. NewDrugApprovalProcess:AcceleratingGlobalRegistrationsByRichardAGuarino,MD,5th edition,DrugsandthePharmaceuticalSciences,Vol.190.
4. Guidebookfordrugregulatorysubmissions/SandyWeinberg.ByJohnWiley&Sons.Inc.
5. FDARegulatoryAffairs:aguideforprescriptiondrugs,medicaldevices,andbiologics/edited byDouglas J. Pisano,David Mantus.
6. GenericDrugProductDevelopment,SolidOralDosageforms,LeonShargelandIsader Kaufer,Marcel Dekkerseries,Vol.143
7. ClinicalTrialsandHumanResearch:APracticalGuidetoRegulatoryComplianceByFay A.RozovskyandRodneyK.Adams
8. PrinciplesandPracticesof ClinicalResearch, SecondEditionEditedby JohnI.GallinandFrederick P.Ognibene
9. Drugs:FromDiscoveryto Approval,SecondEditionByRickNg

BP805T:PHARMACOVIGILANCE(Theory)

45hours

Scope: This paper will provide an opportunity for the student to learn about development ofpharmacovigilanceasa science, basic terminologies used inpharmacovigilance, globalscenarioofPharmacovigilance,trainstudentsonestablishingpharmacovigilanceprogrammeinan organization, various methods that can be used to generate safety data and signal detection. Thispaperalsodevelopstheskillsof classifyingdrugs,diseasesandadversedrugreactions.

Objectives:

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

1. Whydrugsafetymonitoringisimportant?
2. Historyanddevelopmentofpharmacovigilance
3. Nationalandinternationalscenarioofpharmacovigilance
4. Dictionaries,codingandterminologiesusedinpharmacovigilance
5. Detectionofnewadversedrugreactionsandtheirassessment
6. Internationalstandardsforclassificationofdiseasesanddrugs
7. Adversedrugreactionreportingsystemsandcommunicationinpharmacovigilance
8. Methodstogeneratesafetydataduringpreclinical,clinicalandpostapprovalphasesofdrugs' life cycle
9. Drugsafetyevaluationinpaediatrics,geriatrics,pregnancyandlactation
10. PharmacovigilanceProgramofIndia(PvPI)requirement for ADRreportinginIndia
11. ICHguidelinesforICSR,PSUR,expeditedreporting,pharmacovigilanceplanning
12. CIOMSrequirementsforADRreporting
13. Writingcasenarrativesofadverseeventsandtheirquality.

CourseContent

UnitI **10Hours**

IntroductiontoPharmacovigilance

- HistoryanddevelopmentofPharmacovigilance
- ImportanceofsafetymonitoringofMedicine
- WHOinternationaldrugmonitoringprogramme
- PharmacovigilanceProgramofIndia(PvPI)

Introductiontoadversedrugreactions

- DefinitionsandclassificationofADRs
- Detectionandreporting
- MethodsinCausalityassessment
- Severityandseriousnessassessment
- Predictabilityandpreventabilityassessment
- Managementofadversedrugreactions

Basicterminologiesusedinpharmacovigilance

- Terminologiesofadversemedicationrelatedevents
- Regulatoryterminologies

Unit II **10hours**

Druganddiseaseclassification

- Anatomical,therapeuticandchemicalclassificationofdrugs
- Internationalclassificationofdiseases
- Dailydefineddoses
- InternationalNonproprietaryNamesfordrugs

Drugdictionariesandcodinginpharmacovigilance

- WHOadversereactionterminologies
- MedDRAandStandardisedMedDRAqueries
- WHOdrugdictionary
- Eudravigilancemedicinalproductdictionary

Informationresourcesinpharmacovigilance

- Basicdruginformationresources
- SpecialisedresourcesforADRs

Establishingpharmacovigilanceprogramme

- Establishinginahospital
- Establishment &operationofdrugsafetydepartment inindustry
- ContractResearchOrganisations(CROs)
- Establishinganationalprogramme

Unit III **10Hours**

Vaccinesafetysurveillance

- VaccinePharmacovigilance
- Vaccinationfailure
- Adverseeventsfollowingimmunization

Pharmacovigilancemethods

- Passivesurveillance–Spontaneousreportsandcaseseries
- Stimulatedreporting
- Activesurveillance–Sentinelsites,drugeventmonitoringandregistries
- Comparativeobservationalstudies– Crosssectionalstudy,casecontrolstudyandcohort study
- Targetedclinicalinvestigations

Communicationinpharmacovigilance

- EffectivecommunicationinPharmacovigilance
- CommunicationinDrugSafetyCrisismanagement
- CommunicatingwithRegulatoryAgencies,BusinessPartners,Healthcarefacilities&Media

UnitIV **8Hours**

Safetydatageneration

- Preclinicalphase
- Clinicalphase
- Postapprovalphase(PMS)

ICHGuidelinesforPharmacovigilance

- OrganizationandobjectivesofICH
- Expeditedreporting
- Individualcasesafetyreports
- Periodicsafetyupdatereports
- Postapprovalexpeditedreporting
- Pharmacovigilanceplanning
- Goodclinicalpracticeinpharmacovigilancestudies

UnitV **7hours**

Pharmacogenomicsofadversedrugreactions

- GeneticsrelatedADRwithexamplefocusingPKparameters.

Drugsafetyevaluationinspecialpopulation

- Paediatrics
- Pregnancyandlactation
- Geriatrics

CIOMS

- CIOMSWorkingGroups
- CIOMSForm

CDSCO(India)andPharmacovigilance

- D&CActandScheduleY
- DifferencesinIndianandglobalpharmacovigilancerequirements

RecommendedBooks(Latestedition):

1. TextbookofPharmacovigilance:SKGupta,JaypeeBrothers,Medical Publishers.
2. PracticalDrugSafetyfromAtoZByBartonCobert,PierreBiron,JonesandBartlettPublishers.
3. Mann'sPharmacovigilance:ElizabethB.Andrews,Nicholas,WileyPublishers.
4. Stephens'DetectionofNewAdverseDrug Reactions:JohnTalbot,PatrickWalle,WileyPublishers.
5. AnIntroductiontoPharmacovigilance:PatrickWaller,WileyPublishers.
6. Cobert'sManualofDrugSafetyandPharmacovigilance:BartonCobert,Jones&Bartlett Publishers.
7. TextbookofPharmacoepidemiologeditedbyBrianL.Strom,StephenEKimmel,SeanHennessy,WileyPublishers.
8. ATextbookofClinicalPharmacyPractice-EssentialConceptsandSkills:G.Parthasarathi,Karin NyfortHansen,MilapC.Nahata
9. NationalFormularyofIndia
10. TextBookofMedicinebyYashpal Munjal

11. TextbookofPharmacovigilance:conceptandpracticebyGPMohantaandPKManna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/pv_home.html

BP806ET.QUALITYCONTROLANDSTANDARDIZATIONOFHERBALS (Theory)

Scope: In this subject the student learns about the various methods and guidelines forevaluation and standardization of herbs and herbal drugs. The subject also provides anopportunity forthestudenttolearncGMP,GAPandGLPintraditionalsystemofmedicines.

Objectives: Upon completionofthesubjectstudentshallbeableto;

1. knowWHO guidelines forqualitycontrol ofherbal drugs
2. knowQualityassurance in herbaldrugindustry
3. knowtheregulatoryapprovalprocessandtheirregistrationinIndianandintern ationalmarkets
4. appreciateEUandICH guidelinesforqualitycontrolofherbaldrugs

UnitI **10 hours**

Basictestsfordrugs–Pharmaceuticalsubstances,Medicinalplantsmaterialsanddosageforms WHO guidelines for quality control of herbal drugs.Evaluationofcommercialcrudedrugsintended foruse

UnitII **10 hours**

QualityassuranceinherbaldrugindustryofcGMP,GAP,GMPandGLPintraditional system of medicine.

WHOGuidelinesoncurrentgoodmanufacturingPractices(cGMP)forHerbalMedicinesWHO Guidelines onGACPforMedicinal Plants.

UnitIII **10 hours**

EU andICHguidelinesfor qualitycontrol ofherbal drugs.
ResearchGuidelinesforEvaluatingtheSafetyand EfficacyofHerbal Medicines

UnitIV **08hours**

Stabilitytestingofherbalmedicines.Applicationofvariouschromatographictechniquesinstand ardizationof herbal products.
Preparationofdocumentsfornewdrugapplicationandexportregistration GMP requirementsandDrugs&CosmeticsAct provisions.

UnitV **07 hours**

Regulatoryrequirements forherbalmedicines.

WHOguidelinesonsafetymonitoringofherbalmedicinesinpharmacovigilancesystemsComparisonofvarious HerbalPharmacopoeias.

Roleofchemical andbiologicalmarkersinstandardizationofherbalproducts

Recommended Books:(LatestEditions

1. PharmacognosybyTreaseandEvans
2. PharmacognosybyKokate,PurohitandGokhale
3. Rangari,V.D.,Text bookofPharmacognosyandPhytochemistryVol.I,CarrierPub.,2006.
4. Aggrawal,S.S.,HerbalDrugTechnology.UniversitiesPress,2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional MedicinalProducts,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation ofBotanicals.BusinessHorizonsPublishers,NewDelhi,India,2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality controlprinciplestoherbaldrugs.InternationalJournalofPhytomedicine1(2009);p.4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World HealthOrganization,Geneva,1998.WHO.GuidelinesfortheAppropriateUseofHerbalMedicines. WHO Regional Publications, Western Pacific Series No 3, WHORegional officefortheWesternPacific,Manila,1998.
9. WHO. TheInternationalPharmacopeia,Vol. 2:QualitySpecifications, 3rdedn.WorldHealthOrganization,Geneva,1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World HealthOrganization,Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and AlternativeMedicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World HealthOrganization,Geneva, 2005.
12. WHO.GuidelinesonGoodAgriculturalandCollectionPractices(GACP)forMedicinalPlants.WorldHealthOrganization,Geneva,2004.

BP807ET.COMPUTERAIDEDDRUGDESIGN(Theory)

45HoursS

cope: This subject is designed to provide detailed knowledge of rational drug designprocessand varioustechniques usedinrational drugdesign process.

Objectives: Upon completionofthecourse,thestudentshallbeabletounderstand

- Design anddiscoveryofleadmolecules
- The role ofdrugdesignin drugdiscoveryprocess
- TheconceptofQSAR anddocking
- Variousstrategiestodevelopnewdruglikemolecules.
- Thedesign ofnewdrugmolecules usingmolecularmodelingsoftware

CourseContent:

UNIT-I **10Hours**

IntroductiontoDrugDiscoveryandDevelopment

Stages ofdrugdiscoveryanddevelopment

LeaddiscoveryandAnalogBased DrugDesign

Rationalapproachestoleaddiscovery basedontraditionalmedicine,Random screening, Non-random screening, serendipitous drug discovery,leaddiscoverybasedondrugmetabolism,leaddiscoverybasedoncli nicalobservation.

Analog BasedDrug Design: Bioisosterism,Classification,Bioisostericreplacement. Anythreecasestudies

UNIT-II **10Hours**

QuantitativeStructureActivityRelationship(QSAR)

SARversusQSAR,HistoryanddevelopmentofQSAR,Typesofphysicochemi cal parameters, experimental and theoretical approaches forthe determination ofphysicochemical parameters such as Partitioncoefficient, Hammet'ssubstituent constant and Tafts steric constant.Hanschanalysis,FreeWilsonanalysis,3D-QSARapproacheslikeCOMFAandCOMSIA.

UNIT-III **10Hours**

MolecularModelingandvirtualscreeningtechniques

VirtualScreeningtechniques: Druglikenessscreening,Conceptofpharm acophoremappingandpharmacophorebasedScreening,

Moleculardocking:Rigiddocking,flexibledocking,manualdocking,Docking based screening.*Denovo* drugdesign.

UNIT-IV **08Hours**

Informatics&Methodsindrugdesign

IntroductiontoBioinformatics,chemoinformatics.ADMEdatabases,chemical,biochemicalandpharmaceuticaldatabases.

UNIT-V **07Hours**

Molecular Modeling: Introduction to molecular mechanics and quantummechanics.Energy Minimization methods and Conformational Analysis,global conformational minimadetermination.

Recommended Books(LatestEditions)

1. RobertGCK, ed.,"DrugAction at theMolecularLevel"UniversityPrak PressBaltimore.
2. MartinYC."QuantitativeDrugDesign"Dekker,NewYork.
3. DelgadoJN,RemersWAeds"Wilson&Gisvolds'sTextBookofOrganicMedicinal&PharmaceuticalChemistry"Lippincott,NewYork.
4. Foye WO"Principles ofMedicinalchemistry'Lea&Febiger.
5. KorolkovasA,BurckhalterJH."EssentialsofMedicinalChemistry"WileyInterscience.
6. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry"JohnWiley&Sons,NewYork.
7. PatrickGraham,L.,AnIntroductiontoMedicinalChemistry,OxfordUniversityPress.
8. SmithHJ,WilliamsH,eds,"IntroductiontotheprinciplesofDrugDesign"WrightBoston.
9. SilvermanR.B."TheorganicChemistryofDrugDesignandDrugAction"AcademicPress NewYork.

BP808ET:CELLANDMOLECULARBIOLOGY(Elective subject)

45Hours

Scope:

- Cellbiology isabranchof biology thatstudies cells –their physiologicalproperties,theirstructure,the organelles theycontain,interactionswiththeirenvironment,theirlifecycle,division,deathand cellfunction.
- Thisisdonebothonamicroscopicandmolecularlevel.
- Cell biologyresearchencompassesboththegreatdiversityofsingle-celledorganismslike bacteria and protozoa,aswellasthemany specializedcellsinmulti-cellularorganismssuchas humans,plants,andsponges.

Objectives: Upon completionofthesubjectstudentshallbeableto;

- Summarize cellandmolecularbiologyhistory.
- Summarizecellularfunctioningandcomposition.
- Describethechemicalfoundationsofcellbiology.
- SummarizetheDNApropertiesofcellbiology.
- Describeproteinstructureandfunction.
- Describecellularmembranestructureandfunction.
- Describebasicmoleculargeneticmechanisms.
- SummarizetheCellCycle

Coursecontent:

UnitI **10Hours**

a) CellandMolecularBiology:DefinitionstheoryandbasicsandApplications.
b) CellandMolecular Biology:HistoryandSummation.
c) Propertiesofcellsandcellmembrane.
d) ProkaryoticversusEukaryotic
e) CellularReproduction
f) ChemicalFoundations–anIntroductionandReactions(Types)

UnitII **10Hours**

a) DNA andtheFlowofMolecularInformation
b) DNAFunctioning
c) DNAandRNA
d) TypesofRNA
e) TranscriptionandTranslation

UnitIII **10Hours**

a) Proteins: Defined**and**AminoAcids
b) ProteinStructure

c) RegularitiesinProteinPathways
d) CellularProcesses
e) PositiveControlandsignificanceofProteinSynthesis

UnitIV **08Hours**

a) ScienceofGenetics
b) TransgenicsandGenomicAnalysis
c) CellCycleanalysis
d) MitosisandMeiosis
e) CellularActivitiesandCheckpoints

UnitV **07Hours**

a) CellSignals:Introduction
b) ReceptorsforCellSignals
c) SignalingPathways:Overview
d) MisregulationofSignalingPathways
e) Protein-Kinases:Functioning

RecommendedBooks(latestedition):

1. W.B.HugoandA.D.Russel:PharmaceuticalMicrobiology,BlackwellScientificpublications,OxfordLondon.
2. PrescottandDunn.,IndustrialMicrobiology,4th edition,CBSPublishers&Distributors,Delhi.
3. Pelczar,ChanKreig,Microbiology,TataMcGrawHilledn.
4. MalcolmHarris,BalliereTindallandCox:PharmaceuticalMicrobiology.
5. Rose:IndustrialMicrobiology.
6. Probisher,Hinsdilletal:FundamentalsofMicrobiology,9thed.Japan
7. CooperandGunn's:TutorialPharmacy,CBSPublisherandDistribution.
8. Peppler:MicrobialTechnology.
9. Edward:FundamentalsofMicrobiology.
10. N.K.Jain:PharmaceuticalMicrobiology,VallabhPrakashan,Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverlycompany
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles andApplicationsofRecombinantDNA: ASMPress WashingtonD.C.
13. RAGoldshyet.al.,:KubyImmunology.

BP809ET.COSMETICSCIENCE(Theory)

45Hours

UNITI **10Hours**

Classificationofcosmeticandcosmeceuticalproducts

DefinitionofcosmeticsasperIndianandEUregulations,Evolutionofcosmeceuticalsfromcosmetics,cosmetics as quasiandOTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients,preservatives.Classification andapplication

Skin: Basicstructureandfunctionofskin.

Hair: Basicstructureofhair.Hairgrowthcycle.

OralCavity: Commonproblemassociatedwithteethandgums**.**

UNITII **10Hours**

Principlesof formulationandbuildingblocksofskincareproducts:

Facewash, Moisturizingcream,ColdCream,Vanishingcreamandtheiradvantagesanddisadvantages.Application of these products in formulation of cosmecuticals.**Antiperspants&deodorants**-Actives&mechanismofaction.

Principlesof formulationandbuildingblocksofHaircareproducts:

Conditioningshampoo,Hairconditioner,anti-dandruffshampoo.Hairoils.

Chemistry and formulation of Para-phylene diamine based hair dye.Principles of formulation and building blocks of oral care products:Toothpasteforbleedinggums,sensitiveteeth.Teethwhitening,Mouthwash.

UNITIII **10Hours**

Sunprotection,ClassificationofSunscreens andSPF.

Roleofherbsin cosmetics:

Skin Care:Aloe and turmericHaircare:Hennaand amla.

Oralcare:Neemandclove

Analyticalcosmetics:BIS specificationandanalyticalmethodsforshampoo,skin-creamandtoothpaste**.**

UNITIV **08Hours**.

PrinciplesofCosmeticEvaluation:Principlesofsebumeter,corneometer.MeasurementofTEWL,Skin Color,Hairtensilestrength,Haircombingproperties

Soaps,andsyndetbars.Evolutionandskinbenfits.

UNITV **07Hours**

Oilyand dryskin,causesleadingtodryskin, skinmoisturisation.Basic understandingoftheterms Comedogenic,dermatitis.

Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causesCosmeticproblemsassociatedwithskin:blemishes,wrinkles,acne,pricklyheatandbodyodor.

AntiperspirantsandDeodorants-Activesandmechanismofaction

References

1) Harry'sCosmeticology,Wilkinson,Moore,SeventhEdition,George Godwin.
2) Cosmetics– Formulations,ManufacturingandQualityControl,P.P.Sharma,4th Edition,VandanaPublications Pvt.Ltd., Delhi.
3) Text bookof cosmelicologybySanju Nanda&RoopK. Khar, TataPublishers.

BP810ET.EXPERIMENTAL PHARMACOLOGY (PHARMACOLOGICALSCREENINGMETHODS)

45Hours

Scope: Thissubjectisdesignedtoimpartthebasicknowledgeofpreclinicalstudiesinexperimentalanimals includingdesign,conductandinterpretationsofresults.

Objectives

Uponcompletionofthecoursethestudentshallbeableto,

- Appreciatetheapplications ofvarious commonlyusedlaboratoryanimals.
- Appreciateanddemonstrate thevariousscreeningmethodsusedinpreclinicalresearch
- Appreciateanddemonstratetheimportanceofbiostatisticsandresearchmethodology
- Designandexecutearesearch hypothesisindependently

Unit–I	**08Hours**
LaboratoryAnimals: Study of CPCSEA and OECD guidelines for maintenance, breedingandconductofexperimentsonlaboratoryanimals,Commonlabanimals: Descriptionandapplicationsofdifferentspeciesandstrainsofanimals. Popular transgenicandmutant animals. Techniquesforcollectionofbloodandcommonroutesofdrugadministration in laboratory animals,Techniquesof blood collectionandeuthanasia.	
Unit–II	**10Hours**
Preclinicalscreening models a. Introduction: Dose selection, calculation and conversions,preparation of drug solution/suspensions, grouping of animals andimportanceofshamnegativeandpositivecontrolgroups.Rationaleforselection of animalspeciesandsexforthestudy. **b. Studyof screeninganimalmodelsfor** Diuretics, nootropics, anti-Parkinson's,antiasthmatics,**Preclinical screening models:** for CNS activity- analgesic,antipyretic,anti-inflammatory,generalanaesthetics,sedativeandhypnotics, antipsychotic, antidepressant, antiepileptic,antiparkinsonism,alzheimer's disease	

Unit–III **Preclinical screening models:** for ANS activity, sympathomimetics,sympatholytics, parasympathomimetics, parasympatholytics, skeletalmusclerelaxants,drugsactingoneye,localanaethetics	**10Hours**
Unit–IV **Preclinicalscreeningmodels:** forCVSactivity-antihypertensives,diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory,coagulants, and anticoagulants Preclinicalscreeningmodelsforotherimportantdrugslike antiulcer,antidiabetic,anticancerand antiasthmatics.	**10Hours**
ResearchmethodologyandBio-statistics Selectionofresearchtopic,reviewofliterature,researchhypothesisandstudydesign Pre-clinicaldataanalysisandinterpretationusingStudents‘t’test and One-wayANOVA.Graphicalrepresentationof data	**05Hours**

RecommendedBooks(latestedition):

1. FundamentalsofexperimentalPharmacology-byM.N.Ghosh
2. HandbookofExperimentalPharmacology-S.K.Kulakarni
3. CPCSEAguidelinesforlaboratoryanimalfacility.
4. DrugdiscoveryandEvaluationbyVogelH.G.
5. DrugScreeningMethodsbySureshKumar GuptaandS. K. Gupta
6. IntroductiontobiostatisticsandresearchmethodsbyPSSSundarRaoandJRichard

BP811ET. ADVANCEDINSTRUMENTATIONTECHNIQUES

45Hours

Scope: This subject deals with the application of instrumental methods in qualitative andquantitative analysis of drugs. This subject is designed to impart advanced knowledge ontheprinciplesandinstrumentationofspectroscopicandchromatographichyphenatedtechniques.Thisalsoemphasizesontheoreticalandpracticalknowledgeonmodernanalyticalinstruments that areusedfordrugtesting.

Objectives: Upon completionofthecoursethestudentshallbeableto

- understandtheadvancedinstrumentsusedanditsapplicationsindruganalysis
- understandthechromatographicseparationandanalysisofdrugs.
- understandthecalibrationofvariousanalyticalinstruments
- knowanalysisof drugsusingvariousanalyticalinstruments.

CourseContent:

UNIT-I **10Hours**

NuclearMagneticResonancespectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemicalshift, coupling constant, Spin - spin coupling, relaxation, instrumentation andapplications

MassSpectrometry-Principles,Fragmentation,Ionizationtechniques– Electronimpact,chemicalionization,MALDI,FAB,Analyzers-TimeofflightandQuadrupole,instrumentation, applications

UNIT-II **10Hours**

ThermalMethods ofAnalysis: Principles, instrumentationand applicationsof ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA),Differential ScanningCalorimetry(DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X-ray

Crystallography, rotating crystal technique, single crystal diffraction,powderdiffraction,structural elucidationandapplications.

UNIT-III **10Hours**

Calibrationandvalidation-asperICHandUSFDAguidelines

CalibrationoffollowingInstruments

Electronicbalance,UV-Visiblespectrophotometer,IRspectrophotometer,

Fluorimeter,FlamePhotometer,HPLCandGC

UNIT-IV **08Hours**

Radio immune assay: Importance, various components, Principle, differentmethods,Limitation andApplicationsofRadioimmuno assay

Extractiontechniques:Generalprincipleandprocedureinvolvedinthesolidphaseextraction andliquid-liquidextraction

UNIT-V **07Hours**

Hyphenatedtechniques-LC-MS/MS,GC-MS/MS,HPTLC-MS.

RecommendedBooks(LatestEditions)

1. InstrumentalMethodsofChemicalAnalysis byB.KSharma
2. Organic spectroscopybyY.RSharma
3. TextbookofPharmaceutical Analysis byKennethA.Connors
4. Vogel'sTextbookofQuantitativeChemicalAnalysisbyA.I.Vogel
5. Practical PharmaceuticalChemistrybyA.H.BeckettandJ.B.Stenlake
6. OrganicChemistrybyI.L.Finar
7. Organic spectroscopybyWilliamKemp
8. QuantitativeAnalysisofDrugsbyD.C.Garrett
9. Quantitative Analysisof Drugs in PharmaceuticalFormulationsbyP.D. Sethi
10. Spectrophotometric identification of OrganicCompoundsbySilverstein

BP812ET.DIETARYSUPPLEMENTSANDNUTRACEUTICALS

No.ofhours:3 Tutorial:1 Credit

point:4Scope:

Thissubjectcoversfoundationaltopicthatareimportantforunderstandingtheneedandrequirementso fdietarysupplementsamongdifferent groupsinthepopulation.

Objective:

This module aims to provide an understanding of the concepts behind the theoreticalapplicationsofdietarysupplements.Bytheendofthecourse,studentsshouldbe ableto:

1. Understandtheneedofsupplementsbythedifferentgroupofpeopletomaintainhealthy life.
2. Understandtheoutcomeofdeficienciesindietarysupplements.
3. Appreciatethecomponentsindietarysupplementsandtheapplication.
4. Appreciatetheregulatoryand commercialaspectsofdietarysupplementsincludinghealthclaims.

UNITI 07 hours

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classificationof Nutraceuticals, Health problems and diseases that can be prevented or cured byNutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis,hypertensionetc.
b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutritioneducationincommunity.
c. Source, Name of marker compounds and their chemical nature, Medicinal uses andhealthbenefitsoffollowingusedasnutraceuticals/functionalfoods:Spirulina,Soyabean, Ginseng, Garlic, Broccoli,Gingko,Flaxseeds

UNITII 15 hours

Phytochemicalsasnutraceuticals:Occurrenceandcharacteristicfeatures(chemicalnaturemedicinal benefits)offollowing

a) Carotenoids-αandβ-Carotene,Lycopene,Xanthophylls,leutin
b) Sulfides:Diallylsulfides,Allyltrisulfide.
c) Polyphenolics:Reservetrol
d) Flavonoids-Rutin,Naringin,Quercitin,Anthocyanidins,catechins,Flavones
e) Prebiotics/Probiotics.:Fructooligosaccharides,Lactobacillum
f) Phytoestrogens:Isoflavones,daidzein,Geebustin,lignans
g) Tocopherols
h) Proteins,vitamins, minerals,cereal, vegetablesandbeveragesasfunctionalfoods: oats,wheatbran,ricebran, sea foods, coffee,teaandthelike.

UNITIII 07 hours

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of freeradicalsincells,damagingreactionsoffreeradicalsonlipids,proteins,Carbohydrates,nu cleicacids.

b) Dietaryfibresandcomplexcarbohydrates asfunctionalfoodingredients..

UNITIV **10 hours**

a) FreeradicalsinDiabetesmellitus, Inflammation, Ischemicreperfusioninjury,Cancer,Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage,muscle damage. Free radicals involvement in other disorders. Free radicals theory ofageing.

b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidantdefence,Superoxidedismutase,catalase,Glutathioneperoxidase,GlutathioneVitaminC,VitaminE,α-Lipoicacid,melatonin
Syntheticantioxidants:ButylatedhydroxyToluene,ButylatedhydroxyAnisole.

c) Functionalfoodsforchronicdiseaseprevention

UNITV **06 hours**

a) Effectofprocessing,storageandinteractionsofvariousenvironmentalfactorsonthepotentialofnutraceuticals.

b) RegulatoryAspects;FSSAI,FDA,FPO,MPO,AGMARK.HACCPandGMPsonFoodSafety.Adulterationoffoods.

c) PharmacopoeialSpecificationsfordietarysupplementsandnutraceuticals.

References:

1. DieteticsbySriLakshmi
2. RoleofdietaryfibresandneutraceuticalsinpreventingdiseasesbyK.TAgustiandP.Faizal:BS Punblication.
3. Advanced NutritionalTherapiesbyCooper.K.A., (1996).
4. TheFoodPharmacybyJeanCarper,Simon&Schuster,UKLtd.,(1988).
5. PrescriptionforNutritionalHealingbyJamesF.BalchandPhyllisA.Balch2nd Edn.,AveryPublishingGroup,NY(1997).
6. G.GibsonandC.williamsEditors *2000Functionalfoods*WoodheadPubl.Co.London.
7. Goldberg,I.*FunctionalFoods*.1994.ChapmanandHall,New York.
8. Labuza,T.P.2000FunctionalFoodsandDietarySupplements:Safety,GoodManufacturing Practice(GMPs) and Shelf Life Testing in*Essentials of FunctionalFoods* M.K.Sachmidland T.P.Labuzaeds.AspenPress.
9. HandbookofNutraceuticalsandFunctionalFoods,ThirdEdition(ModernNutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*.Eighthedition.LeaandFebiger

SemesterVIII–Elective course on

PharmaceuticalProductDevelopmentNoofHours:3 Tutorial:1

Creditpoints:4

Unit-I **10Hours**

Introduction to pharmaceutical product development, objectives, regulations related topreformulation,formulationdevelopment,stabilityassessment,manufacturingandquality controltestingofdifferent types ofdosageforms

Unit-II **10Hours**

Anadvancedstudy ofPharmaceuticalExcipientsinpharmaceuticalproductdevelopmentwithaspecialreferencetothefollowingcategories

i. Solventsandsolubilizers
ii. Cyclodextrinsandtheirapplications
iii. Non-ionicsurfactantsandtheirapplications
iv. Polyethyleneglycolsandsorbitols
v. Suspendingandemulsifyingagents
vi. Semisolidexcipients

Unit-III **10Hours**

AnadvancedstudyofPharmaceuticalExcipientsinpharmaceuticalproductdevelopmentwithaspecial referencetothefollowingcategories

i. Tabletandcapsuleexcipients
ii. Directlycompressiblevehicles
iii. Coatmaterials
iv. Excipientsinparenteralandaerosolsproducts
v. ExcipientsforformulationofNDDS

Selectionandapplicationofexcipientsinpharmaceuticalformulationswithspecificindustrialapplications

Unit-IV **08Hours**

Optimizationtechniquesinpharmaceuticalproductdevelopment.Astudy ofvariousoptimizationtechniquesforpharmaceuticalproductdevelopmentwithspecificexamples.Optimization by factorial designs and their applications.A study of QbD and itsapplicationinpharmaceutical productdevelopment.

Unit-V **07Hours**

Selectionandqualitycontroltestingofpackagingmaterialsforpharmaceuticalproductdevelopment-regulatoryconsiderations.