

Nirma University

Institute of Pharmacy

Programme: Bachelor of Pharmacy

NIRMA UNIVERSITY
Institute of Pharmacy
(B. Pharm)
(Semester - I)

L	T	P	C
3	1		4

Course Code	BP101T
Course Title	Human Anatomy and Physiology I- Theory

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 homeostatic mechanisms. The subject provides the basic knowledge required to understand various disciplines of pharmacy.

Objectives:

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

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Identify the structure, location of cell, tissues, muscles and various organs of the body.
2. Remember various feedback mechanisms that help to regulate physiological processes.
3. Describe anatomy, physiology and functions of integumentary, skeletal and nervous system.
4. Explain structure and functions of various endocrine glands and list their disorders.
5. Assess normal and abnormal functioning of various sensory organs.

Syllabus:

Teaching hours: 45 Hours

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

UNIT III

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 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

- **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.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings/\: (Latest Edition)

1. Sembulingam, K. Sembulingam, P. Essentials of Medical Physiology. New Delhi, Jaypee Brother's Medical Publishers.
2. Wilson, K.J.W. Anatomy and Physiology in Health and Illness. New York, Churchill Livingstone.
3. Best and Taylor. Physiological basis of Medical Practice. MI USA, Williams & Wilkins Co, Riverview.
4. Guyton, A.C, Hall J.E, Miamisburg, O.H. Text book of Medical Physiology. U.S.A. Elsevier Saunders.
5. Tortora G, Palmetto, G.A. Principles of Anatomy and Physiology. U.S.A. John Wiley & sons.
6. Singh I. Textbook of Human Histology. New Delhi, Jaypee Brother's Medical Publishers.
7. Ghai, C.L. Textbook of Practical Physiology. New Delhi. Jaypee Brother's Medical

Publishers.

8. Srinageswari, K., Sharma, R. Practical workbook of Human Physiology. New Delhi, Jaypee Brother's Medical Publishers.
9. Chatterje, C.C. Human Physiology (vol I and 2). Kolkata, Academic Publishers

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(B.Pharm)
(Semester- I)

L	T	P	C
3	1		4

Course Code	BP102T
Course Title	Pharmaceutical Analysis I - Theory

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

1. Understand the principles of volumetric and electro chemical analysis
2. Carryout various volumetric and electrochemical titrations
3. Develop analytical skills

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the basics of different types of titrimetric methods.
2. Describe the principle, instrumentation and electrodes of various electro analytical methods
3. Analyze the different sources and types of the error
4. Prepare solutions of different strengths used in pharmaceutical field (Molar, Normal etc.)

Syllabus:

Teaching hours: 45 Hours

UNIT-I

10 Hours

- **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 eerie ammonium sulphate
- **Errors:** Sources of errors, types of errors, methods of minimizing errors, accuracy,

precision and significant figures

- 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

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings/ (Latest edition)

1. Beckett, A. H., & Stenlake, J. B. (Eds.). Practical Pharmaceutical Chemistry: Part I & II. A&C Black.
2. Mendham, J. Vogel's textbook of quantitative chemical analysis. Pearson Education India.
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry. Vallabh Publications.
4. Driver, J. E. Bentley & Driver's text-book of pharmaceutical chemistry. London.
5. Kennedy, J. H. Analytical Chemistry: Principles. Harcourt School.
6. Indian Pharmacopoeia

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(B. Pharm.)
(Semester - I)

L	T	P	C
3	1		4

Course Code	BP103T
Course Title	Pharmaceutics I - Theory

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:

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Discuss history of pharmacy profession and various dosage forms
2. Explain various conversions systems used in pharmaceutical dispensing
3. Understand the concepts of dispensing methods for various dosage forms
4. Interpret types of prescriptions and study their handling
5. Solve pharmaceutical calculations and pharmaceutical incompatibilities related to dispensing of products
6. Prepare various types of dispensed products at small scale with suitable labeling and packaging

Syllabus:

Teaching hours: 45 Hours

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**10 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 of Emulsion, 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 semisolid dosage forms. Evaluation of semisolid dosages forms.

Tutorials**Teaching hours: 15 Hours**

Tutorials will be based on above syllabus

Suggested Readings'': (Latest edition)

1. Loyd, V.A., Nicholas, .P., & Ansel, H.C. Ansel's Pharmaceutical Dosage Form and Drug Delivery Systems. Lippincott Williams and Walkins.
2. Cooper J.W., Gunn, C, & Cater, S. J. Dispensing for Pharmaceutical Students. Edinburgh; London: Churchill Livingstone.
3. Aulton, M.E. Pharmaceutics: The Science & Dosage Form Design. Edinburgh; London: Churchill Livingstone.
4. Indian pharmacopoeia, Indian Pharmacopoeial Commission.
5. British pharmacopoeia, British Pharmacopoeial Commission.
6. Leon Lachmann, & Herbert, A.L. The Theory and Practice of Industrial Pharmacy. New Delhi: CBS Publishers & Distributors Pvt. Ltd.
7. Remington, J. P., & Gennaro, A. R. Remington: The Science and Practice of Pharmacy. Lippincott Williams.
8. Cooper J.W., Gunn, C, & Cater, S. J. Cooper and Gunn's Tutorial Pharmacy. New Delhi: CBS Publishers.
9. Bentley, A.O., & Rawlins, E.A. Bentley's Text Book of Pharmaceutics. USA: Elsevier Health Sciences.

10. Isaac Ghebre Sellassie. Pharmaceutical Pelletization Technology. New York: Marcel Dekker.
11. Parikh, D.M. Handbook of Pharmaceutical Granulation Technology. New York: Informa Healthcare.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions. New York: Informa Healthcare, cop.

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(B. Pharm)
(Semester - I)

L	T	P	C
3	1		4

Course Code	BP104T
Course Title	Pharmaceutical Inorganic Chemistry - Theory

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

Objectives: Upon completion of course student shall be able to

1. Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
2. Understand the medicinal and pharmaceutical importance of inorganic compounds

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Remember biological functions of ions and trace elements and mechanism of action of selected inorganic agents.
2. Understand basic concepts and principles of inorganic inorganic chemistry and radiopharmaceuticals.
3. Describe various sources of impurities and methods to determine the impurities in pharmaceuticals.
4. Discuss method of preparation, properties, assay principle and uses of some important inorganic pharmaceuticals.
5. Synthesise and/or analyse selected inorganic compounds.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

- **Impurities in pharmaceutical substances:**

History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test or 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 radiations, Half life, radio isotopes and **study of radio isotopes** - Sodium iodide 131 , **Storage conditions**, precautions & **pharmaceutical application of radioactive substances**.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings": (Latest edition)

1. Beckett, A. H., & Stenlake, J. B. (Eds.). Practical Pharmaceutical Chemistry: Part II (Vol. I & 2). A&C Black.
2. Vogel, A. I. A Text-book of Quantitative inorganic analysis: including elementary instrumental analysis. London: Longmans.
3. Rao, P. G. Inorganic Pharmaceutical Chemistry. Vallabh Prakashan.
4. Schroff, M. L. *Pharmaceutical chemistry*. Calcutta: National Book Centre.
5. Bentley, A., Driver, J., & Atherden, L. Bentley and Driver's textbook of pharmaceutical chemistry. Oxford: Oxford University Press.
6. Chatwal, G. R. Pharmaceutical Chemistry: Inorganic, Volume I. Himalaya Pub. House.
7. Indian Pharmacopoeia, Indian Pharmacopoeia Commission

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(B. Pharm)
(Semester - I)

L	T	P	C
2			2

Course Code	BPI0ST
Course Title	Communication Skills - Theory

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Describe various elements of communication
2. Express effectively in verbal and non-verbal communications
3. Demonstrate communication skills in speaking, writing, listening and narrating in English
4. Develop group discussion skills
5. Create skills for effective presentation and interview

Syllabus:

Teaching hours: 30 Hours

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 Don'ts 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 Don'ts of group discussion

Suggested Readings": (Latest Edition)

1. Rutherford, A.I. Basic communication skills for Technology, Pearson Education.
2. Pushpalata, S.K. Communication skills. Oxford Press.
3. Robbins, S.P. Organizational Behaviour. Pearson.
4. Hasson, G. Brilliant - Communication skills. Pearson Life.
5. Gopaldaswamy, R. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Pearson.
6. Dalley, D., Burton, M. & Greenhall, M. Developing your Influencing Skills. Universe of Learning Ltd.
7. Konar, N. Communication Skills for Professionals, PHI.
8. Mitra, B.K. Personality Development and Soft Skills. Oxford Press.
9. Butterfield. Soft Skill for Everyone. Cengage Learning India Pvt. Ltd
10. Peters, F.S.J. Soft Skills and Professional Communication. Mc Graw Hill Education.
11. Adair, J. Effective Communication. Pan Mac Millan.
12. Daniels, A. Bringing Out the Best in People. Mc Graw Hill.

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(B. Pharm)
(Semester - I)

L	T	P	C
2			2

Course Code	BP106RBT
Course Title	Remedial Biology - Theory

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

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Identify the five kingdoms of life and living world
2. Understand the morphology of flowering plants
3. Describe the anatomy and physiology of animals and human beings
4. Explain the various phases of plant growth and different plant tissues.
5. Illustrate the process of photosynthesis and plant nutrition

Syllabus:

Teaching hours: 30 Hours

UNIT I

7 Hours

• **Living world:**

Definition and characters of living organisms

Diversity in the living world

Binomial nomenclature

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

• **Morphology of Flowering plants:**

Morphology of different parts of flowering plants - Root, stem, inflorescence, flower, leaf, fruit, seed.

General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledons.

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

Renin 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.

Suggested Readings": (Latest edition)

1. Gokhale, S.B. Text book of Pharmaceutical Biology, Pragati Books.
2. Thulajappa, S. A. & Seetaram. A Text book of Biology.
3. Naidu, S.B.V. A Text book of Biology.
4. Naidu, M. A. & Murthy. Text book of Biology.
5. Dutta, A.C. Botany for Degree students. Oxford University Press.
6. Ayyer, M.E. & Ananthakrishnan T.N. A Manual of Zoology.
7. Gokhale, S.B. & Kokate, C.K.. A Manual for Pharmaceutical Biology Practical. Nirali Prakashan.

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(B. Pharm)
(Semester - I)

L	T	P	C
2			2

Course Code	BP106RMT
Course Title	Remedial Mathematics - Theory

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Relate the theory and applications of basic mathematics with pharmacy
2. Discuss applications of partial fraction, limits and continuity and logarithm for pharmaceutical computation
3. Understand calculus and analytical geometry for pharmaceutical problems solving
4. Utilize the formulas of matrices and determinant for calculations related to pharmacy
5. Evaluate differential equations used in pharmaceutical sciences

Syllabus:

Teaching hours: 30 Hours

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 ($\epsilon - \delta$ definition)

$$\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}, \quad \lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1.$$

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, Application of Matrices in solving Pharmacokinetic equations

UNIT III

06 Hours

- **Calculus**
Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) - **Without Proof**, Derivative of x^n w.r.t.x, where n is any rational number, Derivative of \sqrt{x} , Derivative of $\log_e x$, Derivative of cf , 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

Suggested Readings/\: (Latest edition)

1. Narayan, S. Differential Calculus. S. Chand Publishers.
2. Panchaksharappa Gowda, D.H. Pharmaceutical Mathematics with application to Pharmacy. PharmaMed Press.

3. Narayan, S., & Mittal, P. K. Integral calculus. S. Chand Publishers .
4. Grewal, B. S. Higher Engineering Mathematics

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(B. Pharm)
(Semester - I)

L	T	P	C
		4	2

Course Code	BP107P
Course Title	Human Anatomy and Physiology - Practical

Syllabus:

Total Hours: 60 Hours

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. To study the integumentary and special senses using specimen, models, etc.,
7. To study the nervous system using specimen, models, etc.,
8. To study the endocrine system using specimen, models, etc
9. To demonstrate the general neurological examination
10. To demonstrate the function of olfactory nerve
11. To examine the different types of taste.
12. To demonstrate the visual acuity
13. To demonstrate the reflex activity
14. Recording of body temperature
15. To demonstrate positive and negative feedback mechanism.

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B.Pharm)
(Semester- I)

L	T	P	C
		4	2

Course Code	BP108P
Course Title	Pharmaceutical Analysis I - Practical

Syllabus:

Total hours: 60 Hours

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm.)
(Semester - I)

L	T	P	C
		4	2

Course Code	BP109P
Course Title	Pharmaceutics I - Practical

Syllabus:**Total hours: 60 Hours****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) Aluminium Hydroxide gel

6. Emulsions

- a) Turpentine Liniment
- b) Liquid paraffin emulsion

7. Powders and Granules

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

8. Suppositories

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

9. Semisolids

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

10. Gargles and Mouthwashes

- a) Iodine gargle
- b) Chlorhexidine mouthwash

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm) (Semester-I)

L	T	P	C
		4	2

Course Code	BPII0P
Course Title	Pharmaceutical Inorganic Chemistry - Practical

Syllabus:

Total hours: 60 Hours

1. Limit tests for following ions

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

2. Identification test

- Magnesium hydroxide
- Ferrous sulphate
- Sodium bicarbonate
- Calcium gluconate
- Copper sulphate

3. Test for purity

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

4. Preparation of inorganic pharmaceuticals

Boric acid
Potash alum
Ferrous sulphate

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - I)

L	T	P	C
		2	1

Course Code	BP111P
Course Title	Communication Skills - Practical

Syllabus:

Total hours: 30 Hours

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

1. Basic communication covering the following topics

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

2. Pronunciations covering the following topics

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

3. 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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester-I)

L	T	P	C
		2	1

Course Code	BP112RBP
Course Title	Remedial Biology - Practical

Syllabus:

Total hours: 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

Suggested Readings;\: (Latest edition)

1. Kale, S.R. & Kale, R.R. Practical Human Anatomy and Physiology
2. Gokhale, S.B. Kokate, C.K. & Shriwastava S.P. A Manual of Pharmaceutical Biology Practical
3. Shafi, M.J.H. Biology Practical Manual according to National Core Curriculum. Biology Forum of Kamataka.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

**NIRMA UNIVERSITY
INSTITUTE OF PHARMACY**

**B. Pharm. Semester - I
COURSE NAME : FUNDAMENTALS OF PHARMACEUTICS [2PH111]**

Course Outcomes:

After successful completion of the course student will be able to :

- Remember unit systems, unit processes and conversion factors
- Understand concepts of Reynolds' number, viscosity, surface tension, HLB value, etc.
- Describe principle, construction, and working of various manometers, flow-meters, viscometers, etc.
- Determine viscosity, surface tension, fluid pressure, flow-rates etc.
- Solve basic calculations involved in pharmaceutical unit operations
- Use knowledge for understanding selection of materials for plant construction

Theory (Detailed Syllabus)

		L P C
1	Introduction Pharma engineering and its significance, unit operations and unit processes. Unit systems, Physical quantities, SI unit, CGS unit, gas constant and conversion of units. Dimensions and units, dimensional equations, dimensional analysis and dimensionless groups. Different types of graphical representation.	3 3 5
2	Stoichiometry General principles, material balance-tie substances, chemical reactions and molal units, rate process, steady, unsteady and equilibrium state, laws of combining weights, applications of gas laws, energy balance, fuels and combustion, Limekiln performance etc. (Mathematical problems included)	
3	Fluid Flow Type of steady flow, Reynold number & its significance, types of pressure, viscosity, concept of boundary layers, total energy balance and total mechanical energy balance, losses in mechanical energy of fluids, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow rate and pressure (Mathematical problems included).	
4	Viscosity and Rheology Law of flow, kinematic viscosity, effect of temperature, non-newtonian systems, pseudoplastic, dilatant, plastic, thixotropy in formulation, determination of viscosity - capillary, falling ball, rotational, Brookfield viscometer etc. Applications of rheology in pharmacy.	
5	Surface and Interfacial Phenomena Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, applications of surface active agents, HLB classifications, solubilizations, detergency, adsorption at solid interface, solid-gas and solid-liquid interfaces complex films, electrical properties of interface.	
6	Materials of Pharmaceutical Plant Construction Factors affecting the material selection for pharmaceutical plants, metals and non-metals, corrosion and its prevention.	
Total Lectures		45

Practicals

- 1 Study of conversion factors and plotting of different graphs.
- 2 Concept of Material Balance & Tie-substance in unit operations like evaporation.
- 3 Measurement of fluid pressure by various types of manometers.
- 4 Application of Reynold's apparatus for determination of types of flow.

- 5 Determination of Flow Rate by Orificemeter, Venturimeter, Rotameter, etc.
- 6 Determination of Surface Tension/ Interfacial tension by various methods.
- 7 Concept of **HLB** value of emulsifiers and CMC of Surfactants.
- 8 Determination of viscosity using Ostwald's & Brookfield's viscometers and study of Viscosity at different temperature.
- 9 Other practicals related with theory section.

Total hours

45

Books Recommended

1. Elementary Chemical Engineering - Max S. Peters, Published by McGraw Hill Book Company, New York.
2. Perry's Chemical Engineer's Handbook - Robert H Perry, Green D.W., Maloney J.O. McGraw - Hill Inc. , New York.
3. Tutorial Pharmacy by Cooper & Gunn, ed. SJ Carter, CBS Publishers & Distributors, Delhi.
4. Unit Operations of Chemical Engineering, by McCabe, Smith & Harriott, McGraw - Hill Inc., New York.
5. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins , New York.
6. Pharmaceutics: The Science of Dosage Form Design - M.E. Aulton.
7. The Theory & Practice of Industrial Pharmacy - Lachman L., Lieberman H.A. & Kanjig J.L, Varghese Publishing House, Bombay.
8. Alfonso G. Remington: The Science & Practice of Pharmacy. Vol.I & II, Lippincott, Williams & Wilkins Philadelphia.
9. Florence, A. T. Atwood, D. (Eds.) Physicochemical Principles of Pharmacy, Macmillan Press Ltd., London.
10. Ansel, Howard. C., Allen, Loyd V., Popovich, Nicholas G. Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams & Wilkins, New York.
11. Martin Alfred, Physical pharmacy by Alfred Martin, Lippincott Williams & Wilkins, New York.
12. . Aulton, Michael E., Pharmaceutics : The Science of Dosage Form Design, Churchill Livingstone, London .
13. Introduction to Chemical Engineering by Walter L. Badger & Julius T. Banchemo, McGraw Hill International edition, New Delhi.

B. Pharm. Semester - I
COURSE NAME: INTRODUCTION TO PHARMACEUTICAL CHEMISTRY [2PH112]

Course Outcomes:

After successful completion of the course student will be able to :

- Understand the basics of physical chemistry
- Discuss various sources and methods of determination of impurities in pharmaceuticals
- Explain fundamentals of acids and bases
- Describe different kinds of intermolecular forces in molecules.
- Demonstrate use of the pharmacopoeia to find out information related to various official compounds and pharmaceuticals
- Analyse qualitatively and quantitatively few pharmaceutical substances in terms of limit tests, assays, physical properties, etc.

L	P	C
2	2	3

Theory (Detailed Syllabus)

1. Sources of Contamination in Pharmaceuticals and Methods to Control

Various limit tests including chloride, sulphate, arsenic, lead, iron and heavy metals. Limits of insoluble matter, soluble matter, non-volatile matter, residue on ignition and ash values. Qualitative tests for alkali and alkaline earth metals and other impurities.

2. Physical Properties and Chemical Constitution

Study of various physical properties like surface tension, viscosity, dipole moment, molar refraction, optical activity, magnetic properties and their applications to the determination of molecular structure. Study of some colligative properties like vapour pressure lowering, boiling point elevation and freezing point depression in relation to determination of molecular structure.

3. Intermolecular Forces

Dipole - Dipole interactions, Ion - Dipole interactions, Ion-Induced Dipole and Dipole - induced Dipole interactions, Dispersion interactions, London interactions, hydrogen bond, structure and properties of water.

4. Study of Periodic Table

Periodicity and valency, Ionization energy trends, Atomic size trends, Relativistic effects, oxidation state of selected transition state elements, Study of selected organo-metallic compounds and their utility as catalysts (Li⁺, Mg⁺², Al⁺³, Boron etc.)

5. Study of Kinetic Modes of Chemical Reactions

Rate of laws and mechanism, Steady state, Catalysis, Detailed study of zero order, first order and second order kinetic reactions with suitable examples.

Total hours

30

Practicals

Care and handling of balance.

Calibration of weights. Precision in weighing, use of a rider.

Limit tests with few modifications (where ever possible) for chlorides, sulphate, iron, lead, heavy metals and arsenic as per the Indian Pharmacopoeia.

Experiments on surface tension & viscosity, partition coefficients, adsorption, freezing point depression, boiling point elevation & colorimetry.

Total hours

30

Books Recommended

- 1 Textbook of Physical Chemistry- 2nd Edition - 1974 - Samuel Glasstone - Macmillan India Limited
- 2 Physical Chemistry with Applications to Biological systems - Raymond Chang - 2nd Edition - 1981 - Macmillan Publishing Co.
- 3 Essential of Physical Chemistry- 23rd Edition- 1996- B.S.Bhal, G.D.Tuli and Arnn Bhal - S.Chand and Company Ltd.
- 4 Advanced Physical Chemistry- 20th Edition - 1996 - Gurdeep Raj - Goel Publishing House 2000
- 5 Solved Problems in Physical Chemistry- 1990 - Clyde R. Metz - McGraw Hill Publishing Company.
- 6 Physical Chemistry- 5th Edition- 1997- P.W. Atkins - Oxford University Press.
- 7 Remington: The Science and Practice of Pharmacy Vol. I & II - 20th Edition - 2000 - Lippincott, Williams & Wilkins

- 8 Advanced Practical Physical Chemistry- 15th Edition - 1997 - J.B.Yadav - Goel Publishing House
- 9 Experiments in Physical Chemistry- 5th Edition - 1989 - D.P.Shoemaker, C.W.Garland & J.W. Nibler - McGraw Hill Book Company.
- 10 Practical Pharmaceutical Chemistry Vol. - I & II - 4th Edition - 1986 - A.H.Beckett & J.B.Stenlake - CBS.
- 11 Inorganic Chemistry by James E. House Academic Press: Burlington, 2008
- 12 Modern Inorganic Chemistry by William Jolly 2nd ed Tata McGraw-Hill Publishing Company Ltd.: New Delhi, 2006
- 13 Inorganic Chemistry by R. L.Madan and G. D.Tuli S. Chand & Company Ltd.: New Delhi, 2005
- 14 Bentley and Driver's Textbook of Pharmaceutical Chemistry / by L. M. Atherden 8th ed Oxford University Press: New Delhi, 1969

B. Pharm. Semester - I

COURSE NAME : HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION
[2PH113]

Course Outcomes :

After successful completion of the course student will be able to :

- Identify the structure, location of cell, tissues, muscles and various organs of the body.
- Describe functions of cardiovascular, haemopoietic, skeletal, muscular and digestive system.
- Discuss communicable diseases with reference to their epidemiology, spread, prevention and health policies.
- Explain fundamental concepts of immunity, metabolism and body temperature regulation.
- Assess haemoglobin level and blood cell count, bleeding time, clotting time, blood group, blood pressure and heart rate.
- Predict macro and microscopical characteristics of various organs and tissues.

Theory (Detailed Syllabus)

	L	P	C
1. Organization of the Human Body	3	3	5
I Introduction & Scope of Human Anatomy & Physiology			
II Structural & functional organization of Biological systems at the molecular, sub-cellular, cellular levels. Structure of cell membrane, transport across the cell membrane, molecular structure and function of cellular organelles and cytoplasm. Cell cycle and its significance.			
III Elementary tissues of the human body Epithelial, connective, muscular & nervous tissues , their sub-types , characteristics, location & function.			
2. Support & Movement			
I Integumentary System Anatomy & physiology of hypodermis, skin & accessory skin structures. Effects of aging on the integumentary system			
II Skeletal System Structure, composition & functions of skeleton. Articulations & movements of joints. Disorders of bones & joints.			
III Muscular System Gross anatomy, physiology of skeletal muscles. Muscular contraction, physiological properties of skeletal muscles and their disorders.			
3. Maintenance of Human body			
I Cardiovascular system Anatomy of the heart. Physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Brief introduction to cardiovascular disorders like hypertension, arteriosclerosis , angina pectoris, myocardial ischemia & infarction, congestive cardiac failure and cardiac arrhythmias.			
II Haemopoietic System Composition and functions of blood & its elements, their disorders, blood groups and their significance, mechanisms of coagulation, disorders of platelets, coagulation defects etc.			
III Lymph & Lymphatic System Formation, composition, circulation and disorders of lymph and lymphatic system. Basic physiology and functions of spleen.			
IV Body defense Mechanisms & Immunity Basic principles of immunity , innate immunity, adaptive immunity , immune interactions , acquired immunity and brief overview of immune system pathology .			
V Digestive System Gross anatomy & physiology of the gastro-intestinal tract and its accessory organs (liver, pancreas and gall bladder). Digestion, absorption and transport of carbohydrates, lipids, proteins,			

water and ions. Disorders of the digestive system.

VI Metabolism and Body Temperature Regulation

Metabolic rate and body temperature regulation.

4 Public Health, Diseases & awareness

- I Definition of public health and disease, role pharmacist in public health issues.
Brief outline of common communicable diseases.
Communicable diseases with special emphasis on causative agent, epidemiology, mode of spread and prevention of the following diseases: Chicken Pox, Measles, Influenza, Diphtheria, Poliomyelitis, Cholera, Typhoid fever, Paratyphoid fever, Plague, Rabies, Tetanus, tuberculosis, filariasis, helminthiasis, malaria, hepatitis, leishmaniasis, Encephalitis.
- II **First aid treatment** in accident, shock, snakebite, burns, poisoning and resuscitation methods.
- Total Lectures** **45**

Practicals

1. Haematology Experiments

- Brief introduction to use & care of Microscope
Study of Haemocytometry
Estimation of
- Hemoglobin content & oxygen carrying capacity of blood.
 - Total RBC count
 - Total leucocyte count
 - Differential Leucocyte Count
 - Bleeding and clotting time
 - Erythrocyte Sedimentation Rate (ESR)
 - Study of effect of osmotic pressure on human RBC
 - Study of blood groups & their examination

2. Cardiovascular System

Clinical Examination of cardiovascular system

- ▶ Determination of body temperature, pulse rate, blood pressure, listening to heart sounds, demonstration of ECG.

3. Study of Gross Anatomy & Physiology of Various Organ Systems by Models / Charts /

- A Circulatory System
- A Heart
- A Muscular System
- A Skeletal System
- A Digestive System

4. Amphibian Experiments (Whole Animal Experiments / Computer Aided Learning)

- A Study of instruments used in experimental physiology
- A Study of Simple Muscle Curve (SMC) using gastrocnemius sciatic muscle-nerve preparation
- A Study of effect of fatigue, temperature, successive stimulation & load on gastrocnemius sciatic muscle-nerve preparation
- A Study of effect of Temperature, Stannius Ligature & Vagal Stimulation on frog heart.

5 Study of First Aid Measures

6 Histology

Microscopic study of different types of primary tissues and organs from permanent slides.

Total hours

45

Books Recommended

1. Anne M.R. Agur & Ming J. Lee: Grant's Atlas of Anatomy, Lippincott, Williams and Wilkins
2. B.D. Chaurasia's Human Anatomy (3 Volumes) CBS Publishers & Distributors
3. B. Young, J.W. Heath: Wheater's functional Histology- a Text and Colour Atlas, Churchill Livingstone
4. Bullock B.L. & Henze R.L., Focus on Pathophysiology, Lippincott
5. Chatterjee, C.C. Human Physiology (Medical Allied Agency, Calcutta)

6. Chummy S. Sinnatamby: Last's Anatomy- Regional and Applied, Churchill Livingstone.
7. Gandhi, T.P. et. al.: Human Anatomy, Physiology & Health Education (B.S.Shah Prakashan, Ahmedabad)
8. Garg K. et al. A Text Book of Histology (CBS Publishers, New Delhi).
9. Ghai, C.L.: A Textbook of practical physiology (Jaypee Brothers Medical Publisher (P) Ltd.)
10. Gosling T.A., Harris P.F., Whitmore I., William, Human Anatomy: Color Atlas and Text Book
11. Goyal, R.K. et al.: Practical Anatomy Physiology and Biochemistry (B.S. Shah Prakashan, Ahmedabad)
12. Gray's Anatomy - Peter L. Williams - The Anatomical Basis of Medicine and Surgery, Churchill
13. Guyton A.C. and Hall J.E. : Textbook of Medical Physiology, W.B.Saunders
14. Joshi, Vijaya D. Preparatory Manual for Undergraduates Physiology (B.I. Churchill Livingstone)
15. Lesson, C.R. et al.: Text Book of Histology (W.B.Saunders Company)
16. . Macfarlane P.S., Reid R. and Callander R.: Pathology Illustrated, Churchill Livingstone
17. Martini, F. Fundamentals of Anatomy and Physiology (Prentice Hall)
18. Park's Textbook of Preventive and Social Medicine, M/s. Banarasidas Bhanot
19. Parmar, N.S. Health Education and Community Pharmacy (CBS Publishers, New Delhi)
20. Seeley R.R., Stephens T.D. and Tate P.: Anatomy and Physiology, McGraw Hill Co.
21. Sobotta: Atlas of Human Anatomy (2 Volumes), Edited by Putz and R. Pabst, Lippincott, Williams and
22. Subhas Shalya: Human Physiology (CBS Publishers, New Delhi)
23. Tortora G.J. and Anagnodokos, N.P. Principles of Anatomy and Physiology (Harper and Colling Publishers, New York)
24. Van de Graaff and Crawley , J.L.: A Photographic Atlas for the Anatomy and Physiology Laboratory (Morton Publishing Company)
25. Waugh A. and Grant A.: Ross and Wilson's Anatomy and Physiology in Health & illness, Churchill
26. West, J.B. Best and Taylor's physiological Basis of Medical Practice (Williams and Wilkins, Baltimore)
27. William J. Larsen: Anatomv - Develoement. function. Clinical Correlations. (Elsevier Science)
28. <http://msjensen.cehd.umn.edu/webanatomy/default.asp>
29. <http://www.anatomv.org/non-aaa-reso urcelinks>

B. Pharm. Semester - I
COURSE NAME : INTRODUCTION TO PHARMACOGNOSY [2PH114]

Course Outcomes :

After successful completion of the course student will be able to :

- Recognize drugs of natural origin with systematic practical approach
- Understand botanical characteristics of different parts of plants
- Describe various plant families taxonomically
- Discuss various aspects of cultivation, collection and storage of crude drugs
- Explain the classification of crude drugs
- Identify various microscopical characteristics of crude drugs and plant tissues

Theory (Detailed Syllabus)

L P C
3 3 5

1. Introduction, definition, historical background, development, present status and future scope of pharmacognosy
2. Plant cell and its structure, mitosis and meiosis, mechanism of photo synthesis
3. Study of plant tissues: parenchyma, collenchyma, sclerenchyma, xylem and phloem
4. Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed
5. Introduction to plant taxonomy with examples of some important families
6. Natural sources of drugs: plant, animal kingdom, marine and minerals
7. Classification of the crude drugs: alphabetical, morphological, taxonomical, chemical and phannacological.
8. Cultivation, collection, processing and storage of crude drugs
9. Factors affecting cultivation of medicinal plants: soil, fertilizers, plant hormones, polyploidy, mutation and hybridization.
10. Microscopy and micrometry: ca-oxalate crystals, starch grains, trichomes, lycopodium spores and fibres as diagnostic characters
11. Introduction to primary and secondary plant metabolites

Total Lecture

45

Practicals

1. Introduction, care, use and type of microscopes.
2. Microscopic examination of plant cell and tissues.
3. Morphology and organoleptic characters of roots, stems, flowers, fruits, seeds, leaf, wood and bark
4. Histology of leaf
5. Histology of monocot and dicot stem.
6. Histology of monocot and dicot root.
7. Study of different type of stomata, trichomes and calcium oxalate crystals
8. Study of some families like Apocynaceae, Solanaceae and Umbelliferae.
9. etenninatio of length and width of phloem fibres
10. Determination of size of starch grains

11. Gross examination of some permanent slides.

12. Preparation of herbarium and plant specimens.

Total Hours

45

Books Recommended

- Pharmacognosy: W.C.Evans, W.B. Saunders, Edinburgh- 15th Edition- 2002
- 2 Pharmacognosy: C.K.Kokate, A.P.Purohit and S.B.Gokhale, Nirali Prakashan, Pune- 17th Edition-2001
 - 3 Text Book of Pharmacognosy: T.E.Wallis, CBS publishers and Distributors Delhi - 5th Edition-Reprint
 - 4 Botany for Degree Students: A.C.Dutta, Calcutta Oxford Univeristy, Press, Delhi- 15th Impression-1994
 - 5 Botany in Forestry and Environment- Ashokkumar, Kumar Media (P) Ltd., Gandhinagar - 1st Edition - 2001

B. Pharm. Semester - I
COURSE NAME: FUNDAMENTALS OF PHARMACEUTICAL ANALYSIS [2PH115]

Learning Outcomes :

After successful completion of the course student will be able to:

- Prepare different strengths types of solutions used in pharmaceutical field. (Molar, Normality etc.)
- Report the information of various drugs and pharmaceuticals from the pharmacopoeia.
- Understand the fundamentals of acid-base titration as well as different categories of water used in pharmaceutical manufacturing.

Theory (Detailed Syllabus)

L P C
2 2 3

1. **Introduction & Scope of Pharmaceutical Analysis-** Definition, Classification & Importance of various analytical techniques
 2. **Titrimetric Methods of Analysis**
Concentration systems, stoichiometric calculations, equivalent weights and expression of concentration of standard solutions.
 3. **Acid Base Equilibria**
Theories, acid - base equilibria in water, the pH scale, distribution of acid - base species with pH, weak acids & bases, salts of weak acids & bases, buffers, polyprotic acids and their salts.
 4. **Acid Base Titration**
Titration curves for strong acid-strong base titration, weak acid-strong base titration, weak base strong acid titration, titration of polyfunctional acids and bases, acid - base indicators, titration of amino acid.
 5. **Buffer-** Definition, Preparation of buffers, mechanism of buffer action, Systemic buffers
 6. **Water**
Detailed study from the viewpoint of water as universal pharmaceutical vehicle
 7. **Introduction to the Indian pharmacopoeia and the study of monographs of official compounds. (Acidifying agents & antacids)**
- Total Lecture** **30**

Practicals

1. Care and handling of balance. Calibration of weights. Precision in weighing, use of a rider.
2. Study of different sections of pharmacopoeias.
3. Pharmaceutical calculation for preparation of different volumetric solutions.
4. Assay of various official compounds for acidifying agents and antacids.
5. Qualitative tests for identification of various cations and anions belonging to acidifying agents and antacids.

Total Hours

30

Books Recommended

1. D.A.Skoog, D.M.West, F.J.Holler, S.R.Crouch, Fundamentals of Analytical Chemistry, 8th edition, 2004, Thomson Asia Pvt. Ltd.
2. Kenneth A. Connors, A textbook of Pharmaceutical Analysis, 3rd edition, 2002, John Wiley & Sons, New York, USA.
3. F.W.Fifield, D.Kealey, Principles and Practice of Analytical Chemistry, 5th edition, 2000, Blackwell Science, Oxford, U.K.
4. Gary D. Christian, Analytical Chemistry, 6th edition, 2004, John Wiley & Sons, New York, USA.
5. R.A.Day, Jr, A.L.Underwood, Quantitative Analysis, 6th edition, 2001, Prentice Hall of India.
6. Ashotosh Kar. Pharmaceutical Analysis: Theory, Methodology and Drug Assay, 2007, C. B. S. Publishers & Distributors, Delhi
7. D. G. Watson, Pharmaceutical Analysis: A Textbook of Pharmacy Students and Pharmaceutical Chemists, 2005, Churchill Livingstone, London.
8. P. Parimoo, Pharmaceutical Analysis, 1999, C. B. S. Publishers & Distributors, Delhi.

9. D. C. Lee & M. L. Webb , Pharmaceutical Analysis,2003, Blackwell Science, Oxford.
10. Practical Pharmaceutical Chemistry Vol. - I & II - 4th Edition - 1986 - AH.Beckett & J.B.Stenlake - CBS Publishers, New Delhi.
11. A. R. Gennaro, Remington: The Science and Practice of Pharmacy Vol. I & II - 20th Edition - 2001 - Lippincott, Williams & Wilkins, New York, USA.
12. The Indian Pharmacopoeia , Latest Edition, the Controller of Publications, Government of India, New Delhi

B. PHARM. SEMESTER- I
COURSE NAME: FUNDAMENTALS OF COMPUTER APPLICATIONS IN PHARMACY
[2PH116]

Course Outcomes:

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

- Remember and utilize tools for word processing, spreadsheet, power-point and database applications.
- Understand different types of software for structural drawings and prepare tables and charts for presentations of chemical and biological data.
- Analyse different bio-phannaceutical calculations using mathematical and statistical functions.
- Prepare project reports in terms of dissertation using computer tools.
- Develop various types of presentations and posters with animation.
- Utilize various search engines and applications in order to explore Pharma fields.

Practicals :

L P C

Exercises will be given on the following topics:

- 3 2

1. **Word Processing Applications**
Word processing application including creating and formatting word documents, text editing, table handling, importing objects from other systems, equation editors, practise on mail merge*
2. **Database Applications**
Study of various properties of chemical compounds and drugs using suitable online database tools*
3. **Power Point and Publisher Applications**
Preparation of slides and posters for different pharmacy applications. Formatting, adding animations and giving various effects for effective presentations*
4. **Database Applications**
Study of various properties of chemical compounds and drugs using suitable online database tools*
5. **Study on Various Search Engines and Applications**
Study and experimentation on how to use various search engmes for scientific search of drugs/formulations, proteins, chemical structures drawing and similar tools for relevant applications*
6. **Study on various software of pharmaceutical importance**
Study and experimentation on **CHEMSKETCH/CHEMDRAW**, etc
* Experiments and tools as recommended by the concerned teachers.

Total hours

45

Books Recommended :

1. Manuals provided with the license version of the softwares.
2. Rajaraman, V. Fundamentals of Computers. Prentice-Hall ofIndia Pvt. Ltd. New Delhi, 2001
3. Thakur, Praveen S, Computers in Pharmacy. Birla Publications India. Delhi, 2006
4. Tiwari, N. K. Computer Fundamentals with Pharmacy Applications. PharmaMed Press: Hyderabad, 2010
5. Faruki, Parvez. Basic Computer Applications for Pharmacy. Mahajan Publishing House: Ahmedabad, 2008

B.Pharm Semester - I
COURSE NAME: BASIC MATHEMATICS [2SPPH111]
(Supplementary Course)

Course Outcomes:

- Relate the theory and applications of basic mathematics with pharmacy
- Discuss applications of logarithm for pharmaceutical computation
- Utilize the formulas of quadratic equations, matrices and trigonometry for calculations related to pharmacy
- Understand differential equations of first order and first degree
- Use basics of mathematics in advanced study like biostatistics in Pharmacy
- Evaluate Cartesian Coordinate Systems, distance between two points and area of a triangle

<u>Theory (Detailed Syllabus)</u>	L	T	C
A. Quadratic Equations Method of Solving, Equations Reducible to Quadratic Equations, Applications.	2	2	
A. Determinants Second and third order determinants, Properties, Minors and Cofactors, Solution of Simultaneous Linear Equations by Cramer's Rule.			
A. Matrices Definition, Types of Matrices, Algebra of Matrices, Special types of Matrices, Solutions of Simultaneous Linear Equations by Matrix method.			
A. Applications of Logarithm to Pharmaceutical Computation Introduction Logarithm, Laws of Logarithm, Napierian logarithm, Laws of Growth and Decay, Application to Population growth and Pharmaceutical Computation Problems.			
A. Trigonometry Measurement of Angle, T - ratios, Addition, Subtraction and Transformation formulae, if - ratios of Multiple, Submultiple and allied angles, Inverse trigonometric functions and formulae based on it.			
A. Binomial Theorem Binomial Theorem, Positions of Terms, Binomial theorem for any index, Applications.			
A. Arithmetic and Geometric Progressions Sequence, Arithmetic Progressions (A.P.) and Geometric Progressions (G.P.).			
A. Analytical Plane Geometry Cartesian Coordinate Systems, Distance between two points, Area of a triangle, Section Formulae, Locus of a point, Straight Line: Slope of a line, angle between two lines, various forms of Equation of a line.			
A. Calculus Functions and limits: Functions, Domains, Co-domain and range. Classification of functions, Definition of limit, Limits at infinity. Differentiation: Definition of differential Coefficient, Derivative of Standard functions including function of a function, Differentiation of implicit inverse trigonometric, logarithmic and parametric functions, Successive differentiation. Integration : Integration as inverse of differentiation, indefinite integrals of standard forms, Integration by method of Substitution and by parts, integration by partial fractions, definite integrals, fundamental theorems and properties of definite integral.			
A. Differential Equations of First Order and First Degree: Order, degree and solution of formation of differential equation, Solution of differential equations: Variable Separable, Homogeneous and Linear differential equations, Equations reducible to linear form. Bernoulli equation, Applications - Modeling, Constructing Mathematical Models, Growth and Decay, Pharmaceutical Models.			
Total Lectures			30

Tutorials

Tutorial sessions shall comprise of illustrations & problem solving from topic mentioned in the theory section.

Total hours

30

Books Recommended

- 1 Remedial Mathematics for Pharmacy, Second Edition, by Dr. K. R. Kachot, Mahajan Publishing House.
- 2 Remedial Mathematics by Gupta & Prabhakar, Pragati Prakashan.
- 3 College Mathematics by Kai L. Nilson, Barnes & Noble inc.
- 4 Calculus by Frank Ayres, Mendelson, Elliot, McGraw Hill Companies, New York.
- 5 Integral Calculus by Shanti Narayan, S. Chand & Company Ltd., New Delhi.

B. Pharm. Semester - I

COURSE NAME: ENGLISH & COMMUNICATION SKILLS [2SPPH112] (Supplementary Course)

Course Outcomes:

After successful completion of the course student will be able to :

- Understand the basics of English grammar and phonetics
- Use appropriate English vocabulary for fluent and confident communication in English
- Practice effective word choice, idioms, grammar and sentence structure allowing accurate communication of meaning in written work.
- Initiate conversation & express their interest, views or opinions
- Develop communication capacities in speaking, writing, listening and narrating in English.
- Create outline ideas for essays and other forms of academic writing.

Theory (Detailed Syllabus)

L T C
2 -

- Introduction on Language & Communication
- Give personal information, describe people & places, give compliments, express likes & dislikes, and describe habits & routines.
- Ask for & give opinions, agree & disagree.
- Initiate conversation & express interest.
- Give instructions & advice.
- Talk about problems.
- Narrate ways of travelling, how things are done.
- Grammar: Tenses, conditionals, voice, articles, gerunds & infinitives
- Phonetic symbols

Total hours

30

Books Recommended

- 1 A Course in English Communication by Madhavi Apte ;Prentice-Hall ofIndia Pvt. Ltd.: New Delhi, 2007.
- 2 Speaking Effectively: Developing speaking Skills for Business English by Jeremy Comfort; Cambridge University Press: Cambridge, 2002.
- 3 The Cambridge Guide to Teaching English to Speakers of Other Language by Ronald, Carte,; Cambridge University Press: New York, 2001.
- 4 English Conversation Practice by Grant Taylor; Tata McGraw-Hill Publishing Company Ltd.: New Delhi, 2003.
- 5 Common Errors in English by Grenville Kleiser,; A. P.H. P Publishing Corporation: New Delhi, 2005.
A Handbook of English for Professionals by Elish, P.; 2nd ed B. S. Publications: Hyderabad, 2008.

NIRMA UNIVERSITY
Institute of Pharmacy

(B. Pharm)
(Semester - II)

L	T	P	C
3	1		4

Course Code	BP201T
Course Title	Human Anatomy and Physiology II - Theory

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 -

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Identify the structure, location of cell, tissues, muscles and various organs of the body.
2. Explain the anatomy, physiology and functions of cardiovascular, digestive, respiratory and reproductive system.
3. Outline the concepts of genetics.
4. Summarize the roles and functions of body fluids, blood and lymph.
5. Discuss various feedback mechanisms and regulation of physiological processes.
6. Perform hematological tests like blood cell counts, hemoglobin estimation, bleeding/clotting time etc. and also record blood pressure, heart rate, pulse and respiratory volume.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

Body fluids and blood:

Body fluids, composition and functions of blood, hemopoiesis, 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 II**10 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.

UNIT III**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.

UNIT IV**10 Hours****Respiratory system:**

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

Urinary system:

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

UNIT 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.

Tutorials:**Teaching hours: 15 Hours**

Tutorials will be based on above syllabus

Suggested Readings/ (Latest Edition)

1. Sembulingam, K. Sembulingam, P. *Essentials of Medical Physiology*. New Delhi, Jaypee Brother's Medical Publishers.
2. Wilson, K.J.W. *Anatomy and Physiology in Health and Illness*. New York, Churchill Livingstone.

3. Best and Taylor. *Physiological basis of Medical Practice*. MI USA, Williams & Wilkins Co, Riverview.
4. Guyton, A.C, Hall J.E, Miamisburg, O.H. *Text book of Medical Physiology*. U.S.A. Elsevier Saunders.
5. Tortora G, Palmetto, G.A. *Principles of Anatomy and Physiology*. U.S.A. John Wiley & sons.
6. Singh I. *Textbook of Human Histology*. New Delhi, Jaypee Brother's Medical Publishers.
7. Ghai, C.L. *Textbook of Practical Physiology*. New Delhi. Jaypee Brother's Medical Publishers.
8. Srinageswari, K., Sharma, R. *Practical workbook of Human Physiology*. New Delhi, Jaypee Brother's Medical Publishers.
9. Gandhi, T.P. et. al. *Human Anatomy, Physiology & Health Education*. B.S.Shah Prakashan, Ahmedabad.
10. Goyal, R.K. et al.: *Practical Anatomy Physiology and Biochemistry*. B.S. Shah Prakashan, Ahmedabad.

L= Lecture, T= Tutorial, P= Practical, C= Credit

Athis is not an exhaustive list

(B. Pharm)
(Semester - II)

L	T	P	C
		4	2

Course Code	BP207P
Course Title	Human Anatomy and Physiology II - Practical

Syllabus:

Total Hours: 60 Hours

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. Introduction to hemocytometry.
2. Enumeration of white blood cell (WBC) count.
3. Enumeration of total red blood corpuscles (RBC) count.
4. Determination of bleeding time.
5. Determination of clotting time.
6. Estimation of hemoglobin content.
7. Determination of blood group.
8. Determination of erythrocyte sedimentation rate (ESR).
9. Determination of heart rate and pulse rate.
10. Recording of blood pressure.
11. Determination of tidal volume and vital capacity, Human spirometer.
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.

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - II)

	L	T	P	C
	3	1		4
Course Code	BP202T			
Course Title	Pharmaceutical Organic Chemistry I - Theory			

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Remember IUPAC nomenclature and uses of of selected organic compounds.
2. Understand **basic concepts and principle of organic chemistry**.
3. Discuss **concepts of reactivity and orientation** of chemical reactions.
4. Explain methods of **preparation and reactions of various functional groups**.
5. **Analyse unknown organic compounds** and prepare their derivatives.

Syllabus:

Teaching hours: 45 Hours

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

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

UNIT I

07 Hours

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

UNIT II

10 Hours

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

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

Stabilities of alkenes, SP² hybridization in alkenes

E1 and E2 reactions - kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeff's orientation and evidences. E1 versus E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, **Markownikoff's orientation**, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

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

UNIT III

10 Hours

- **Alkyl halides***

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

SN, versus SN2 reactions, Factors affecting SN1 and SN2 reactions

Structure and uses of ethyl chloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform

- **Alcohols***

Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, Isopropyl alcohol, Chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT IV

10 Hours

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

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

UNIT V

08 Hours

- **Carboxylic acids***

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

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

- **Aliphatic amines***

Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus.

Suggested Readings/\: (Latest edition)

1. Morrison, R. T., Boyd, R. N. *Organic Chemistry*. Prentice Hall, Inc., USA.
2. Finar, I. L. *Organic Chemistry*, Vol. I, ELBS.
3. Bahl, B. S. *Text Book Of Organic Chemistry {For B. Sc. Students}*. S. Chand And Company Ltd Ram Nagar; New Delhi.
4. March, J. *Advanced organic chemistry: reactions, mechanisms, and structure*. John Wiley & Sons,.
5. Soni, P. L. *Fundamental organic chemistry*. New Delhi: S. Chand.
6. Mann, F. G., & Saunders, B. C. *Practical organic chemistry*. London: Longman.
7. Solomons, T. W., Fryhle, C. B., & Johnson, R. G. *Organic chemistry*. New York: Wiley.
8. Ahluwalia, V. K. *Organic Reaction Mechanism*. New Delhi: Ane Books India.
9. Mann, F. G. *Practical organic chemistry*. Pearson Education India.

10. Vishnoi, N. K. *Advanced practical organic chemistry*. Vikas Publishing House Pvt. Limited.
11. Pavia, D. L. *Introduction to organic laboratory techniques: a small scale approach*. Cengage Learning.
12. Gurudeep, C.R., & Gurudeep, C.R. *Reaction Mechanism and Reagents in Organic Chemistry*. Bombay: Himalaya Publishing House.
13. Furniss, B. S. *Vogel's textbook of practical organic chemistry*. Pearson Education India.

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^this is not an exhaustive list

(B. Pharm)
(Semester - II)

L	T	P	C
		4	2

Course Code	BP208P
Course Title	Pharmaceutical Organic Chemistry (Practical)

Syllabus:

Teaching hours: 60 Hours

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - II)

L	T	P	C
3	1		4

Course Code	BP203T
Course Title	Biochemistry (Theory)

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Remember the general principles of biochemistry.
2. Understand the structure and functions of biomolecules and their role in energy metabolism.
3. Describe the basic metabolic pathways of biomolecules and variety of metabolic disorders.
4. Discuss fundamentals of enzymes, enzyme kinetics and their applications.
5. Analyse different biomolecules qualitatively and/or quantitatively.

Syllabus:

Teaching hours: 45 Hours

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**
-Oxidation of saturated fatty acid (Palmitic acid)
Formation and utilization of ketone bodies; ketoacidosis
De novo synthesis of fatty acids (Palmitic acid)
Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D
Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.
- **Amino acid metabolism**
General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and **its disorders**
Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alcaptonuria, 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**

UNITY

07 Hours

- **Enzymes and Vitamin**
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 including design of new drugs.
Coenzymes -Structure and biochemical functions.
Details of Vitamin.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus.

Suggested Readings": (Latest Editions)

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. *Lehninger principles of biochemistry*. Macmillan.
2. Murray, R. K., Granner, D. K., Mayes, P., & Rodwell, V. *Harper's illustrated biochemistry*. New York: McGraw-Hill.
3. Berg, J.M., Tymoczko, J. L., & Stryer, L. *Biochemistry*. New York: WH Freeman.
4. Satyanarayan, U. & Chakrapani, D. *Biochemishy*. India: Elsevier.
5. Rama Rao, A. V. S., & Devlin, T. M. *Textbook of Biochemistry: For Medical Students*. UBS publishers.

6. Deb, A. C., *Fundamentals of biochemistry*. New Central Book Agency (P) Limited.
7. Conn, E., & Stumpf, P. *Outlines of biochemistry*. John Wiley & Sons.
8. Gupta, R.C. & Bhargava, S. *Practical Biochemistry*. CBS Publishers & Distributors Pvt. Ltd
9. Mu, P., & Plummer, D. T. *Introduction to practical biochemistry*. Tata McGraw-Hill Education.
10. Rajagopal, G. & Ramakrishna S. *Practical Biochemistry for Medical Students*. orient blackswan
11. Varley, H. *Practical clinical biochemistry*. London: William Heine-mann Medical Books, Ltd..

L= Lecture, T= Tutorial, P= Practical, C= Credit
 Athis is not an exhaustive list

(B. Pharm)
(Semester - II)

		L	T	p	C
				4	2
Course Code	BP209P				
Course Title	Biochemistry (Practical)				

Syllabus:

Teaching hours: 60 Hours

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - II)

		L	T	P	C
		3	1		4
Course Code	BP204T				
Course Title	Pathophysiology - Theory				

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Recall the basic principles of Cell injury and Adaptation.
2. Understand pathophysiology of cardiovascular diseases, respiratory diseases, and renal disorders.
3. Explain hematological diseases, diseases of endocrine system, nervous system and gastrointestinal system.
4. Summarize about inflammatory disorders, liver disorders and disorders of bones and joints.
5. Discuss about pathophysiology of cancer.
6. Elaborate upon infectious diseases including sexually transmitted diseases.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

Basic principles of cell injury and adaptation:

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

Basic mechanism involved in the process of inflammation and repair:

Introduction, Clinical signs of inflammation, Different types of Inflammation, 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

10 Hours

Cardiovascular System:

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

Respiratory system:

Asthma, Chronic obstructive airways diseases.

Renal system:

Acute and chronic renal failure.

UNIT III**10 Hours****Haematological Diseases:**

Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, 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, inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.

UNIT IV**8 Hours****Disease of bones and joints:**

Rheumatoid arthritis, osteoporosis and gout.

Pathophysiology of cancer:

Classification, etiology and pathogenesis of cancer.

Diseases of Genitourinary system:

Disorders of bladder and ureter, infertility.

UNITY**7 Hours****Infectious diseases:**

Meningitis, Typhoid, Leprosy, Tuberculosis , Urinary tract infections.

Sexually transmitted diseases:

AIDS, Syphilis, Gonorrhoea.

Tutorials**Teaching hours: 15 Hours**

Tutorials will be based on above syllabus.

Suggested ReadingsA: (Latest Edition)

1. Kumar, V., Abbas, A. **K.**, Fausto, N., & Aster, J. C. *Robbins and Cotran Pathologic Basis of Disease*, Professional Edition E-Book. Elsevier Health Sciences.
2. Mohan, H. *Textbook of pathology* (pp. 280-283). New Delhi: Jaypee Brothers Medical Publishers.
3. Laurence B, Bruce C, Bjorn K. *Goodman Gilman's The Pharmacological Basis of Therapeutics*. New York; McGraw-Hill.
4. Best and Taylor. *Physiological basis of Medical Practice*. MI USA, Williams & Wilkins Co, Riverview.
5. Walker, B. R., Colledge, N. R. *Davidson's Principles and Practice of Medicine*. E-Book. Elsevier Health Sciences.
6. Hall, J. E. Guyton and Hall. *Textbook of Medical Physiology*. E-Book. Elsevier Health Sciences.
7. Dipiro, J.T., Talbert, R.L., Yee, G.C., Matzke, G.R. Wells, B.G., Posey, M.L. *Pharmacotherapy: A Pathophysiologic Approach*. New York: Mc Graw Hills Publishers.
8. Robbins, S. L., Kumar, V., Cotran, R. S. *Robbins Basic Pathology*. Philadelphia, USA, Saunders.
9. Walker, R., & Edwards, C. *Clinical Pharmacy and Therapeutics*. Churchill Livingstone. London.

10. Sylvia, P. A., Wilson, L. M., et al. *Pathophysiology: Clinical Concepts of Disease Processes*. Elsevier Science Publishers.
11. Bullock B. A., Henze R. L. *Focus on Pathophysiology*. Lippincott Williams & Wilkins, Philadelphia.

Recommended Journals

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

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^this is not an exhaustive list

(B. Pharm) (Semester - II)

L	T	P	C
3			3

Course Code	BP205T
Course Title	Computer Applications in Pharmacy - Theory

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 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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand various types of **computer applications in pharmacy**.
2. Describe various types of databases.
3. Discuss **various applications of databases in pharmacy**.
4. Explain concepts of bioinformatics.
5. Identify the role of computers in data analysis.

Syllabus:

Teaching hours: 45 Hours

UNIT I

09 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

09 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

09 Hours

Application of computers in Pharmacy:

Drug information storage and retrieval, Pharmacokinetic s, 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

09 Hours

Bioinformatics:

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

UNIT V

09 Hours

Computers as data analysis in Preclinical development:

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

Suggested Readings/\\: (Latest Edition)

1. Fasset, W. E. *Computer Application in Pharmacy*. South Washington Square, USA: Lea and Febiger.
2. Ekins, S. *Computer Applications in Pharmaceutical Research and Development*. USA: Wiley-Interscience.
3. Rastogi, S.C. *Bioinformatics-Concept, Skills and Applications*. New Delhi, CBS Publishers & Distributors.
4. Prague, C.N. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. New Delhi, Wiley Dreamtech India (P) Ltd.

L= Lecture, T= Tutorial, P= Practical, C= Credit

Athis is not an exhaustive list

(B. Pharm)
(Semester - II)

L	T	P	C
		2	1

Course Code	BP210P
Course Title	Computer Applications in Pharmacy - Practical

Syllabus:

Teaching hours: 30 Hours

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.

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Phann)
(Semester - II)

L	T	P	C
3			3

Course Code	BP206T
Course Title	Environmental sciences - Theory

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Define various natural resources.
2. Identify the renewable and non-renewable resources.
3. Describe the concepts of ecosystems.
4. Discuss the structure and function of various ecosystems.
5. Explain various types of environmental pollution.

Syllabus:

Teaching hours: 45 Hours

UNIT I

15 Hours

The Multidisciplinary nature of environmental studies.
Natural Resources.

Renewable and non-renewable resources:

Natural resources and associated problems

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

15 Hours

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

15 Hours

Environmental Pollution: Air pollution; Water pollution; Soil pollution.

Suggested Readings^: (Latest edition)

1. Singh, Y.K. *Environmental Science*. Bangalore, New Age International Pvt, Publishers.
2. Agarwal, K.C. *Environmental Biology*. Bikaner, Nidhi Publ. Ltd.
3. Bharucha, E. *The Biodiversity of India*. Ahmedabad, Mapin Publishing Pvt. Ltd.
4. Brunner, R.C. *Hazardous Waste Incineration*. McGraw Hill Inc.
5. Clark, R.S. *Marine Pollution*. Oxford, Clarendon Press.
6. Cunningham, W.P., Cooper, T.H., Gorhani, E & Hepworth, M.T. *Environmental Encyclopedia*. Mumbai, Jaico Publ. House.
7. De, A.K. *Environmental Chemistry*. New Delhi, Wiley Eastern Ltd.
8. *Down to Earth*, Centre for Science and Environment. New Delhi.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^this is not an exhaustive list

B. Pharm. Semester - II
COURSE NAME : PHARMACEUTICS - I (UNIT OPERATIONS - I) [2PH211]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand principles involved in heat transfer, mass transfer, filtration, centrifugation and drying
- Describe factors influencing above unit operations
- **Explain pharmaceutical equipment for above unit operations**
- Utilize knowledge of unit operations in understanding formulations, process and determining parameters
- **Correlate various unit operations and its applications**
- **Solve basic calculations involved in pharmaceutical unit operations.**

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Heat Transfer**
 Mode of Heat Transfers - Conduction, Convection and Radiation. Concept of various law and mathematical problem solving for different modes of heat transfers. Steam as heating media, properties of steam and study of steam table. Steam traps for removal of condensate. Equipments like heat exchangers, condensers, boilers, etc. Applications of Heat transfer in processes like fluidized bed process, sterilization, etc.
2. **Mass Transfer**
 Principle, streams in mass-transfer operations, solid/fluid and fluid/fluid mass transfer, Applications of mass transfer on unit operations like solubilization of crystals, etc.
3. **Filtration**
 Theory and mechanism of filtration process, factors affecting rate of filtration, filter media, filter aids, types of filters, operation of filters, industrial filters-leaf filter, filter press, rotary filter, Edge filters, Membrane filter, etc, Mathematical problems on filtration, optimum cleaning cycle in batch filters, Applications in pharmaceutical industries with special emphasis on liquid orals, syrups and parenteral formulations.
4. **Centrifugation**
 Principle and theory of centrifugation, industrial centrifuges-perforated basket centrifuge, sedimentation type centrifuge, cooling centrifuge, continuous centrifuges etc. Mathematical problems, Applications in pharmaceutical fields.
5. **Drying**
 Principle, Moisture content, loss on drying, mechanism of drying, drying rate and time calculations, drying of dilute solutions & suspensions - drum dryer, spray drier Drying of solid material - study of driers based on conduction, convection & radiation mechanism (including dryers used in pharmaceutical industrial, mathematical problems on drying), Recent advances in pharmaceutical dryers.
6. **Humidification, Dehumidification & Humidity Control**
 Definitions of various terms, wet bulb and adiabatic saturation temperatures, humidity chart and determination of humidity, equipments for humidification operations, theory and calculations of humidification processes, Humidity control, Introduction to Air Handling Unit (AHU), Applications of concept of humidity in various pharmaceutical processes like formulation of tablets, capsule and parenterals, mathematical problems related to humidity.
7. **Refrigeration and Air Conditioning**
 Basic concepts, types of refrigeration cycles, air conditioning, Applications in pharmacy.

Total Lectures

45

Note : Examples shown under each topic are for indication purpose. Additional examples for their application in Conventional and Novel Drug Delivery Systems (NDDS) should be discussed in order to increase the industrial adaptability.

Practicals

1. Overall heat transfer coefficient determination, fuel value determination & effect of lagging (insulation) etc.
2. Determination of rate of filtration & calculating specific cake resistance and resistance of filter medium. Study of factors affecting filtration.
3. Demonstration and use of industrial centrifuge and industrial filters.
4. Rate of drying of solids & determination of CMC, EMC etc.
5. Determination of humidity by dry bulb, wet bulb temp & dew point method. Use of psychometric chart in determination.
6. Other practicals related with theory section

Total hours

45

Books Recommended

1. Elementary Chemical Engineering - Max S. Peters, Published by McGraw Hill Book Company, New York.
2. Perry's Chemical Engineer's Handbook - Robert H Perry, Green D.W., Maloney J.O. McGraw - Hill Inc., New York.
3. Tutorial Pharmacy by Cooper & Gunn, ed. S.J.Carter, CBS Publishers & Distributors, Delhi.
4. Unit Operations of Chemical Engineering, by McCabe, Smith & Harriott, McGraw - Hill Inc., New York.
5. Introduction to Chemical Engineering by Walter L. Badger & Julius T. Banchero, McGraw Hill International edition, New Delhi .
6. Pharmaceutics: The Science of Dosage Form Design - M.E. Aulton.
7. The Theory & Practice of Industrial Pharmacy - Lachman L., Lieberman H.A. & Kanjig J.L, Varghese Publishing House, Bombay.
8. Alfonso G. Remington: The Science & Practice of Pharmacy. Vol.I & II, Lippincott, Williams & Wilkins Philadelphia.
9. Filtration in Pharma. Industry by Theodore H. Meltzed, Marcel Dekker Inc., New York

B. Pharm. Semester - II
COURSE NAME : PHYSICAL PHARMACEUTICS [2PH212]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand basic concepts of physical and chemical properties of various materials.
- Describe solubility and distribution principles of solids, liquids and gaseous compounds
- Determine properties of solid and liquid samples
- Discuss various types of dispersion systems in formulations
- Explain particle properties and its impact on various parameters
- Use solubilizing agents, buffers, isotonicity modifiers, glidants, suspending agents, emulsifying agents in various dosage forms..

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Solubility & Distribution Phenomena**
General principles, solvent-solute interactions, solubility of gases in liquids (aerosols) and solubility of liquids in liquids, solubility of nonionic solids in liquids, distribution of solutes between immiscible solvent, concept of co-solvency & Dielectric Constant (DIC), Overview of importance of Solubility in sterile and non-sterile products.
2. **State of Matter**
Introduction, binding forces between molecules, changes in the state of matter, latent heats and vapour pressure, sublimation critical point, eutectic mixture, gases, aerosols-inhalers, liquid complexes, liquid crystalline state, solids and crystalline state, polymorphism and phase equilibria.
3. **Micromeritics**
Particle size and size distribution, average particle size, number and weight distribution, particle number, method for determining particle size and volume, optical microscopy sieving, sedimentation measurement, particle shape and surface area, methods for determining surface area, derived properties of powder, porosity, packing arrangement, densities, bulkiness and flow properties, basics of nano-meritics, applications in dosage forms with suitable illustrations.
4. **Colloidal Dispersion Systems**
Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy
5. **Coarse Dispersion Systems**
Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, Emulsions: brief overview of various types of emulsion (simple & multiple emulsion, microemulsion, nanoemulsion), theories & physical stability.
6. **Complexation**
Classification of complexes, methods of preparation and analysis, applications in dosage forms (i.e. cyclodextrins)
7. **Buffers and Isotonic Solutions**
Preparation & stability of buffered solutions, Buffer equation, buffer capacity, importance of buffers in stability, log k_a vs pH plots, use of buffers in pharmaceutical formulations, isotonic solutions, measurements of tonicity calculations, and methods of adjusting isotonicity.

Total Lectures

45

Practical

1. Determination of CST in Two component systems like phenol-water system, Eutectic point determination in camphor - menthol system
2. Determination particle size and surface area, derived properties of powders like density porosity, compressibility angle of repose etc.
3. Studies on different types of complexes and determination of their stability constants.
4. Study on polymorphs, their identification & properties.

5. Studies of different types of colloids and their properties, determination of sedimentation parameters for suspensions and emulsions.
6. Evaluation of types and concentration of pharmaceutical buffers.
7. Practicals demonstrating any theoretical aspects of above topics.

Total hours

45

Books Recommended

1. Martin Alfred, Physical pharmacy by Alfred Martin, Lippincott Williams & Wilkins, New York.
2. Aulton, Michael E., Pharmaceutics: The Science of Dosage Form Design, Churchill Livingstone, London.
3. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.
4. Ansel, Howard. C., Allen, Loyd V., Popovich, Nicholas G. Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams & Wilkins, New York.
5. Cooper and Gunn's Tutorial Pharmacy, ed. Carter, S. J., CBS Publishers & Distributors, Delhi.
6. Florence, A. T. Atwood, D. (Eds.) Physicochemical Principles of Pharmacy, Macmillan Press Ltd., London.

B. Pharm. Semester - II

COURSE NAME: PHARMACEUTICAL CHEMISTRY (INORGANIC AND NUCLEAR MEDICINAL CHEMISTRY) [2PH213]

Course Outcomes:

After successful completion of the course student will be able to:

- Remember biological importance of electrolytes, ions and trace elements
- Understand the basic concepts and principles of inorganic medicinal chemistry and nuclear chemistry
- Discuss method of preparation, properties, assay principle and uses of important inorganic pharmaceuticals
- Explain mechanism of action of important inorganic therapeutic and diagnostic agents
- Synthesize and/or Analyze few inorganic pharmaceuticals

Theory (Detailed Syllabus)

	L	P	C
	3	2	4
A. (A) Inorganic Medicinal Chemistry: An outline of methods of preparation uses, sources, impurities, tests for purity and identity, including various limit tests, and special tests, if any of the following classes of inorganic pharmaceuticals included in the current edition of the Indian Pharmacopoeia .			
• Gastrointestinal agents Protectives, Adsorbents, Laxatives, Cathartics			
• Electrolytes Electrolyte replenishers			
• Essential and trace elements Mineral supplements, Iron and haematinics, Antithyroid agents			
• Topical agents Protectives, Astringents, Anti-infectives, Deodorants and Anti-perspirants.			
• Complexing and chelating agents Disodium-EDTA etc.			
• Dental products Dentifrices, Anti-caries agents.			
• Gases and vapours Oxygen and anesthetics			
• Miscellaneous agents Expectorants, Radioopaque medium, Antidotes, Antidepressant, Cytotoxic agents, Excipients, surgical aid, colorants, constituents of peritoneal dialysis fluid, Tonicity agents and Mineral carriers			
(B) Nuclear Pharmacy Practice: Basic concepts and principles of Radioactivity, Radioactive rays, Radiation Dosimetry, Definition and characteristics of radiopharmaceuticals, production of radionuclides, Radiolabeling of compounds to prepare radiotracers and radiopharmaceuticals, Radiation protection, Basic laboratory organization, Procurement, compounding, quality assurance, dispensing and distribution of radiopharmaceuticals, Radiochemical methods in analysis, Isotopic dilution techniques, Radioimmunoassay, Radioisotopes as therapeutic and diagnostic aids.			

Total Lectures

45

Practicals

Practicals are related to theory section.

1. Study of the complete monograph of the various inorganic drugs covered in the theory classes.
 2. Use of electro analytical techniques like colorimetry and potentiometry in the estimation of metals, trace elements and drugs.
 3. Synthesis of a few compounds used as drugs in the categories introduced in theory
- Note: The drugs covered in the theory and practical under the various categories are subject to variation depending upon innovations in technology or revision of the pharmacopoeia.

Total hours

30

Books Recommended

1. Bentley and Driver's Textbook of Pharmaceutical Chemistry (Revised by L.M.Atherden)- Oxford University Press
2. A. R. Genna ro, Remington: The Science and Practice of Pharmacy Vol. I & II - Lippincott, Williams & Wilkins, New York, USA.
3. C. A. Discher, Thomas Medwick, Leonard Bailey, Modern Inorganic Pharmaceutical Chemistry, Waveland Press Inc.
4. Peter Krumbiegel, Stable Isotope Phannaceuticals for Clinical Research and Diagnosis: Drug Development and Evaluation, Gustav Fischer Verlag.

Course Outcomes :

After successful completion of the course student will be able to:

- Remember anatomy and physiology of urinary, nervous, respiratory system and sense organs
- Describe the reproductive anatomy and physiology, process of prenatal development and basics of genetics
- Demonstrate various feedback mechanisms and endocrine functions that helps to regulate physiological processes as well as functions of autacoids and eicosanoids
- Test urine for its normal and abnormal constituents.
- Predict the normal and abnormal functions of various sensory organs.

Theory (Detailed Syllabus)

	L	P	C
	3	2	4
1. Integration & Control Systems			
I Nervous Systems			
a. Central Nervous System (Brain & Spinal Cord): Function of different parts of brain and spinal cord. Neurohumoral transmission in the CNS, reflex action, Electroencephalogram & specialized functions of the brain			
b. Peripheral Nervous System (PNS) (Cranial nerves & spinal nerves): Description of spinal & cranial nerves.			
c. Autonomic Nervous System (ANS): Physiology and functions of the ANS. Neurohumoral transmission & brief introduction to functional significance of various neurotransmitters.			
II Special Senses			
Basic anatomy and physiology of eye (vision), ear (hearing & balance), tongue (taste) & nose (olfaction) etc.			
2. Respiratory System			
Anatomy of respiratory organs. Physiology (mechanism and regulation) of respiration. Brief overview of measuring lung functions i.e. respiratory volumes, vital capacity & respiratory disorders.			
3. Endocrine System			
I Anatomy & physiology of pituitary gland, thyroid, parathyroid, adrenals, pancreas, testes and ovary, their hormones & functions with brief outlines of their disorders.			
II Local Hormones & Autacoids			
Functional importance of histamine, 5-hydroxytryptamine (5-HT), bradykinin, substance P, Platelet-Activating Factors (PAF) & peptides with specific reference to their role in inflammation & allergy.			
4. Reproduction & Development			
I Reproductive System			
Male and female reproductive systems, their hormones, menstruation, coitus and fertilization, sex differentiation, Oogenesis and spermatogenesis, implantation of embryo, pregnancy and its maintenance, parturition, and contraceptive methods.			
II Development, Growth, Aging & Genetics			
Prenatal development, parturition, the newborn, lactation, life stages, aging, death, genetics, genetic disorders etc.			
5. Urinary System			
Brief outline of anatomy & physiology of kidney. Physiology of urine formation & acid base balance. Diseases of the urinary system.			
6. Water electrolytes and Acid base balance			
Brief overview of body fluids & regulation of intracellular fluid composition, extracellular fluid composition, ion concentrations, water content and acid base balance.			
Total Lectures			45

Practicals

1. **Urine Analysis**
Analysis of normal and abnormal urine for pH, sugars, proteins, urea, creatinine etc.
 2. **Study of Gross Anatomy & Physiology of Various Organ Systems by Models / Charts / Specimens**
 - A General Viscera
 - A Central Nervous System
 - A Urinary System
 - A Respiratory System
 - A Eye
 - A Ear
 - A Reproductive System
 3. **Histology**
Microscopic study of different types of primary tissues and organs from permanent slides.
 4. **Study of spirometer and determination of vital capacity**
 5. **Study of Contraceptive Methods**
 6. **Study of Reflexes, Memory, Vision and Hearing capacity**
- Total hours** **30**

Books Recommended

1. Anne M.R. Agur & Ming J. Lee: Grant's Atlas of Anatomy, Lippincott, Williams and Wilkins
2. B.D. Chaurasia's Human Anatomy (3 Volumes) CBS Publishers & Distributors
3. B. Young, J.W. Heath: Wheater's functional Histology- a Text and Colour Atlas, Churchill Livingstone
4. Bullock B.L. & Henze R.L., Focus on Pathophysiology, Lippincott
5. Chatterjee, C.C. Human Physiology (Medical Allied Agency, Calcutta)
6. Chummy S. Sinnatamby: Last's Anatomy- Regional and Applied, Churchill Livingstone.
7. Gandhi, T.P. et. al.: Human Anatomy, Physiology & Health Education (RS. Shah Prakashan, Ahmedabad)
8. Garg K. et al. A Text Book of Histology (CBS Publishers, New Delhi).
9. Ghai, C.L.: A Textbook of practical physiology (Jaypee Brothers Medical Publisher (P) Ltd.)
10. Gosling T.A., Harris P.F., Whitmore I., William, Human Anatomy: Color Atlas and Text Book
11. Goyal, R.K. et al.: Practical Anatomy Physiology and Biochemistry (B.S. Shah Prakashan, Ahmedabad)
12. Gray's Anatomy - Peter L. Williams - The Anatomical Basis of Medicine and Surgery, Churchill Livingstone
13. Guyton A.C. and Hall J.E. : Textbook of Medical Physiology, W.B. Saunders
14. Joshi, Vijaya D. Preparatory Manual for Undergraduates Physiology (B.I. Churchill Livingstone)
15. Lesson, C.R. et al.: Text Book of Histology (W.B. Saunders Company)
16. Macfarlane P.S., Reid R. and Callander R.: Pathology Illustrated, Churchill Livingstone
17. Martini, F. Fundamentals of Anatomy and Physiology (Prentice Hall)
18. Park's Textbook of Preventive and Social Medicine, M/s. Banarasidas Bhanot
19. Richard S. Snell: Clinical Neuroanatomy for Medical students, Lippincott Williams and Wilkins
20. Seeley R.R., Stephens T.D. and Tate P.: Anatomy and Physiology, McGraw Hill Co.
21. Sobotta: Atlas of Human Anatomy (2 Volumes), Edited by Putz and R. Pabst, Lippincott, Williams and Wilkins
22. Subhas Shalya: Human Physiology (CBS Publishers, New Delhi)
23. Tortora G.J. and Anagnostokos, N.P. Principles of Anatomy and Physiology (Harper and Colling Publishers, New York)
24. Van de Graaff and Crawley, J.L.: A Photographic Atlas for the Anatomy and Physiology Laboratory (Morton Publishing Company)
25. Waugh A. and Grant A.: Ross and Wilson's Anatomy and Physiology in Health & illness, Churchill Livingstone
26. West, J.B. Best and Taylor's physiological Basis of Medical Practice (Williams and Wilkins, Baltimore)
27. <http://msjensen.cehd.umn.edu/webanatomy/default.asp>
28. [http://www.anatomy.org/non-aaa-resource links](http://www.anatomy.org/non-aaa-resource-links)
29. <http://ect.downstate.edu/courseware/haonline/index.htm>

B. Pharm. Semester - II
COURSE NAME : PHYTOPHARMACEUTICALS - I [2PH215]

Course Outcomes :

After successful completions of the course student will be able to:

- Recognize pharmacognostical characteristics of different drugs belonging to various categories mentioned in syllabus along with practical approach
- Describe crude drugs belonging to category of essential oil with respect to phytochemistry and pharmacological uses.
- Discuss morphological characteristics, pharmacological and pharmaceutical uses of drugs belonging to category of carbohydrates
- Apply comprehensive knowledge of lipids containing crude drugs with respect to its medicinal uses
- Differentiate various phytochemical classes and metabolites (active principles mainly) and its importance and study of crude drugs belonging to each secondary metabolites
- Categorize suitable methods for extraction of volatile oil from medicinal plants

Theory (Detailed Syllabus)

	L	P	C
1 Study of carbohydrates and related drugs: Agar, Alginic Acid, Acacia, Tragacanth, Carrageenan, Guar gum, Sterculia, Honey, Isabgol and Pectin.	3	3	5
2 Study of following lipids and lipid containing drugs: Castor oil, Sesame oil, Olive oil, Hydrocarpus oil, Linseed oil, Coconut oil, Theobroma, Woolfat, Beeswax, Cod liver oil and Shark liver oil.			
3 Introduction to phytopharmaceuticals and different chemical classes of active constituents: Alkaloids, Glycosides, Resins, Volatile oils, Tannins, Flavonoids and Phytosterols.			
4 Pharmacognostic study of tannins and tannin containing drugs: Amla, Gambir (Pale Catechu), Black Catechu, Baheda, Myrobalan, Arjuna and Galls.			
5 Volatile oils Definition, composition, chemistry, classification and biosynthesis of volatile oils.			
Systematic study of drugs containing volatile oils Eucalyptus, Dill, Caraway, Cardamom, Fennel, Cinnamon, Coriander, Citronella, Clove, Gaultheria, Lemon peel, Orange peel, Lemon grass, Pyrethrum, Nutmeg and Sandal wood oil			
General methods of obtaining volatile oils from plant materials			

Total Lectures

45

Practicals

1. Morphological identification of crude drugs mentioned in theory
2. Microscopic studies of 10 selected crude drugs and their powders mentioned under the category of carbohydrates, tannins and volatiles oils in theory
3. General chemical tests for carbohydrates, alkaloids, glycosides, tannins, phytosterols and flavonoids.
4. Swelling index and swelling factor of Isabgol.
5. Powder study of tannin containing crude drugs.
6. Morphology and chemical tests of tannin containing crude drugs.
7. Identification and chemical tests of lipids.
8. TLC methods for separation and identifications of some selected Phytopharmaceuticals

Books Recommended

1. Pharmacognosy: W.C. Evans, W.B. Saunders, Edinburgh - 15th Edition - 2002
2. Pharmacognosy: C.K. Kokate, A.P. Purohit and S.B. Gokhale, Nirali Prakashan, Pune - 17th Edition - 2001
3. Pharmacognosy: Jean Bruneton, Intercept Ltd., Paris - 2nd Edition - 1999
4. Text Book of Pharmacognosy: T.E. Wallis, CBS publishers and Distributors Delhi, 5th Edition - Reprint - 1997
5. Pharmacognosy: V.E. Tyler, L.R. Brady and J.E. Robbers, Lea and Febiger, Philadelphia - 8th Edition - 1981
6. Plant Drug Analysis: Wagner & Hildebert, Springer (India) Ltd. New Delhi, 2nd Edition - 1996
7. Quality Control of Herbal Drugs: P.K. Mukherjee Business Horizons, New Delhi, 1st Edition - 2002.
8. Organic Chemistry: Finar **LL** Volume - 2 Stereochemistry and the chemistry of Natural Products, ELBS Publication, 5th edition - 1996
9. Biologically Active Natural Products- Pharmaceuticals: Cutler & Stephen, CRC Press, London, 2000.
10. Cultivation & Utilization of Aromatic Plants, Edited by C.K. Atal and B.M. Kapoor, R.R.L., Jammu-Tawi, 1982.
11. Phytochemical methods: J.B. Harbone, Chapman and Hall, London, 3^d edition, 1998
12. Herbal Drug Industry, Chief Editor R.D. Chaudhary, Eastern Publishers, New Delhi, 1st edition, 1996.
13. Compendium of Indian Medicinal Plants Vol. I, II, III, IV by R.P. Rastogi and B.N. Mahrotra, CDRI, Lucknow, 1993.
15. Quality standards of Indian medicinal plants: Gupta A.K. ICMR, New Delhi, Vol. 1- 2003.
16. Chemistry of Natural Products: Krishnaswamy N.R., Universities press, Hyderabad, 1999.
17. Healthcare Revolution in Envisioning an Empowered Nation: A. P. J. Abdul Kalam & A.S. Pillai, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004
18. Anatomy of Crude Drugs: M.A. Iyengar and S.G.K. Nayak, Manipal Power Press, Manipal - 7th Edition - 1998

B.Pharm Semester - II

COURSE NAME : TITRIMETRIC METHODS OF PHARMACEUTICAL ANALYSIS [2PH216]

Course Outcomes:

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

- Express the knowledge of different types of volumetric analysis.
- Practice preparation and standardization of different titrants and analyze various drugs and pharmaceutical ingredients.
- Describe the basic techniques, principles and applications of aqueous and non-aqueous titrations.
- Apply the fundamentals of precipitation, complexometric and redox titrations.
- Use gravimetric principles and applications.
- Assess various statistical parameters of analytical data

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Non-aqueous Acid Base Titration**
Dissociating and non-dissociating solvents, acid - base character, leveling and differentiating effects, solvents, titrants & indicators used in determination of acids & bases, applications to pharmacy.
2. **Precipitation Reactions and Titration**
Solubility of slightly soluble salts, solubility product, effect of pH, temperature and solvent on solubility of salts, common ion effect, calculation of titration curves, indicators used, argentometric titration and titration involving ammonium or potassium thiocyanate, Mohr's method, Volhard's method and Fajan's method.
3. **Complexometric Reactions and Titration**
Complexes and stability constants, chelates, metal-EDTA titration curves, metal indicators, replacement titration.
4. **Oxidation - Reduction Reactions and Titration**
Half reactions, Nernst equation, redox equivalent weights, redox indicators, titration with potassium permanganate, compounds of cerium, potassium dichromate, iodine, periodic acid, potassium bromate.
5. **Gravimetric Methods**
Principles, formation and properties of precipitates, drying and ignition of precipitates, organic precipitants, applications.
6. **Statistical Treatment of Analytical Data**
Accuracy and precision, errors and their types, significant figures, standard deviation, confidence limit, test of significance, rejection of a result, correlation coefficient and coefficient of determination.

Practicals

1. Calibration of volumetric apparatus
2. Non-aqueous Titration - Preparation and standardization of perchloric acid and sodium/potassium / lithium methoxide and estimations using these
3. Precipitation Titration - Preparation and standardization of silver nitrate and ammonium thiocyanate, Mohr's method, Volhard's method and Fajan's method
4. Complexometric Titration - Preparation and purification of disodium edetate and estimations using it as titrant
5. Oxidation- Reduction Titration - Preparation and standardization of redox titrants like potassium permanganate, potassium dichromate, iodine, sodium thiosulphate and estimations of oxidizing and reducing agents using the aforementioned standard solutions

Books Recommended

1. J. Mendham, R C.Denney, J.D.Bames, M.Thomas, Vogel's Textbook of Quantitative Chemical Analysis,

- 6th edition, 2002, Pearson Education Asia Ltd.
2. D.A.Skoog, D.M.West, F.J.Holler, S.R.Crouch, Fundamentals of Analytical Chemistry, 8th edition, 2004, Thomson Asia Pvt. Ltd.
 3. Kenneth A. Connors, A textbook of Pharmaceutical Analysis, 3rd edition, 2002, John Wiley & Sons, New York, USA.
 4. F.W.Fifield, D.Kealey, Principles and Practice of Analytical Chemistry, 5th edition, 2000, Blackwell Science, Oxford, U.K.
 5. Gary D. Christan, Analytical Chemistry, 6th edition, 2004, John Wiley & Sons, New York, USA.
 6. R.A.Day, Jr, A.L.Underwood, Quantitative Analysis, 6th edition, 2001, Prentice Hall of India.
 7. Practical Pharmaceutical Chemistry Vol. - I & II - 4th Edition - 1986 - A H.Beckett & J.B.Stenlake - CBS Publishers, New Delhi.
 8. A. R. Gennaro, Remington: The Science and Practice of Pharmacy Vol. I & II - 20th Edition - 2001 - Lippincott, Williams & Wilkins, New York, USA.
 9. The Indian Pharmacopoeia, Latest Edition, the Controller of Publications, Government of India, New Delhi
 10. S.Ahuja, S.Scypinski, Handbook of Modern Pharmaceutical Analysis, 2001, Academic Press, New York, USA.
 11. D.C.Lee, M.L.Webb, Pharmaceutical Analysis, 2003, Blackwell Science, Oxford, U.K.
 12. T.Higuchi, E.Brochmann-Hanssen, Pharmaceutical Analysis, 2002, CBS Publishers, New Delhi.
 13. Lena Ohannesian, A.J.Streeter, Handbook of Pharmaceutical Analysis, 2002, Marcel Dekker, Inc. New York, USA.
 14. P.Parimoo, Pharmaceutical Analysis, 2nd edition, 1999 C.B.S. Publishers & Distributors, Delhi.
 15. The British Pharmacopoeia, Latest Edition, The Department of Health, Social Services and Public Safety, U.K.
 16. The United State Pharmacopoeia, Latest Edition, The United States Pharmacopoeial Convention, Rockville, U.S.A.

B.Pharm Semester - II
COURSE NAME : YOG AND HEALTH [2SPPH113]
(Supplementary Course)

Course Outcomes :

After successful completion of the course student will be able to:

- Define basic principles of Asanas.
- Identify different foods and healthy eating habits.
- Demonstrate the use of yoga in mental and physical well being
- Differentiate various kriyas, surya namaskar etc.
- Estimate importance of diet for health
- Perform various Asanas

Tutorial (Detailed Syllabus) :

L T C
1

Introduction of "YOG"

Astangyog

Sukshmayog (Light exercises)

Suryanamaskar

Rules for asanas (Before & After)

Asanas for brain & stomach

Asanas for relaxation and rest

Kriya (Kapalbhranti and Tratak), Bhastrika, Tribandha, Ujjayi

Pranayama (Anuloma, Viloma)

Omkar (Bhramari)

Importance of diet for " Total Health"

Reference:

- 1 YOG - Its Philosophy & Practice
- 2 PRANAYAMA- Its Philosophy and Practice
- 3 AYURVEDA- Its Principles & Philosophies
Divya Prakashan, Divya Yog Mandir Trust, Kripalu Bagh, Ashram, Kankhal, Haridwar - 249408

NIRMA UNIVERSITY
Institute of Pharmacy
(B. Pharm.)
(Semester - III)

	L	T	P	C
	3	1		4
Course Code	BP301T			
Course Title	Pharmaceutical Organic Chemistry II - Theory			

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 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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Remember structure derivation, reactions and their mechanism of benzene and uses of selected compounds.
2. Understand properties, methods of preparation and reactions of functional groups along with uses of selected compounds.
3. Describe methods of preparation, stability and reactions of cycloalkanes.
4. Discuss properties, reactions and analysis of fats and oils.
5. Synthesize organic compounds involving laboratory techniques and determine oil values.

Syllabus:

Teaching hours: 45 Hours

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

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

UNIT I

10 Hours

Benzene and its derivatives:

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

- **Reactions of benzene** - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation.
- Substituents, **effect of substituents on reactivity and orientation of mono** substituted benzene compounds towards electrophilic substitution reaction.
- **Structure and uses** of DDT, Saccharin, BHC and Chloramine.

UNIT II

10 Hours

Phenols*:

- Acidity of phenols, effect of substituents on acidity, qualitative tests, structure and uses of phenol, cresols, resorcinol, naphthols.

Aromatic Amines*:

- Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts.

Aromatic Acids*:

- Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III

10 Hours

Fats and Oils:

- Fatty acids - reactions.
- Hydrolysis, hydrogenation, saponification and rancidity of oils, drying oils.
- **Analytical constants** - Acid value, saponification value, ester value, iodine value, acetyl value, reichert meissl (RM) value - significance and principle involved in their determination.

UNIT IV

08 Hours

Polynuclear hydrocarbons:

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

UNIT V

07 Hours

Cyclo alkanes*:

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

Tutorials

15 Hours

Tutorials will be based on above syllabus.

Suggested ReadingsA:(Latest edition)

- Morrison, R. T., Boyd, R. N. *Organic Chemistry*. Prentice Hall, Inc., USA.
- Finar, I. L. *Organic Chemistry*, Vol. I, ELBS.
- Bahl, B. S. *Text Book Of Organic Chemistry {For B. Sc. Students}*. S. Chand And Company Ltd Ram Nagar; New Delhi.
- March, J. *Advanced organic chemistry: reactions, mechanisms, and structure*. John Wiley & Sons,.
- Soni, P. L. *Fundamental organic chemistry*. New Delhi: S. Chand.
- Mann, F. G., & Saunders, B. C. *Practical organic chemistry*. London: Longman.
- Solomons, T. W., Fryhle, C. B., & Johnson, R. G. *Organic chemistry*. New York: Wiley.
- Ahluwalia, V. K. *Organic Reaction Mechanism*. New Delhi: Ane Books India.
- Mann, F. G. *Practical organic chemistry*. Pearson Education India.
- Yishnoi, N. K. *Advanced practical organic chemistry*. Yikas Publishing House Pvt. Limited.
- Pavia, D. L. *Introduction to organic laboratory techniques: a small scale approach*. Cengage Learning.

25. Gurudeep, C. R., & Gurudeep, C. R. *Reaction Mechanism and Reagents in Organic Chemistry*.
Bombay: Himalaya Publishing House.
26. Furniss, B. S. *Vogel's textbook of practical organic chemistry*. Pearson Education India.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

(B. Pharm)
(Semester - III)

		L	T	P	C
				4	2
Course Code	BP305P				
Course Title	Pharmaceutical Organic Chemistry II - Practical				

Syllabus:

Teaching hours: 60 Hours

- 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.
 - I-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.
 - Benzil from Benzoin by oxidation reaction.
 - Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction.
 - Cinnamic acid from Benzaldehyde by Perkin reaction.
 - *P-Iodo* benzoic acid from P-amino benzoic acid.

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - III)

		L	T	P	C
		3	1		4
Course Code	BP302T				

Course Title	Physical Pharmaceutics I - Theory
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Scope:

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

Objectives:

After completion of course student is able to know

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Recognize basic concepts of physical and chemical properties of various materials
2. Describe principles and methodology related to above properties.
3. Determine properties of solid and liquid samples using various methods.
4. Discuss factors affecting properties of drug and excipients.
5. Explain particle properties and its impact on various parameters.
6. Solve calculations related to above topics.

Syllabus:

Teaching hours: 45 Hours

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

12 Hours

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 and its applications.

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 and its determination.

UNIT IV**08 Hours****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.

TUTORIALS**Teaching hours: 15 Hours**

Tutorials will be based on above syllabus

Suggested Readings": (Latest edition)

1. Martin, A. *Physical Pharmacy*. New York, Lippincott Williams & Wilkins
2. Eugene, P. *Experimental Pharmaceutics*. USA, Burgess Pub. Co.
3. Cooper and Gunn. *Tutorial Pharmacy*. Delhi. CBS Publishers & Distributors
4. Stocklosam, J. *Pharmaceutical Calculations*. Philadelphia, USA, Lea & Febiger
5. Liberman, H.A, Lachman, C. *Pharmaceutical Dosage forms, Tablets. Volume-I to 3*, New York, USA, Marcel Dekker Inc
6. Liberman, H.A, Lachman, C. *Pharmaceutical Dosage forms, Disperse systems. Volume-I to 3*, New York, USA, Marcel Dekker Inc
7. Ramasamy, C. Manavalan, R. *Physical Pharmaceutics*. Chennai, Vignesh Publisher.
8. Subramanyam, C.V.S, Thimmasettee, J. *Laboratory Manual of Physical Pharmaceutics*. Delhi, Vallabh Prakashan
9. Subramanyam, C.V.S. *Physical Pharmaceutics*. Delhi, Vallabh Prakashan
10. Jain, G. Khar, R.K. *Test book of Physical Pharmacy*. India, Elsevier

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" this is not an exhaustive list

**(B. Pharm.)
(Semester - III)**

L	T	P	C
		4	2

Course Code	BP306P
Course Title	Physical Pharmaceutics I - Practical

Syllabus:**Teaching hours: 60 Hours**

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water

4. Determination of Partition co- efficient of Iodine in CCl₄ and water
5. Determination of% composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

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(B. Pharm.)
(Semester - III)

L	T	P	C
3	1		4

Course Code	BP303T
Course Title	Pharmaceutical Microbiology - Theory

Scope:

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

Objectives:

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

1. Understand methods of identification, cultivation and preservation of various microorganisms.
2. To understand the importance and implementation of sterilization 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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand fundamentals of pharmaceutical microbiology and cell culturing.
2. Identify various types of microorganisms.
3. Describe principle, operations and applications of various sterilization techniques.
4. Explain concept of disinfection, sterility testing, contamination and its prevention.
5. Practice aseptic processing for cultivation and isolation of microorganism.
6. Evaluate antibiotics, vitamins and amino acids by microbiological assay.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

Basics of Microbiology:

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).

Types of Microscopy:

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

UNIT II

10 Hours

Identification of Bacteria:

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

Sterilization:

Study of principle, procedure, merits, demerits and applications of physical, chemical, gaseous, radiation and mechanical method of sterilization and concept of D, Z and F Value. Evaluation of the efficiency of sterilization methods. Equipment employed in large scale sterilization. Sterility indicators.

UNIT III

10 Hours

Fungi and Viruses:

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

Disinfection:

Classification and mode of action of disinfectants, Factors influencing disinfection, antiseptics and their evaluation for bacteriostatic and bactericidal actions.

Sterility Testing:

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

UNIT IV

08 Hours

Aseptic Practice:

Designing of aseptic area, laminar flow equipment; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

Microbiological Assay:

Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

UNIT V

07 Hours

Contamination and Prevention:

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.

Cell Culture:

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.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings'': (Latest edition)

1. Denyer, Stephen P.; Hodges, Norman; Gorman, Sean P.; Gilmore, Brendan F. *Hugo and Russell's Pharmaceutical Microbiology*. Hoboken, NJ: Wiley-Blackwell
2. Prescott and Dunn's *Industrial Microbiology*. Delhi, India: CBS Publishers & Distributors.
3. Pelczar, Chan, Kreig. *Microbiology*. India: Tata McGraw-Hill Education
4. Malcolm, Harris. *Pharmaceutical Microbiology*. London, UK: Bailliere, Tindall and Cox.
5. Rose Anthony H. *Industrial Microbiology*. London, UK: Butterworths
6. Frobisher, Hinsdill, Crabtree, Goodheart. *Fundamentals of Microbiology*. Japan: W.B. Saunders Company.
7. Carter, S.J. *Cooper and Gunn's Tutorial Pharmacy*. Delhi, India: CBS Publisher and Distribution.
8. Pepler, H. J.; Perlman, D. *Microbial Technology: Fermentation technology*. USA: Academic Press of University of Michigan.
9. Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia
10. Ananthnarayan, Paniker. *Text Book of Microbiology*. Chennai, India: Orient-Longman Publisher.
11. Edward, Alcamo. *The Fundamentals of Microbiology*. USA: Jones & Bartlett Publishers
12. Jain N. K. *Pharmaceutical Microbiology*. Delhi, India: Vallabh Prakashan
13. Holt J. G.. *Bergey's Manual of Systematic Bacteriology*. Baltimore, MD, USA: Williams and Wilkins

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**(B. Pharm.)
(Semester - III)**

L	T	P	C
		4	2

Course Code	BP307P
Course Title	Pharmaceutical Microbiology - Practical

Syllabus:**Teaching hours: 60 Hours**

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

10. Biochemical test.

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm.)
(Semester - III)

L	T	P	C
3	1		4

Course Code	BP304T
Course Title	Pharmaceutical Engineering - Theory

Scope:

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

Objectives:

After completion of course student is able to know,

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand theoretical principles of various unit operations.
2. Describe factors influencing various unit operations.
3. Discuss properties of materials used for pharmaceutical plant construction.
4. Explain pharmaceutical equipment of various unit operations.
5. Correlate various unit operations and its applications in formulation development.
6. Solve calculations involved in various pharmaceutical unit operations.

Syllabus:

Teaching hours: 45 Hours

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

12 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 media. 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.

UNITV

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.

TUTORIALS

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings": (Latest edition)

1. Walter L. B., Julius B. T. *Introduction to chemical engineering*. Tata McGraw-Hill Publishing Company Ltd. New Delhi.
2. Nigel J. K. S., *Solid phase extraction, Principles, techniques and applications*. Marcel Dekker Inc., USA.
3. Warren L. M., Julian C. S., Peter H. *Unit operation of chemical engineering*. McGraw-Hill Companies, Inc. USA.
4. Subrahmanyam C.V.S. Setty J. T., Suresh S., Devi V. K. *Pharmaceutical engineering principles and practices*. Vallabh Prakashan, New Delhi.
5. Gennaro A. R. *Remington the science and practice of pharmacy*. Lippincott Williams & Wilkins
6. Lachman I., Lieberman H. A., Kanig L. *Theory and practice of industrial pharmacy*. Varghese Publishing House, Mumbai.
7. Subrahmanyam C. V. S. *Essentials of Physical pharmaceuticals*. Vallabh Prakashan, New Delhi.
8. Carter S. J. *Cooper and Gunn's Tutorial pharmacy*. C. B. S. Publishers & Distributors, Delhi.

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" this is not an exhaustive list

**(B. Pharm.)
(Semester - III)**

		L	T	P	C
				4	2
Course Code	BP308P				
Course Title	Pharmaceutical Engineering - Practical				

Syllabus:**Teaching hours: 60 Hours**

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

B. PHARM SEM III
COURSE NAME: PHARMACEUTICS - II (UNIT OPERATIONS - II) [2PH3II]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand principles involved in evaporation, distillation, size reduction, size separation, mixing, crystallization and extraction
- Describe factors influencing above unit operations
- Explain pharmaceutical equipment for above unit operations
- Utilize knowledge of unit operations in understanding formulations, process and determining parameters
- Correlate various unit operations and its applications
- Solve basic calculations involved in pharmaceutical unit operations

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Evaporation**
Basic concept of phase equilibria, factors affecting evaporation, heat transfer in evaporators, Duhring's Rule and Raoult's law, evaporators, natural circulation, forced circulation & film evaporators, single effect and multiple effect evaporators, mathematical problems
2. **Distillation**
Physical concepts, vapour liquid equilibrium relationship, volatility & relative volatility, simple steam and flash distillations, batch and continuous distillation, rectification distillation columns and their efficiency, McCabe thiele method for calculations of number of theoretical plates, azeotropic, molecular & steam distillation, mathematical problems
3. **Size Reduction**
Objectives and theory of size reduction, factors influencing size reduction, energy aspects in size reduction, study of various mills including ball mill, hammer mill, fluid energy mill etc., study of latest industrial mills used in manufacturing of various dosage forms, their applications, numerical problems.
4. **Size Separation**
Principles of size separation, screen and its standards as per pharmacopoeia, screening equipments including shaking & vibrating screens, gyratory screens, sedimentation type industrial separators etc.
5. **Mixing**
Theory of mixing, mixing mechanisms, solid - solid, solid - liquid and liquid - liquid mixing equipments. Study of latest mixers used in manufacturing of solid, liquid and semisolid dosage forms in industry, applications in Pharmacy.
6. **Crystallization**
Formation of crystals, super saturation theory, factors affecting crystallization process,. Study of various types of crystallizers. Problem in crystallization process, methods for prevention of caking of crystals, crystal growth. Co-crystals. Advance in crystal technology with respect to API and excipients, Spherical crystallization. Numerical problems on yields, a brief study of spherical crystallization process.
7. **Leaching and Extraction**
Principle, theory, types of extraction, solvents used for extraction, leaching and extraction equipments, small scale and large scale extraction methods, special extraction techniques, application in pharmaceutical industry.

Total Lectures

45

Practicals

1. To study Material balance in evaporation
2. To study Rectification and steam distillation

- 3 To Study of Mier's super solubility curve for given substances
- 4 To Determine particle size distribution for a given sample using Stoke's law, sieving method, microscopic method
- 5 To Perform liquid-liquid extraction, study of percolation method, break through capacity of cationic exchange resin etc.
- 6 To Demonstrate spherical crystallization process, planetary mixer, ball mill, colloid mill, industrial crystalizer etc.
- 7 To study mixing efficiency in solid-solid mixer and liquid-liquid mixer
- 8 To study power requirement for given mill
- 9 Other practicals related with theory section.

Total hours

45

Books Recommended

1. Tutorial Pharmacy by Cooper & Gunn, ed. SJ .Carter, CBS Publishers & Distrib utors, Delhi .
2. Unit Operations of Chemical Engineering, by McCabe, Smith & Harriott, McGraw - Hill Inc., New York.
3. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins , New York.
4. Pharmaceutics: The Science of Dosage Form Design - M.E. Aulton.
5. The Theory & Practice ofIndustrial Pharmacy- Lachman L., Lieberman H.A. & Kanjig J.L, Varghese Publishing House, Bombay.
6. Rawlins, E. A., Bently's Text Book of Pharmaceutics, 8th editi on, Bailliere Tindall, London, All India Traveller Book Seller, New Delhi, 2002
7. Perry, Robert H., Green, Don W., Maloney, James O., Perry's Chemical Engineering's Handbook, McGraw-Hill, Inc., New York, 1998
8. Alfonso G. Remington: The Science & Practice of Pharmacy. Vol.I & II, Lippinco tt, Williams & Wilkins Philadelphia.
9. Florence, A. T. Atwood, D. (Eds.) Physicochemical Principles of Pharmacy, Macmillan Press Ltd., London.
10. Ansel, Howard. C., Allen, Loyd V., Popovich, Nicholas G. Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams & Wilkins, New York.
11. Aulton , Michael E., Pharmaceutics: The Science of Dosage Form Design, Chrchill Livingstone, London.
12. Introduction to Chemical Engineering by Walter L. Badger & Julius T. Banchemo, Mcgraw Hill International edition, New Delhi.
13. Ricky, Anthony, J., Ganderton David., Pharmaceutical Process Engineering ,.Marcel Dekker, Inc., New York, 2001

B. PHARM SEM III
COURSE NAME: PREPARATIVE PHARMACY (DISPENSING) [2PH312]

Course Outcomes:

After successful completion of the course student will be able to:

- Remember relationship between various conversions systems used in dispensing of products
- Understand the concepts of dispensing methods for various dosage forms
- Interpret types of prescriptions and study their handling
- Solve pharmaceutical calculations related to dispensing of products
- Select appropriate labelling and packaging requirements of various types of dosage forms
- Prepare various types of dispensed products at small scale.

Theory (Detailed Syllabus)

L P C
3 3 5

1. Introduction:

a) Definitions and scope, Types of dispensed products, General dispensing procedures including labeling, packing and storage of dispensed products.

Prescription - Handling of prescriptions, Source of errors in prescriptions, Prescription writing etc.

2. Pharmaceutical Calculations:

Enlarging and reducing recipes, percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc.

3. A detail study of the following dispensed products. (Definition, characteristics, classification / types, Advantages, limitations, formulation, dispensing, labeling, packing, storage, principles, adopted & study of some prescriptions relating to following dispensed products.)

a. Liquid Products - Oral and external solutions, Mixtures and Emulsions

b. Semisolid Products - Ointment, Creams, Gels, Pastes

c. Solid Products - Powders, Lozenges, Tablet triturates etc.

Suppositories - Bases, Dispensing, Displacement value etc.

Total Lectures

45

Practicals

1. Dispensing of prescriptions falling under the categories:

Mixtures, solutions, emulsions, ointments, creams, pastes, jellies, suppositories, powders, pills, lozenges, pastilles, tablet triturates, lotions, liniments, inhalations, paints, ophthalmics etc.

2. Dispensing of prescriptions involving pharmaceuticals calculations, pricing of prescriptions and dosage calculations for pediatric & geriatric patients

3. Categorization and storage of pharmaceutical products based on legal requirements of labeling and storage.

Total hours

45

Books Recommended

1. Cooper and Gunn's Dispensing for pharmaceutical students by Carter S. J., CBS Publishers and Distributors, Delhi
2. Collett M., Aulton E., Pharmaceutical Practice, Churchill Living stone, New York.
3. Winfield, A. J., Richards R. M. E., Pharmaceutical Practice, Churchill Living stone, New York.
4. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.
5. Ansel, Howard. C., Allen, Loyd V., Popovich, Nicholas G., Pharmaceutical Dosage Forms and Drug Delivery Systems, Lippincott Williams & Wilkins, New York.
6. Ansel, Howard. C., Stoklosa, Mitchell J., Pharmaceutical Calculations, Lippincott Williams & Wilkins, New York.
7. Boh, Larry E. E., Young, Lloyd Y., Pharmacy Practice manual, Lippincott Williams & Wilkins, New York.
8. Singh, Harkishan, Pharmacy Practice, Vallabh Prakashan, Delhi.
9. Comprehensive Pharmacy Review by Leon Shargel, Alan H. Mutnick, Lippincott Williams & Wilkins,

B. PHARM SEM III
COURSE NAME: ORGANIC CHEMISTRY-I [2PH313]

After successful completion of the course student will be able to:

- Remember IUPAC rules for nomenclature of organic compounds
- Understand basic concepts of organic Chemistry
- Discuss concept of reactivity for the possible chemical reactions
- Draw reaction, reaction mechanism and explain orientation of reactions
- Identify unknown organic compound
- Prepare stereo models of stereoisomers and can assign configuration

Theory (Detailed Syllabus)

LP C
3 3 5

1. **Basic Principles and Concepts of Organic Chemistry:**
Atomic and molecular orbitals, covalent bond, electro negativity, bond fission, inductive effect, electromeric effect and resonance, concept of tautomerism and types; Classes of reactions and classes of reagents including electrophiles, nucleophiles and radicals; Transient reaction intermediates - carbocations, carbanions, carbenes, nitrene and nitrenium ions; Theories of acidity and basicity, inductive and resonance effects on acidity and basicity.
2. **Stereochemistry:**
Configuration and conformation, isomerism and its types, geometrical isomerism, Z and E nomenclature, optical isomerism, enantiomers, chirality, representations of a chiral centre, D and L and R and S nomenclature for one and two chiral centers, racemic mixture and its resolution, conformation and potential energy for ethane and n-butane, conformation of cyclohexane, number of stereoisomers and relative stabilities of disubstituted cyclohexanes.
3. **Alkanes:**
Common and IUPAC name, properties and reactions of alkanes, mechanism and kinetics of chlorination and halogenation, molecular and empirical formula.
4. **Alkyl Halides:**
IUPAC nomenclature, Properties, Preparations and Reactions, S_N1 and S_N2 mechanism and stereochemistry, kinetics of Nucleophilic Aliphatic Substitution, Relative stability of carbocations, Rearrangement of carbocations, Reactivity of carbocations towards S_N1 and S_N2, Factors affecting S_N1 v/s S_N2.
5. **Alkenes and Alkynes**
IUPAC name, preparation and reactions, E1 and E2 elimination - mechanism and stereochemistry, Saytzeff and Hoffman rules. Factors affecting substitution v/s elimination. Addition Reaction of Alkenes - Mechanism, regioselectivity (Markonikov & anti markonikov) in addition of hydrogen, halogen, hydrogen halide, halohydrin formation, oxymercuration - demercuration, hydroboration - oxidation, hydroxylation, allylic substitution (using NBS) and ozonolysis. Conjugated Dienes - Structure, electrophilic addition of dienes: 1,2, & 1,4 - addition, Diels -Alder reaction. Alkynes: IUPAC nomenclature, General methods of preparation and reactions.
6. **Benzene and Aromaticity:**
Ruckel rules, resonance in benzene and derivatives. Mechanism of Electrophilic aromatic substitution: Halogenation, Nitration sulphonation and Friedel Crafts reaction, orientation and reactivity in Electrophilic aromatic substitution. Mechanism of nucleophilic aromatic substitution. Addition - elimination and elimination - addition (reactions involving benzene intermediates)
7. **Carboxylic Acids (Aromatic & Aliphatic):**
IUPAC nomenclature, methods of preparation & reactions. Functional derivatives of carboxylic acids - Acid halides, anhydrides, esters & amides - IUPAC nomenclature, general methods of preparation and reactions (alongwith mechanism).
8. **P-keto Esters:**

Mechanism of claisen & Dieckmann reactions, use of aceto - acetic ester and malonic ester in synthesis; Unsaturated compounds : Michael addition and addition of Grignard reagents.

Total Lectures

45

Practicals

1. Practical(s) are related to theory section.
2. Care in Organic Chemistry laboratory. Knowing grades & properties of chemicals.
3. Care in handling hazardous chemicals. Disposal of various classes of chemicals.
4. Introduction to identification of organic compounds
5. Organic spotting / Identification of organic compounds of various classes studied in theory.
6. Study and use of stereo models to improve the understanding of the concepts studied in theory.

Total hours

45

Books Recommended

1. R.T.Morrison and R. N. Boyd, Organic Chemistry, Prentice Hall of India Private Limited, New Delhi.
2. I.L.Finar, Organic Chemistry, Vol. I & II, Pearson Edition, Asia.
3. Reinhard Bruckner, Advanced Organic Chemistry, ACA Press, New Delhi.
4. B.S.Furniss, A.J.Hannaford, P.W.G.Smith, A.R.Tatchell, Vogel's Textbook of Practical Organic Chemistry, ELBS.
5. R.L.Shriner, Christine, K.F.Herman, T C.Morrill, D.Y.Curtin, R.C.Fuson, The Systematic Identification of Organic Compounds, John Wiley & Sons.

B. PHARM SEM III
COURSE NAME: FUNDAMENTALS OF PHARMACOLOGY [2PH314]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand fundamental concepts of pharmacology
- Discuss pharmacokinetic and pharmacodynamics aspects of drugs
- Describe the physiology of pain, inflammation and allergic reactions and to study drugs acting on it.
- Explain basics of autonomic nervous system
- Relate the mechanism of action with the use of autonomic drugs.

Theory (Detailed Syllabus)

L P C
3 - 3

1. General Principles of Pharmacology

- Introduction, definitions and scope of pharmacology
- General Principles of Drug Action
- Molecular Basis of Drug Action, Receptors and Ion channels
- Pharmacokinetics of drugs

2. Inflammation, Hypersensitivity & altered function

- Definition, types and etiology of inflammation
- Pathogenesis of acute and chronic inflammation.
- Definition, classification, type I, II, III and IV of hypersensitivity with examples.
- Pain physiology

3. Drug Therapy of Inflammation & Pain

- Histamine, 5-HT, Bradykinin, Substance P: Agonists and antagonists
- Eicosanoids: Prostaglandins, Thromboxanes and Leukotrienes
- Analgesic - antipyretic and anti-inflammatory agents and drugs employed in the treatment of Gout

4. Drugs acting at synaptic and Neuro-effector junctional sites

- **Neurochemical transmission (Autonomic and Somatic)**
- **Cholinergic transmission:**
Drugs affecting muscarinic receptors
Drugs that enhance cholinergic transmission
Drugs acting on ganglia and neuromuscular junction
- **Noradrenergic transmission:**
Drugs acting on noradrenergic receptors
Drugs that affect noradrenaline synthesis
Drugs that affect noradrenaline storage
Drugs that affect noradrenaline release
Inhibitors of noradrenaline uptake

Total Lectures

45

Books Recommended

- Focus on Pathophysiology, Barbara A. Bullock and Reet L. Henze Lippincott Williams & Wilkins, Philadelphia.
- 2 Robbin's Pathologic Basis of Disease, 6th edition, 1999, Cotran R.S., Kumar V and Collins T. W.B.Saunders, Philadelphia
- 3 Sylvia A. Price, Lorraine M. Wilson et al. Pathophysiology: Clinical Concepts of Disease Processes. Elsevier Science Publishers.
- 4 Pathophysiology-Lippincott's Review Series Ed.Catherine Paradiso.
- 5 Goodman Gilman A., Rall T.W., Nies A.LS. and Taylor, P. Goodman and Gilman's The pharmacological

- 6 Basis of therapeutics, Mc Graw Hill, Pergamon Press.
 6 Rang, H.P. and Dale, M.M. Pharmacology, Publisher: Churchill Livingstone.
 7 Katzung, B.G. Basic and Clinical Pharmacology, McGraw Hill, New York, 2001
 8 Satoskar, R.S. and Bhandarkar, S.D. Pharmacology and Pharmacotherapeutics, Popular, Dubai

B. PHARM SEM III
COURSE NAME : PHYTOPHARMACEUTICALS – II [2PH315]

Course Outcomes:

After successful completion of the course student will be able to :

- Understand the pharmacognostical studies of crude drugs belonging to category of glycosides
- Describe the phytochemistry and pharmacological uses of crude drugs belonging to resins
- Discuss various enzymes and their pharmaceutical applications
- Explain marine drugs and their medicinal uses
- Differentiate between various plant, animal and mineral fibres by chemical tests
- Develop understanding of herbal pesticides, natural allergens and toxic plants

Theory (Detailed Syllabus)

LP C
3 3 5

1. **Plant glycosides:** Definition, description and classification of plant glycosides.
Systematic study of crude drugs containing glycosides:
 - a. Saponins - Ginseng, Dioscorea, Liquorice and Brahmi
 - b. Cardio-actives - Digitalis, Stropanthus, Squill and Thevetia
 - c. Anthraquinone - Senna, Aloe, Cascara and Rhubarb
 Others - Psoralea, Gentian, Chirata, Quassia, Kalmegh, Picrorrhiza, Ammi majus and Visnaga.
 2. **Enzymes:**
 Definition, classification, biological sources, preparation and medicinal importance of following enzymes: Diastase, Pancreatin, Papain, Pepsin, Streptokinase and Trypsin
 3. **General study of drug containing resins and their combinations:**
 Asafoetida, Benzoin, Cannabis, Capsicum, Peru and Tolu balsam, Ginger, Colophony, Guggul, Podophyllum and Turmeric
 4. **Marine Pharmacognosy:** Novel medicinal agents from marine sources
 5. **Pesticides from natural origin, Natural Allergens and other toxic plants**
 6. **Study of fibers used in Pharmacy practice:** cotton, silk, wool, nylon, glass wool, polyester and asbestos.
- Total Lectures** **45**

Practicals

1. Morphological identification of crude drugs mentioned in theory
 2. **Microscopic studies** of some selected crude drugs and their powders mentioned under the category of glycosides and resins in theory
 3. General **chemical tests** of alkaloids, glycosides, tannins, phytosterols and flavonoids.
 4. Morphological study and **chemical tests** of some fibres
- Total Hours** **45**

Books Recommended

1. Pharmacognosy: W.C.Evans, W.B. Saunders, Edinburgh - 15th Edition - 2002
2. Pharmacognosy: C.K.Kokate, A.P.Purohit and S.B.Gokhale, Nirali Prakashan, Pune - 17th Edition - 2001
3. Pharmacognosy: Jean Bruneton, Intercept Ltd., Paris - 2nd Edition - 1999
4. Text Book of Pharmacognosy T E.Wallis, CBS publishers and Distributors Delhi, 1st Edition - Reprint -

1997

5. Pharmacognosy: Y.E.Tyler, L.R.Brady and J.E. Robbers, Lea and Febiger, Philadelphia, 8th Edition - 1981
6. Plant Drug Analysis: Wagner & Hildebert, Springer (India) Ltd. New Delhi, 2nd Edition - 1996
7. Quality Control of Herbal Drugs: P.K. Mukherjee Business Horizons, New Delhi, 1st Edition- 2002.
8. Organic Chemistry: Finar LL Volume - 2 Stereochemistry and the chemistry of Natural Products, ELBS Publication, 5th edition - 1996
9. Biologically Active Natural Products- Pharmaceuticals: Cutler & Stephen, CRC Press.London, 2000.
10. Cultivation & Utilization of Aromatic Plants, Edited by C.K. Atal and B.M. Kapoor, R.R.L., Jammu-Tawi , 1982.
11. Phytochemical methods: J.B. Harbone, Chapman and Hall, London, 3rd edition, 1998
12. Herbal Drug Industry, Chief Editor R.D. Chaudhary, Eastern Publishers, New Delhi, 1st edition, 1996 .
13. Compendium of Indian Medicinal Plants Vol. I, II, III, IV by R.P. Rastogi and B.N. Mahrotra, CDRI, Lucknow, 1993.
14. Quality standards of Indian medicinal plants: Gupta A.K. ICMR, New Delhi, Vol. 1- 2003.
15. Chemistry of Natural Products: Krishnaswamy N.R., Universities press, Hyderabad, 1999.
16. Healthcare Revolution in Envisioning an Empowered Nation: A. P. J. Abdul Kalam & A.S. Pillai, Tata Mc Graw-Hill Publishing Company Ltd.,New Delhi,2004
17. Anatomy of Crude Drugs: M.A.Iyengar and S.G.K. Nayak, Manipal Power Press, Manipal - 7th Edition - 1998

B. Pharm. Semester - III
COURSE NAME: ENVIRONMENTAL STUDIES
[2SPPHI 14] (Supplementary Course)

Course Outcomes:

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

- Define various natural resources
- Understand the concept of different environmental ecosystems
Describe the cause, impact and control measures for different types of environmental **pollution**
- Discuss the impact of population growth on environment
- Explain various methods of water and energy conservation
- Identify various issues related to biodiversity

Theory (Detailed Syllabus)

L P C
2

- **The multidisciplinary nature of environmental studies:**
Definitions, scope and importance, Need for public awareness
- **Natural resources and associated problems:**
Forest resources, Mineral resources, Water resources, Energy resources, Land resources and, Use of resources for sustainable lifestyle.
- **Ecosystems:**
Concept of an eco-system, Structure, function and components of ecosystem, Food chain and ecological pyramids, Introduction, types, characteristics features, structure and function of the any one of the ecosystems such as Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystem (pond, Lakes, Rivers, Oceans)
- **Biodiversity and its conservation:**
Introduction, Biodiversity at global, national and local level, India as a mega diversity nations, Hot spots of biodiversity, Threats to biodiversity: Habitat loss, poaching of wildlife, man wild life, conflicts, Endangered and endemic species of India & conservation of biodiversity.
- **Environmental pollution:**
Causes, effects and control measure of Air pollution, Water pollution, Soil pollution and marine pollution, Noise and thermal pollution, Nuclear hazards, **Solid waste management**, Role of an individual in prevention of pollution,
- **Social issues and the environment:**
Environment ethics: Issues and possible solutions, Urban problems related to energy, Water conservation, rain water harvesting, water shed management- rehabilitation problems & concerns - case study of Sardar Sarovar Dam, Environment protection acts
- **Human population and the environment:**
Population growth, variation and development, Environment- Population - human health, Value education with **case study**
- **Field work and others:**
Site visit, expert lectures, audio visual aids and real field experience to support their feel for the environment during the course of study.

Books Recommended

1. A Text Book of Environmental Chemistry and Pollution Control - S.S Dara, S Chand & Co.
2. Ecology- Eugene P. Odum, Oxford & IBH. Pub.
3. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

B. Pharm. Semester - III
COURSE NAME: ENTREPRENEURSHIP [2SPPH119]
(Supplementary Course)

Course Outcomes:

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

- Understand Entrepreneurship process
- Discuss ideas and evaluate business opportunities
- Explain marketing concepts for entrepreneurs
- Demonstrate a business plan for a new venture
- Identify financial terms for a business plan

Theory (Detailed Syllabus)

L P C
1

Module 1:

Profiles in Entrepreneurship
Entrepreneurial Mindset
Entrepreneurship Process

Module 2:

Creativity Tools for Ideation
Opportunity Evaluation

Module 3:

Business Models
Creating a Venture and Legal Aspects of Business

Module 4:

Basic Marketing Concepts
Developing Marketing and Operational Plans

Module 5:

Basic Financial Concepts
Developing a Financial Plan

Module 6:

Developing a Business Plan

Books Recommended

- Shankar, Raj(2012) Essential of Entrepreneurship, Tata McGraw Hill Private Limited Bizzo, G.C.(2013) 10 steps to Venture Success: Starting and Succeeding in your Business, New Hampshire : Knowledge Institute, Inc. Publication.

NIRMA UNIVERSITY
Institute of Pharmacy
(B. Pharm)
(Semester - IV)

L	T	P	C
3	1		4

Course Code	BP401T
Course Title	Pharmaceutical Organic Chemistry III - Theory

Scope:

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

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

1. Understand the methods of preparation and properties of organic compounds
2. Explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. Know the medicinal uses and other applications of organic compounds

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Remember nomenclature and medicinal uses of heterocyclic compounds.
2. Understand basic aspects of stereochemistry
3. Describe stereoisomerism and stereochemical reactions
4. Discuss important chemical reactions and synthesis of heterocyclic rings.
5. Explain various reactions of synthetic importance.

Syllabus:

Teaching hours: 45 Hours

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

UNIT I

10 Hours

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

10 Hours

Geometrical isomerism

- Nomenclature of geometrical isomers (Cis Trans, EZ, Syn, Anti systems), methods of determination of configuration of geometrical isomers.
- Conformational isomerism in Ethane, n-Butane and Cyclohexane.
- Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.
- Stereospecific and stereoselective reactions.

UNIT III

10 Hours

Heterocyclic compounds

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

UNIT IV

08 Hours

- 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

07 Hours

Reactions of synthetic importance

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

Tutorials

15 Hours

Tutorials will be based on above syllabus.

Suggested Readings A: (Latest edition)

1. Morrison, R. T., Boyd, R. N. *Organic Chemistry*. Prentice Hall, Inc., USA.
2. Finar, I. L. *Organic Chemistry*, Vol. I & II, ELBS.
3. Gilchrist, T. L. *Heterocyclic chemistry*. New Delhi: Pearson.
4. Bahl, B. S. *Text Book Of Organic Chemistry*. S. Chand And Company Ltd Ram Nagar; New Delhi.
5. Bansal, R. K. *Heterocyclic chemistry*, New Age International.
6. March, J. *Advanced organic chemistry: reactions, mechanisms, and structure*. John Wiley & Sons,.
7. Solomons, T. W., Fryhle, C. B., & Johnson, R. G. *Organic chemistry*. New York: Wiley.
8. Vishnoi, N. K. *Advanced practical organic chemistry*. Vikas Publishing House Pvt. Limited.
9. Gurudeep, C.R., & Gurudeep, C.R. *Reaction Mechanism and Reagents in Organic Chemistry*. Bombay: Himalaya Publishing House.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

(B. Pharm)
(Semester - IV)

		L	T	P	C
		3	1		4
Course Code	BP402T				
Course Title	Medicinal Chemistry I -Theory				

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 (SAR) of different class of drugs
4. Write the chemical synthesis of some drugs

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the basic principles of medicinal chemistry and drug metabolism.
2. Describe classification, mechanism of action uses and adverse effects of different classes of drugs of ANS and CNS.
3. Discuss structure activity relationship studies of different classes of drugs.
4. Report synthetic protocol of some drugs.
5. Synthesize and/or analyze drugs and drug intermediates.

Syllabus:

Teaching hours: 45 Hours

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

UNIT I

10 Hours

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

UNIT II

10 Hours

Drugs acting on **Autonomic Nervous System**

- **Adrenergic Neurotransmitters:**
Biosynthesis and catabolism of catecholamine.
Adrenergic receptors (Alpha & Beta) and their distribution.
- **Sympathomimetic agents: SAR of Sympathomimetic agents:**
Direct acting agents:
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*, Metipranolol, Atenolol, Betaxolol, Bisoprolol, Esmolol, Metoprolol, Labetalol, Carvedilol.

UNIT III

10 Hours

Drugs acting on **Autonomic Nervous System**

- **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, Isoflurophate, Echothiophate iodide, Parathion, 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, Biperiden hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT IV

08 Hours

Drugs acting on **Central Nervous System**

- **Sedatives and Hypnotics:**

Benzodiazepines:

SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Clorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturates:

SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital.

Miscellaneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

- **Antipsychotics:**

Phenothiazines:

SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazines:

Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluoro butyrophenones:

Haloperidol, Droperidol, Risperidone.

Beta amino ketones:

Molindone hydrochloride.

Benzamides:

Sulpiride.

- **Anticonvulsants:**

SAR of Anticonvulsants, mechanism of anticonvulsant action

Barbiturates:

Phenobarbitone, Metharbital.

Hydantoins:

Phenytoin*, Mephentoin, Ethotoin

Oxazolidinediones:

Trimethadione, Paramethadione

Succinimides:

Phensuximide, Methsuximide, Ethosuximide*

Urea and monoacylureas:

Phenacemide, Carbamazepine*

Benzodiazepines:

Clonazepam

Miscellaneous:

Primidone, Valproic acid, Gabapentin, Felbamate

UNITV**07 Hours****Drugs acting on Central Nervous System**

- **General anesthetics:**

Inhalation anesthetics:

Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbiturates:

Methohexital sodium*, Thiethylal 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, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartrate.

Narcotic antagonists:

Nalorphine hydrochloride, Levallorphan tartrate, Naloxone hydrochloride.

Anti-inflammatory agents:

Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone .

Tutorials

Tutorials will be based on above syllabus.

Teaching hours: 15 Hours

Suggested Readings": (Latest edition)

1. Wilson, C. O., Beale, J. M., & Block, J. H. *Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry*. Lippincott Williams & Wilkins.
2. Foye, W. O. *Foye's principles of medicinal chemistry*. Lippincott Williams & Wilkins.
3. Burger, A., & Abraham, D. J. *Burger's medicinal chemistry and drug discovery* (Vol. I-IV). Wiley.
4. Smith, H. J., & Williams, H. *Introduction to the principles of Drug design*. Elsevier.
5. Remington, J. P. *Remington: the science and practice of pharmacy* (Vol. 1 & 2). Lippincott Williams & Wilkins.
6. Reynolds, J.E. F., *Martindale: the extra pharmacopoeia*. Pharmaceutical Press, London.
7. Finar, I. L. *Organic Chemistry, Volume 2: Stereochemistry And The Chemistry Natural Product.*, Pearson Education India.
8. Lednicer, D. *The organic chemistry of drug synthesis* (Vol. 1-5). John Wiley & Sons.
9. Indian pharmacopoeia, Indian Pharmacopoeial Commission.
10. Furniss, B. S. *Vogel's textbook of practical organic chemistry*. Pearson Education India.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

(B. Pharm)
(Semester - IV)

		L	T	P	C
				4	2
Course Code	BP406P				
Course Title	Medicinal Chemistry I - Practical				

Syllabus:

Teaching hours: 60 Hours

I. Preparation of drugs/ intermediates:

1. 1,3-pyrazole

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

II. **Assay of drugs:**

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

III. **Determination of Partition coefficient for any two drugs**

L= Lecture, T= Tutorial, P= Practical, C= Credit

**(B. Pharm.)
(Semester - IV)**

L	T	P	C
3	1		4

Course Code	BP403T
Course Title	Physical Pharmaceutics II - Theory

Scope:

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

Objectives:

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

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand physicochemical properties of solids and dispersed systems.

2. Discuss colloidal dispersion systems in designing formulations.
3. Describe rheological behavior of various compounds and its measurement by viscometers.
4. Determine coarse dispersion systems, its properties and stability.
5. Explain particle properties and its impact on various parameters.
6. Identify various conditions for stability testing.

Syllabus:

Teaching hours: 45 Hours

UNIT I

05 Hours

Colloidal dispersions:

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

UNIT II

10 Hours

Rheology:

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

Deformation of solids:

Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.

UNIT-III

10 Hours

Coarse dispersion:

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

UNIT-IV

10 Hours

Micromeritics:

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

UNIT-V

10 Hours

Drug stability:

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

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings (Latest edition)

1. Sinko, P. J., & Martin, A. N. *Martin's physical pharmacy and pharmaceutical sciences: Physical chemical and biopharmaceutical principles in the pharmaceutical sciences*. Philadelphia: Lippincott Williams & Wilkins.
2. Parrott, E.L. *Experimental Pharmaceutics*. Burgess Pub. Co
3. Cooper, J.W., Gunn, C., & Carter S.J. *Cooper and Gunn 's tutorial pharmacy*. London: Pitman Medical.
4. Stocklosa, M.J., & Ansel, H.C. *Pharmaceutical calculations*. Philadelphia: Lea & Febiger.
5. Lieberman, H.A., Lachman, L., & Schwartz, J.B. *Pharmaceutical Dosage forms - Tablets*, volume I to 3. New York: Marcel Dekkar Inc.
6. Lieberman, H.A, Rie ger, M.M., & Banker, G.S. *Pharmaceutical dosage forms - Disperse systems*, volume 1 to 3. New York: Marcel Dekkar Inc.
7. Ramasamy, C., & Manavalan, R. *Physical Pharmaceutics*. India: Vignesh Publisher

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^ this is not an exhaustive list

(B. Pharm.)
(Semester - IV)

L	T	P	C
		4	2

Course Code	BP407P
Course Title	Physical Pharmaceutics II - Practical

Syllabus:**Total hours: 60 Hours**

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - IV)

L	T	P	C
3	1		4

Course Code	BP404T
Course Title	Pharmacology I - Theory

Scope:

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

Objectives:

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

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand general concepts of pharmacology, adverse drug reactions, drug interactions, drug discovery and clinical evaluation of drugs.
2. Relate pharmacodynamics principles of drugs with mechanism of action.
3. Describe pharmacokinetics of drugs with respect to absorption, distribution, metabolism and elimination.
4. Discuss pharmacology of drugs acting on peripheral nervous system.
5. Explain pharmacology of drugs acting on central nervous system.
6. Apply their skills of handling of instruments, animals and softwares for studying pharmacological effects of the drugs.

Syllabus:

Teaching hours: 45 Hours

UNIT I

08 Hours

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

12 Hours

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

10 Hours

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), ganglion stimulants and blockers.

Local anesthetic agents.

Drugs used **in** myasthenia gravis and glaucoma.

UNIT IV

08 Hours

Pharmacology of drugs acting on central nervous system:

Neurohumoral transmission in the CNS. 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.

Alcohol and disulfiram.

UNIT V

07 Hours

Pharmacology of drugs acting on central nervous system:

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

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

CNS stimulants and nootropics.

Opioid analgesics and antagonists.

Drug addiction, drug abuse, tolerance and dependence.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings": (Latest Edition)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology. New York, Churchill Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and Clinical Pharmacology. New Delhi, Tata Mc Graw-Hill
3. Brunton L., Chabner B.A., Knollman B. Goodman and Gillman's The Pharmacological Basis of

- Therapeutics. USA, McGraw Hill Education.
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. USA, The Point Lippincott Williams & Wilkins
 5. Harvey R.A., Clark M.A., Finkel R., Rey J.A., Whalen K. Pharmacology (Lippincott's Illustrated Reviews). New Jersey, Lippincott Williams and Wilkins
 6. Tripathi K.D. Essentials of Medical Pharmacology. New Delhi, Jaypee Brothers Medical Publishers (P) Ltd.
 7. Shanna H. L., Shanna **K. K.** Principles of Pharmacology. New Delhi, Paras Medical Publisher
 8. Craig C.R. Stitzel R. E. Modern Pharmacology with Clinical Applications. Lippincott Williams & Wilkins
 9. Ghosh MN. Fundamentals of Experimental Pharmacology. Kolkata. Hilton & Company.
 10. Kulkarni SK. Handbook of Experimental Pharmacology. New Delhi. Vallabh Prakashan
- I I. Goyal R.K., Mehta A.A., Balaraman R., Burande M.D. Dearsari and Gandhi's Elements of Pharmacology. Ahmedabad, B.S. Shah Prakashan.

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(B. Pharm)
(Semester - IV)

LT		P	C
		4	2

Course Code	BP408P
Course Title	Pharmacology I - Practical

Syllabus:

Total Hours: 60 Hours

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

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - IV)

L	T	P	C
3	1		4

Course Code	BP405T
Course Title	Pharmacognosy and Phytochemistry I - Theory

Scope:

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

Objectives:

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

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the history and scope of pharmacognosy, various sources of crude drugs and their classification.
2. Describe various aspects of cultivation, collection, processing and storage of herbal drugs.
3. Discuss the technique and applications of plant tissue culture.
4. Explain the role of pharmacognosy in various systems of traditional medicine and classify secondary metabolites.
5. Express the pharmacognostic study of some crude drugs belonging to category of carbohydrates, proteins, lipids, fibres and marine drugs.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

Introduction to Pharmacognosy:

Definition, history, scope and development of Pharmacognosy.

Sources of Drugs - Plants, Animals, Marine & Tissue culture.

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

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and serotaxonomical classification of drugs.

Quality control of Drugs of Natural Origin:

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

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

UNIT II

10 Hours

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

Cultivation and Collection of drugs of natural origin.

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants.

Conservation of medicinal plants.

UNIT III

07 Hours

Plant tissue culture:

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

Applications of plant tissue culture in pharmacognosy.

Edible vaccines.

UNIT IV

10 Hours

Pharmacognosy in various systems of medicine:

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

Introduction to secondary metabolites:

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

UNIT V

08 Hours

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

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

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

Carbohydrates:

Acacia, Agar, Tragacanth, Honey.

Proteins and Enzymes:

Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils) :

Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax.

Marine Drugs:

Novel medicinal agents from marine sources.

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings": (Latest Edition)

1. Evans, W.C. *Trease and Evans Pharmacognosy*. London, W.B. Saunders & Co.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E. *Pharmacognosy*. Philadelphia, Lea and Febiger.
3. Wallis, T.E. *Text Book of Pharmacognosy*. London. J&A Churchill Ltd.
4. Ali, M. *Pharmacognosy and Phytochemistry*. New Delhi, CBS Publishers & Distribution.
5. Kokate, C.K. *Text Book of Pharmacognosy*. New Delhi, Nirali Prakashan.
6. Chaudhary, R..D. *Herbal Drug Industry*. New Delhi, Eastern Publisher.
7. Ansari, S.H. *Essentials of Pharmacognosy*. New Delhi. Birla Publications.
8. Kokate, C.K., Gokhale S.B. *Practical Pharmacognosy*. Pune, Nirali Prakashan.
9. Iyengar, M.A., Nayak, S.G. *Anatomy of Crude Drugs*. Career Publications.

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(B. Pharm)
(Semester - IV)

		L	T	P	C
				4	2
Course Code	BP409P				
Course Title	Pharmacognosy and Phytochemistry I - Practical				

Syllabus:

Teaching hours: 60 Hours

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

B. PHARM SEM IV

COURSE NAME : HOSPITAL AND COMMUNITY PHARMACY [2PH411]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand the hospital pharmacy and its functions in healthcare services
- Describe the role of hospital and community pharmacist
- Explain principles of purchase, inventory management and storage of drugs
- Utilize appropriately various drug distribution systems for patients in the hospitals
- Demonstrate community services in disease care management
- Calculate the correct dose of the drug for pediatric and geriatric patients

Theory (Detailed Syllabus)

LPC
2 -- 2

(A) Hospital Pharmacy

Hospital Pharmacy - Organisation and Management

Organization of hospital & hospital pharmacy, Roles & responsibilities of hospital pharmacist, Budget preparation & implementation

A brief study of

- a. Pharmacy and Therapeutic Committee
Objectives, organization, functions & limitations
- b. Hospital formulary
Contents, preparation & Revision of formulary
- c. The Pharmacy- Central Sterile Supply Room
Objectives, personnel, location, planning the CSSR, lay out for small, medium and large size hospitals, standardization committee etc.

Purchase & inventory control

Organisation of drug store, Principles in purchasing procedures, organization of hospital contracts, purchase orders, procurement, and stocking etc.

Technical services in hospital pharmacy

Pharmaceutical repackaging, overview of preparations of various formulations in hospital pharmacy department

Aseptic preparation - IV admixtures, cytotoxic infusions, total parenteral nutrition solutions, radiopharmaceuticals

Drug distribution in hospitals

Outpatient, Inpatient & Ambulatory patient dispensing

Methods adopted - Individual prescription method, floor stock method, Unit dose drug distribution method etc.

- Distribution of Narcotic & other controlled substances.

Hospital biomedical waste management

- Importance, technology available, treatment and disposal of waste

Pharmaceutical Dosage Calculation

(B) Community Pharmacy

1 **Introduction, Scope and Management**

Definition and scope of community pharmacy, roles and responsibilities of community pharmacist in health care and education. Selection of site, space lay out, design, legal requirements, materials, and maintenance for community pharmacy

2 **Patient Communication & Counseling**

Definitions, communication, compliance, counseling and concordance Advantages, disadvantages, Various stages in communication & counseling, Barriers in counseling,

Books Recommended

- Cooper and Gunn's Dispensing for pharmaceutical students by Carter S. J., CBS Publishers and Distributors, Delhi
- Collett M., Aulton E., Pharmaceutical Practice, Churchill Living stone, New York.
- Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.
- Parnar, N. S., Health Education and Community Pharmacy, CBS Publishers and Dis tributors, Delhi .
- Dipiro, Joseph T., Encyclopedia of clinical pharmacy, Marcel Dekker, Inc., New York.
- Stephens, Martin, Hospital pharmacy edited by Pharmaceutical press, London.
- Bob, Larry E. E., Young, Lioyd Y., Pharmacy Practice manual, Lippincott Williams & Wilkins, New York.

B. PHARM SEM - IV
COURSE NAME: PHARMACEUTICAL MICROBIOLOGY [2PH412]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand fundamentals of pharmaceutical microbiology and types of micro-organism
- Identify type of bacteria (by various staining techniques) and counting of microorganisms
- Describe principle, operations and applications of various sterilization techniques
- Explain type of disinfectant and its evaluation
- Practice aseptic processing for cultivation and isolation of microorganism
- Evaluate potency of antibiotics, and sterility of pharmaceutical products

Theory (Detailed Syllabus)

		L	P	C
		3	3	5
1.	Introduction to Pharmaceutical Microbiology History & contributions of great scientists to microbiology, scope and future of microbiology.			
2.	Identification and classification of microbes ▶ Stains and types of staining techniques for microbes, different types of microscopic techniques Taxonomy, Study of bacteria and bacterial cell, Brief introduction about actinomycetes, rickettsia, spirochetes, fungi and viruses and their importance in pharmaceuticals.			
3.	Microbial growth ▶ Nutrition, study of growth cycle, cultivation, isolation & counting of bacteria			
4.	Microbial control in pharmaceutical industries ▶ Disinfection: Classification, mode of action, factors influencing disinfectants, uses, evaluation and effectiveness. Sterilization: Introduction, significance, sensitivity of microorganisms, detailed methods for sterilization processes. Sterilization control and sterility assurance.			
5.	Sterility testing of pharmaceutical products ▶ Importance, objectives, methodology as per pharmacopoeia! standards, evaluation tests			
6.	Microbiological assays of antibiotics, vitamins, amino acids etc.			
7.	Microbial limit tests for Pharmaceutical dosage forms			
	Total Lectures			45

Practicals

1	To Study of various simple, differential and special staining techniques of microorganisms	
2	To Study of motility of microorganisms by hanging drop techniques	
3	To study isolation, cultivation and counting of microorganisms by various methods	
4	Study of effects of oligodynamic and UV light on growth of microorganisms	
5	Microbiological assays of vitamins, antibiotics and aminoacids etc. as per IP	
6	Sterility testing of various samples	
7	Vallidation of sterilization equipments like hot air oven, autoclave etc	
8	Study of Pharmacopoeia} specifications of sterilization as per IP, BP, USP	
9	Microbial limit test of raw materials and finished products etc. as per IP	
	Total hours	45

Books Recommended

1. Bey Russell. Microbiology Laboratory Manual. Singapore : Thomson Asia Pvt Ltd, 2001. Print

2. Aneja KR. Experiments In Microbiology, Plant Pathology, Biotechnology. New Delhi : New Age International Publishers , 2003. Print
3. Denyer SP, Hodges NA, and Gorman SP. Hugo and Ruseell's Pharmaceutical Microbiology, Blackwell Publishing, 2004. Print
4. Atlas RM. Principles of Microbiology. Wm. C. Brown Publishers, 1997. Print
5. Bergey's Manual of Systemic Bacteriology. Williams and Wilkins. A Waverly company: WC Brown Publishers, 1994. Print
6. Block SS. Disinfection, Sterilization and Preservation . Fifthe edition. Philadelphia, London: LWW, 2000. Print
7. Aulton Michael E. Pharmaceutics: The Science of Dosage Fonn Design. London: Chrchill Livingstone, 2002. Print
8. Carter SJ. Cooper and Gunn's Dispensing Pharmacy. Delhi: CBS Publishers & Distributors, 2000. Print
9. Gennaro Alfonso R. Remington: The Science and Practice of Pharmacy, Vol-I & II, 20th Edition. New York: Lippincott Williams & Wilkins, 2001. Print
- 10.** Harley John P. Prescott Lancing M. Laboratory Exercises in Microbiology. 3rd Editon, Boston: McGraw Hill, 1996. Print
- 11.** Pelczar M, Chan ECS, Kreig NR. Microbiology. Fifth edition, New Delhi : Tata McGraw Hill, 1993. Print
12. Tortora Gerard J. Microbiology: An Introduction. San Frabciso: Person Education Inc, 2004. Print

B. PHARM SEM IV
COURSE NAME: ORGANIC CHEMISTRY-II [2PH413]

Course Outcomes:

After successful completion of the course student will be able to:

- Remember five and six member heterocyclic ring systems
- Understand methods of preparation and properties of organic compounds
- Describe important chemical reactions and synthesis of heterocyclic rings
- Explain mechanism of various chemical and molecular rearrangement reactions
- Identify unknown organic compound
- Synthesize compounds involving nitration, halogenation and hydrolysis reactions.

Theory (Detailed Syllabus)

L P C
3 3 5

1. Aldehydes and Ketones:

IUPAC nomenclature, general methods of preparation, mechanism of nucleophilic addition and condensation reactions; Acetal, amine, oximes, hydrazones, semicarbazones, enamine - preparation and uses. Addition of Grignard Reagents and hydrides, MPV reduction, Oppenauer oxidation, Aldol condensation Cannizzaro's reaction, Reformatsky reaction, Perkin reaction, Knoevenagel reaction, Haloform reaction and Mannich reaction.

2. Phenols:

Nomenclature, methods of preparation and general reactions

3. Sulphonic Acids:

Preparation, reactions and uses.

4. Molecular Rearrangement Reactions:

Mechanism and stereochemistry of - Whitmore-1,2-shift, Pinacol rearrangement, Wolff rearrangement, Beckmann rearrangement, Hofmann rearrangement, Schmidt rearrangement, Baeyer-Villiger oxidation, Wittig rearrangement, Benzilic acid rearrangement, Fries rearrangement, Claisen rearrangement, Cope rearrangement, Sandmeyer reaction, Gomberg reaction.

5. Alcohols and Ethers:

IUPAC nomenclature, methods of preparation, types and general reactions.

6. Amines:

IUPAC nomenclature, methods of preparation, types, general reactions, preparation and use of diazonium salts.

7. Heterocyclic Chemistry:

Nomenclature of the following heterocyclic ring systems and examples of drugs (name and structure) containing it - Pyrrole, Furan, Thiophene, Pyrazole, Imidazole, Oxazole, Thiazole, Triazole, Tetrazole, Pyridine, Pyridazine, Pyrimidine, Pyrazine, Indole, Quinoline, Isoquinoline, Acridine. Important route of synthesis and chemical reactions of the following heterocyclic rings: Pyrrole, Furan, Thiophene, Imidazole, Thiazole, Pyridine, Pyrimidine, Indole, Quinoline.

8. Polycyclic Compounds:

Structure, synthesis and reactions of naphthalene, anthracene and phenanthrene involving substituents.

Total Lectures

45

Practicals

Practicals are related to theory section.

1. Introduction to identification of Organic compound having different functional groups
2. Organic spotting / Identification of Organic compounds of various classes studied in theory.
3. Synthesis of some compounds having importance as intermediates in medicinal organic chemistry involving single step reactions.
4. Study and use of stereo models to improve the understanding of the concepts studied in theory

Total hours

45

Books Recommended

1. R.T. Morrison and R. N. Boyd, Organic Chemistry, Prentice Hall of India Private Limited, New Delhi.
2. Jerry March. Advanced Organic Chemistry, J W & Sons, Singapore.
3. B.S.Furniss, A.J.Hannaford, P.W.G.Smith, A.R.Tatchell, Vogel's Textbook of Practical Organic Chemistry, ELBS.\
4. Jag Mohan, Organic Analytical Chemistry-Theory and Practice, Narosa Publishing House, New Delhi

B. PHARM SEM IV
COURSE NAME: PATHOPHYSIOLOGY AND PHARMACOLOGY-I [2PH414]

Course Outcomes:

After successful completion of the course student will be able to :

- Understand pathophysiology and clinical manifestations of gastrointestinal disorders
- Describe effects of drugs used in cardiovascular and renal disorders.
- Discuss drugs useful in blood disorders.
- Explain detailed pharmacology of drugs acting on respiratory system.
- Identify heavy metal toxicity and their antidotes.
- Demonstrate use of equipments and softwares for studying pharmacological effects of various drugs.

Theory (Detailed Syllabus)

L P C
3 3 5

1. Gastrointestinal System

- **Pathophysiology of gastrointestinal disorders**
Peptic Ulcer, Inflammatory Bowel Diseases, Hepatitis, Alcoholic Liver Diseases, Cirrhosis
- **Drug Affecting gastrointestinal function**
Drugs used in gastric acidity, peptic ulcers and gastro esophageal reflux disease.
Prokinetic agents, emetics, anti emetics and agents used in Irritable bowel syndrome.
Agents used in diarrhoea, constipation.
Drugs used in inflammatory bowel diseases, biliary & pancreatic disease.

2. Respiratory System

- Pathophysiology and treatment of asthma and COPD

3. Renal and Cardiovascular System

- **Pathophysiology of renal disorders:**
Acute renal failure, chronic renal failure.
- **Pathophysiology of cardiovascular diseases:**
Hypertension, Angina, Myocardial Ischaemia and Infarction, Heart Failure, Atherosclerosis, Arrhythmia
- **Drugs affecting renal and cardiovascular function**
Diuretics
Anti-hypertensives
Anti angina} agents
Drugs used for the treatment of myocardial ischaemia
Drug therapy for hypercholesterolemia and dyslipidemia
Cardiotonics
Anti-arrhythmic agents

4. Drugs acting on blood and blood forming organs

- Anaemia and Haematopoietic agents
- Anti-coagulants, thrombolytics, fibrinolytic and anti platelet agents
- Blood and plasma volume expanders

5. Heavy metals (Iron, lead, Mercury, Arsenic) and heavy metal antagonists

Total Lectures

45

Practicals

- 1 Study of laboratory animals and methods of handling experimental animals.
- 2 CPCSEA guidelines for experimental animals, methods used for sacrifice and rendering animals unconscious

- 3 Study of laboratory appliances used in experimental pharmacology
- 4 Study of different physiological salt solutions and methods of preparation of various drug solutions and PSS used in experimental pharmacology
- 5 Study of different routes of drug administration and collection of blood.
- 6 Study of Dose Response Curve (DRC) and determine PD₂ value of agonists (acetylcholine, histamine, adrenaline etc.) on various preparations (frog's rectus Abdominus muscle, rat ileum, guinea- pig ileum, rabbit jejunum etc.)
- 7 Study of competitive antagonism and determine PA₂ values of antagonists on suitable isolated tissue preparations.
- 8 Study of non-competitive antagonism and determine PD₂' values of antagonists on suitable isolated tissue preparations.
- 9 Study of mydriatic - miotic using suitable animal models.
- 10 Study of effect of autonomic drugs on intra-ocular pressure using rabbits.
- 11 Study of effect of cholinergic agents on salivary secretions.
- 12 Study of effect of autonomic drugs on lacrimal secretions using suitable animal models.
- 13 Study of analgesics using animal models like Hot Plate method / tail flick / writhing method.
- 14 Study of analgesics in human volunteers.
- 15 Study of anti-inflammatory agents using animal models using phlogistic agents.
- 16 Study of various spasmogenics and spasmolytics using suitable isolated tissue preparations.
- 17 Identification of nature of unknown drug using suitable isolated tissue preparations
- 18 To study the effect of various drugs on isolated frog's heart preparation.
- 19 To study the effect of various drugs on perfused frog's heart preparation
- 20 To demonstrate the cardiotoxic effects of drugs on frog's hypodynamic heart preparation.
- 21 To demonstrate the diuretic effect of the drug using suitable animal model.
- 22 To demonstrate the effect of drugs on the coronary blood flow and heart rate of isolated rat's heart (Lagendorff's heart preparation).

Total hours

45

Books Recommended

- Focus on Pathophysiology, Barbara A. Bullock and Reet L. Henze Lippincott Williams & Wilkins, Philadelphia.
- 2 Robbin's Pathologic Basis of Disease, Cotran R.S., Kumar V and Collins T. W.B.Saunders, Philadelphia
 - 3 Pharmacotherapy : A pathophysiologic approach - Joseph T. Dipiro et. al. Appleton & Lange.
 - 4 Sylvia A. Price, Lorraine M. Wilson et al. Pathophysiology: Clinical Concepts of Disease Processes. Elsevier Science Publishers.
 - 5 Pathophysiology-Lippincott's Review Series Ed.Catherine Paradiso.
 - 6 Goodman Gilman A., Rall T.W., Nies A.L.S. and Taylor, P. Goodman and Oilman's The pharmacological Basis of therapeutics, Mc Graw Hill, Pergamon Press.
 - 7 Rang, H.P. and Dale, M.M. Pharmacology, Publisher: Churchill Livingstone.
 - 8 Katzung, B.G. Basic and Clinical Pharmacology, McGraw Hill, New York, 2001
 - 9 Satoskar, R.S. and Bhandarkar, S.D. Pharmacology and Pharmacotherapeutics, Popular, Dubai
 - 10 Kulkarni S.K. Handbook of experimental pharmacology, Vallabh Prakashan, New Delhi.
 - 11 Goyal R.K. et al: Practical in Pharmacology, B.S.Shah Prakashan, Ahmedabad - 1.
 - 12 Ghosh, M.N. Fundamentals of experimental pharmacology, Scientific Book agency, Kolkata.
 - 13 H.G.Vogel et al. Drug Discovery and Evaluation. Pharmacological Assays. Springer-Verlag New-york.

B. PHARM SEM IV
COURSE NAME : ANALYTICAL PHARMACOGNOSY & HERBAL DRUG
TECHNOLOGY [2PH415]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand pharmacognostical studies of various crude drugs belonging to category of alkaloids
- Describe various plant tissue culture techniques
- Discuss various chromatographic techniques used in evaluation of phytoconstituents
- Explain biosynthesis of secondary plant metabolites
- Determine different types of adulteration in crude drugs
- Apply different analytical methods for standardization of herbal drugs and relate the factors affecting quality of crude drugs

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Pharmacognostic study of following alkaloid containing crude drugs:**
 - a. Tropane - Coca, Withania, Datura, Belladonna and Hyoscyamus
 - b. Quinoline and Isoquinoline- Cinchona Camptotheca, Opium and Ipecac
 - c. Indole -Catharanthus, Ergot, Physostigma, Nux-Vomica and Rauwolfia
 - d. Steroidal - Veratrum and Kurchi
 - e. Amine - Ephedra and Colchicum
 - f. Quinazoline - Vasaka
 - g. Imidazole - Pilocarpus
 - h. Purines -Coffee, Tea and Cola
2. **Plant Tissue Culture Techniques & its Application in Pharmacy :**
Introduction, techniques of initiation and maintenance of various types of cultures. Immobilized cell techniques & biotransformation studies including recent developments in production of biological active constituents in static, suspension and hairy root cultures.
3. **General biosynthetic pathways of secondary plant metabolites**
4. **Factors affecting quality of herbal drugs**
Collection and processing of herbal drugs. Seasonal & geographical variations; natural & artificial drying methods. **Packaging & labeling** of herbal drugs prior to extraction.
5. **Introduction to Standardization and quality control of herbal drugs:**
Identification, authentication, standardization of medicinal plants as per WHO guidelines & different herbal pharmacopoeias. Determination of physical and chemical constants such as ash values, extractive values, moisture content and LOD, volatile oil content, bitterness value, determination of microbial load, pesticides, heavy metals and radio-active contaminants, foreign matters applicable to the various herbal drugs. Determination of *RJ*. value and chemical tests.
6. **Adulteration of crude drugs and their detection:** Organoleptic, microscopic, physical, chemical, biology and other methods of evaluation.

Total Lectures

30

Practicals

1. Morphological identification of crude drugs mentioned in theory
 2. **Microscopic studies** of some selected crude drugs and their powders mentioned under the category of alkaloids in theory
 3. **Determination of L.O.D, ash value, acid insoluble ash value of some crude drugs.**
 4. **Determination of water and alcohol soluble extractive value of some crude drugs.**
 5. **Determination of *RJ*, value of some extracts using T.L.C.**
 6. **Determination of absorbance** of some phytopharmaceuticals usmg U.V. Spectrophotometer.
Demonstration of Immobilization techniques of plant cells and enzymes
- Total Hours** **45**

Books Recommended

1. Pharmacognosy: W.C.Evans, W.B. Saunders, Edinburgh- 15th Edition - 2002
2. Pharmacognosy: C.K.Kokate, A.P.Purohit and S.B.Gokhale, Nirali Prakashan, Pune - 17th Edition - 2001
3. Pharmacognosy: Jean Bruneton, Intercept Ltd., Paris - 2nd Edition - 1999
4. Text Book of Pharmacognosy: T.E.Wallis, CBS publishers and Distributors Delhi, 5th Edition - Reprint - 1997
5. Pharmacognosy: V.E.Tyler, LR.Brady and J.E. Robbers, Lea and Febiger, Philadelphia - 8th Edition - 1981
6. Plant Drug Analysis : Wagner & Hildebert, Springer (India) Ltd. New Delhi, 2nd Edition - 1996
7. Quality Control of Herbal Drugs: **P.K.** Mukherjee Business Horizons, New Delhi, 1st Edition - 2002.
8. Organic Chemistry: Finar I.L Volume - 2 Stereochemistry and the chemistry of Natural Products, ELBS Publication, 5th edition - 1996
9. Biologically Active Natural Products- Pharmaceuticals: Cutler & Stephen, CRC Press.London, 2000.
10. Cultivation & Utilization of Aromatic Plants , Edited by C.K. Atal and B.M. Kapoor, R.R.L., Jammu-Tawi, 1982.
11. Phytochemical methods: J.B. Barbone, Chapman and Hall, London, 3rd edition , 1998
12. Herbal Drug Industry, Chief Editor R.D. Chaudhary, Eastern Publishers, New Delhi, 1st edition, 1996.
13. Compendium of Indian Medicinal Plants Vol. I, II, III, IV by R.P. Rastogi and B.N. Mahrotra, CORI, Lucknow, 1993.
14. Quality standards of Indian medicinal plants: Gupta A.K. ICMR, New Delhi, Vol. 1- 2003.
15. Chemistry of Natural Products: Krishnaswamy N.R., Universities press, Hyderabad, 1999.
16. Healthcare Revolution in Envisioning an Empowered Nation: A. P. J. Abdul Kalam & A.S. Pillai, Tata Mc Graw-Hill Publishing Company Ltd.,New Delhi,2004
17. Anatomy of Crude Drugs: M. A. Iyengar and S.G.K. Nayak, Manipal Power Press, Manipal - 7th Edition - 1998

B. Pharm. Semester - IV
COURSE NAME : PROFESSIONAL ETHICS(INCLUDING HUMAN RIGHTS) [2SPPH116]
(Supplementary Course)

Course Outcomes:

After successful completion of the course student will be able to:

- Understand the importance of values, ethics, and rights in their professional life to ensure happiness and prosperity
- Explain the ethical issues related to misconduct in science, teaching and research
- Identify the ethical issues in research conducted on humans and animals
- Develop holistic perspective towards profession, life and happiness.
- Sets up their own standards of code of conduct and ethics of pharmacy profession.

Theory (Detailed Syllabus)

L P C
1 -

General Ethics:

1. Introducing Ethics: What is it and what is it not?
2. Question of Character, Virtue, and role of Ethics in life
3. Duties, Norms and Consequences
4. Nature Justice and Rights
5. Perspectives of Ethics
6. Ethics, Psychology and Evolution: How Ethics is changing?
7. Contemporary Ethical Issues: Ethics in science and research, Standards of ethical conduct in science
8. Civil rights and Human Rights

Professional Ethics:

1. **Professional ethics [Safety responsibility and rights]**

Making patient as your first concern, Use of professional judgement in the interests of patients and the public, showing respect for others, Encouraging patients and the public to participate in decisions about their care, Developing professional knowledge and competence, being honest and trustworthy.

2. **Ethical issues in the laboratory**

Ethics of the mentor-mentee relationship, harassment, reporting misconduct in science, teaching Vs research, ethical issues in hiring and recruitment, sharing and preserving resources, research on human subjects, research on animal subjects and Good Laboratory Practice (GLP).

3. **The scientist in society**

Social responsibility, industrial science, military science, public funding of research, social, political and moral issues.

Books Recommended

1. James Rachels, "A Short Introduction to Moral Philosophy" from The Right Thing to Do by James and Stuart Rachels (McGraw Hill, 2007).

2. Professional ethics and human values by Alavudeen A, Kalil Rahman R, and Jayakumaran M. (Laxmi Publications (P) LTD. New Delhi).
3. The ethics of science an introduction by David B. Resnik (London and New York)
4. Clinical Ethics by Albert R. Jonsen, Mark Siegler and William J. Winslade (New York: McGraw -Hill, 2005) 7th Edition.
5. RR Gaur, R Sangal, GP Bagaria, 2009, A foundation course in human values and professional ethics, Excel books PVT. Ltd. New Delhi.
6. AN Tripathy, 2003. Human Values, New Age International Publishers.
7. Subhas Palekar, 2000. How to practice natural farming. Pracheen (Vaidik) krishi tantra shodh, Amravati.
8. EG Seebauer & Robert L Berry. 2000. Fundamentals of ethics for scientists & engineers. Oxford University Press.
9. Sharma, Poonam Managerial Ethics: Dilemmas and Decision Making. Sage Publications India Pvt. Ltd.: New Delhi, 2004.
10. Excellence in coaching-The Industry Guide. 2nd Edition. Edited by Jonathan Passmore.
11. Guha, Debashis. Practical and Professional Ethics Vol. - 1 Concept Publishing Company: New Delhi, 2006.
12. Guha, Debashis. Practical and Professional Ethics Vol. - 2 Concept Publishing Company: New Delhi, 2006.
13. Hongladarom, Soraj Information Technology Ethics: Cultural Perspectives Idea Group Publishing: Hershey, USA, 2007.
14. Anubhavananda, Swami Ethics in Management: Insights from Ancient Indian Wisdom Ane Books India: New Delhi, 2007.
15. Pimple, Kenneth D. Research Ethics: The International Library of Essays in Public and Professional Ethics Ashgate Publishing Co.: Hampshire, England, 2008.
16. Resnik, David B. The Ethics of Science: An Introduction Routledge: London, 1998.
17. Eleanor W. Myers. Simple truths and moral education. American University of Law Review.

NIRMA UNIVERSITY
Institute of Pharmacy
(B. Pharm)
(Semester - V)

L	T	P	C
3	1		4

Course Code	BP501T
Course Title	Medicinal Chemistry II - Theory

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.

Objective: At the end 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 Learning Outcomes (CLO):

After successful completion of the course, student will be able to -

1. Understand chemistry, biology and functions of histamine, insulin and steroids.
2. Describe chemical classification of different therapeutic classes.
3. Discuss mechanism of action, uses and adverse effects of various classes of drugs.
4. Explain structure activity relationship studies of different classes of drugs.
5. Report synthetic protocol of some drugs.

Syllabus:

Teaching hours: 45 Hours

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

UNIT I

10 Hours

Antihistaminic Agents

- Histamine, receptors and their distribution in the human body
- **Hi-antagonists** : Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamine succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenindamine tartrate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetirizine Cromolyn sodium
- **H2-antagonists**: Cimetidine*, Famotidine, Ranitidine

Gastric Proton Pump Inhibitors

- Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic Agents

- **Alkylating agents:** Meclorothamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepea
- **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 Agents

- **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, Lorcaïnide 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, Nandrolone, Progesterones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol
- **Drugs for Erectile Dysfunction:** Sildenafil, Tadalafil
- **Oral Contraceptives:** Mifepristone, Norgestrel, Levonorgestrel

- **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:** Acarbose, Voglibose

Local Anesthetics

- **SAR of Local anesthetics**
- **Benzoic Acid derivatives:** Cocaine, Hexylcaine, Mepylcaine, Cyclomethycaine, Piperocaine
- **Amino Benzoic acid derivatives:** Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate
- **Lidocaine/Anilide derivatives:** Lignocaine, Mepivacaine, Prilocaine, Etidocaine
- **Miscellaneous:** Phenacaine, Diprodon, Dibucaine.*

Tutorials

15 Hours

Tutorials will be based on above syllabus.

Suggested Readings/\: (Latest edition)

11. Wilson, C. O., Beale, J.M., & Block, J. H. *Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry*. Lippincott Williams & Wilkins.
12. Foye, W. O. *Foye's principles of medicinal chemistry*. Lippincott Williams & Wilkins.
13. Burger, A., & Abraham, D. J. *Burger's medicinal chemistry and drug discovery* (Vol. I- IV). Wiley.
14. Smith, H.J., & Williams, H. *Introduction to the principles of Drug design*. Elsevier .
15. Remington, J. P. *Remington: the science and practice of pharmacy* (Vol. 1 & 2). Lippincott Williams & Wilkins.
16. Reynolds, J.E. F., *Martindale: the extra pharmacopoeia*. Pharmaceutical Press, London.
17. Finar, I. L. *Organic Chemistry, Volume 2: Stereochemistry And The Chemistry Natural Product.*, Pearson Education India.
18. Lednicer, D. *The organic chemistry of drug synthesis* (Vol. 1-5). John Wiley & Sons.
19. Indian pharmacopoeia, Indian Pharmacopoeia! Commission.
20. Furniss, B. S. *Vogel's textbook of practical organic chemistry*. Pearson Education India.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

(B. Pharm) (Semester - V)

L	T	P	C
3	1		4

Course Code	BP502T
Course Title	Industrial Pharmacy I -Theory

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 should be able to:

1. Understand 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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the importance of preformulation factors influencing in the designing the dosage forms.
2. Describe formulation and evaluation of tablet and liquid oral formulation.
3. Discuss manufacturing and quality control of sterile products.
4. Explain formulation and development of hard gelatin capsule, soft gelatin capsule and pellets.
5. Practice solid, liquid orals and cosmetics, with its labelling and packaging.
6. Develop and evaluate formulation of cosmetic and aerosol formulation

Syllabus:**Teaching hours: 45 Hours****UNIT I****07 Hours**

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

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

Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant

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

UNIT II**10 Hours****Tablets:**

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

Equipments and tablet tooling.

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

Quality control tests: In process and finished product tests

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

UNIT-III**8 Hours****Capsules:**

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

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

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

UNIT-IV

10 Hours

Parenteral Products:

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

Production procedure, production facilities and controls, aseptic processing

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

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

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

UNIV-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.

Tutorials

Teaching Hours: 15 Hours

Tutorials will be based on above syllabus.

Suggested Readings": (Latest edition)

8. Banker, G. S. & Rhodes, C. T., *Modern pharmaceuticals*, New York: Marcel Dekkar Inc.
9. Lieberman, H.A., Lachman, L., & Schwartz, J.B. *Pharmaceutical Dosage forms - Tablets*, volume 1 to 3. New York: Marcel Dekkar Inc.
10. Lieberman, H.A, Rieger, M.M., & Banker, G.S. *Pharmaceutical dosage forms - Disperse systems*, volume 1 to 3. New York: Marcel Dekkar Inc.
11. Lieberman, H.A, Lachman, L., & Avis, K. E.. *Pharmaceutical dosage forms - Parenteral medications*, volume 1 to 3. New York: Marcel Dekkar Inc.
12. Aulton, M. E., *Pharmaceutics: The science of dosage form design*. London : Churchill livingstone,
13. Alfonso R., Gennaro, A. M., *Remington: The science and practice of pharmacy*, volume 1 & 2. New York: Lippincott Williams & Wilkins.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

(B. Pharm.)
(Semester - V)

		L	T	P	C
				4	2
Course Code	BP506P				
Course Title	Industrial Pharmacy I - Practical				

Syllabus:

Total hours: 60 Hours

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester -V)

		L	T	P	C
		3	1		4
Course Code	BP503T				
Course Title	Pharmacology II - Theory				

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.

Objective: 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 Learning Outcomes (CLO):

After successful completion of the course, student will be able to -

1. Outline the effects of drugs used in cardiovascular disorders.
2. Explain about drugs acting on blood and in renal disorders
3. Illustrate pharmacology of autacoids, drugs related to autacoids and those used for pain, gout and rheumatoid diseases
4. List detailed pharmacology of drugs useful for treatment of endocrine disorders
5. Assess potency of different drugs using different bioassay techniques.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10

Hours

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

10 Hours

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

Pharmacology of drugs acting on urinary system

- a. Diuretics
- b. Anti-diuretics.

UNIT III

10 Hours

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

08 Hours

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 Hypoglycaemic agents and glucagon.

e. ACTH and corticosteroids.

UNITV

07 Hours

Pharmacology of drugs acting on endocrine system

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

Bioassay

- a. Principles and applications of bioassay.
- b. Types of bioassay
- c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT

Recommended Books (Latest Editions)

- 1. Rang H.P., Dale M. M., Ritter J.M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
- 2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
- 3. Goodman and Oilman'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

(B. Pharm)
(Semester - V)

		LT		P	C
				4	2
Course Code	BP507P				
Course Title	Pharmacology II - Practical				

Syllabus:

Total Hours: 60 Hours

- 1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
- 2. Effect of drugs on isolated frog heart.
- 3. Effect of drugs on blood pressure and heart rate of dog.

4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of PA₂ value of prazosin using rat anococcygeus muscle (by Schild's plot method).
12. Determination of PD₂ value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-oedema 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

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm)
(Semester - V)

	L	T	P	C
	3	1		4
Course Code	BP504 T			
Course Title	Pharmacognosy and Phytochemistry II-Theory			

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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand various types of metabolic pathways of medicinal plants
2. Describe Pharmacognosy of different secondary metabolites along with its therapeutic and commercial applications
3. Discuss methods for isolation and estimation of various classes of phytoconstituents
4. Explain industrial application and utilization of phytoconstituents
5. Relate the applications of various chromatographic and spectroscopic techniques for standardization of herbal extracts/formulations
6. Develop hands on experience for isolation and estimation of some phytoconstituents

Syllabus:

Teaching hours: 45 Hours

UNIT-I

07 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, bio sources, 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: Glycyrrhetic 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

UNITV

08 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.

Recommended Books: (Latest Editions)

1. Evans, W.C. *Trease and Evans Pharmacognosy*. London, W.B. Saunders & Co.
2. Ali, M. *Pharmacognosy and phytochemistry*, CBS Publication & Distributors, New Delhi.
3. Kokate, C.K. *Text Book of Pharmacognosy*. New Delhi, Nirali Prakashan.
4. Choudhary R.D. *Herbal drug industry*, New Delhi, Eastern Publisher.
5. Ansari, S. H. *Essentials of Pharmacognosy*. New Delhi, Birla Publication.
6. Pande, H. *The Complete Technology Book on Herbal Perfumes & Cosmetics*. National Institute of Industrial Research.
7. Kalia, A. N. *Textbook of Industrial Pharmacognosy*. CBS Publishers & Distributors.
8. Endress, R., & Endress, R. *Plant Cell biotechnology*, Berlin, Springer-Verlag.
9. Remington, J. P., *pharmaceutical sciences*.
10. James Bobbers, Marilyn KS, VE Tylor. *Pharmacognosy & Pharmacobiotechnology*.
11. The formulation and preparation of cosmetic, fragrances and flavours.
12. Vyas, S. P., & Dixit, V. K. *Pharmaceutical biotechnology*. CBS Publishers & Distributors.
13. Dubey, R. C. *A textbook of Biotechnology*. S. Chand Publishing.

L= Lecture, T= Tutorial, P= Practical, C= Credit

" this is not an exhaustive list

(B. Pharm)
(Semester - V)

L	T	P	C
		4	2

Course Code	BP508 P
Course Title	Pharmacognosy and Phytochemistry II- Practicals

Syllabus:

Teaching hours: 60 Hours

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

L= Lecture, T= Tutorial, P= Practical, C= Credit

" this is not an exhaustive list

(B. Pharm.)
(Semester - V)

		L	T	P	C
		3	1		4
Course Code	BP505T				
Course Title	Pharmaceutical Jurisprudence - Theory				

Scope:

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

Objectives:

Upon completion of this course the student should 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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Explain importance of Pharmaceutical laws in India
2. Describe regulations related to import and manufacturing of drugs as per Drug & Cosmetic Act.
3. Discuss schedules, sale, labeling & packing of drugs and related regulations as per Drug & Cosmetic Act.
4. Identify functions of state and central pharmacy council
5. Discuss laws related to manufacturing of Narcotic and Alcoholic preparation
6. Understand Indian pharmaceutical Acts and Intellectual Property Rights.

Syllabus:

Teaching hours: 45 Hours

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).

UNIV-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 Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath.

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

Tutorials

Tutorials will be based on above syllabus

Teaching hours: 15 Hours

Suggested Readings": (Latest Edition)

1. Suresh, B. *Forensic Pharmacy: Pharmaceutical Jurisprudence*. Delhi, Birla Publications.
2. Mithal, B.M. *A Text book of Forensic Pharmacy*. Delhi, Vallabh Prakashan.
3. Mehra, M.L. *The Handbook of Drug Laws*. Allahbad, The University Book Agency.
4. Jain N.K. *A text book of Forensic Pharmacy*. Delhi, Vallabh Prakashan.
5. *Drugs and Cosmetics Act/Rules*. Govt. of India publications.
6. *Medicinal and Toilet preparations act 1955*. Govt. of India publications.
7. *Narcotic drugs and psychotropic substances act*. Govt. of India publications.
8. *Drugs and Magic Remedies act*. Govt. of India publications.
9. *Bare Acts of the said laws*. Government of India publications.

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^ this is not an exhaustive list

B. PHARM SEM V
COURSE NAME: PHARMACEUTICAL BIOTECHNOLOGY [2PH5 II]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand basics of gene expression process and recombinant DNA technology
- Describe mutation, its types and factors responsible for mutation
- Discuss concepts of fermentation and isolation of plasmid-DNA from culture
- Explain immunology and immunology preparations like vaccines, sera
- Identify blood and biotechnology products
- Distinguish bacteria based on various enzyme tests

Theory (Detailed Syllabus)

L P C
2 2 3

1. Immunology and immunological preparations

Basic of immunology, Study of antigens, haptens and types of antibodies, cellular & humoral immunity, antigen-antibody reactions and their applications in diagnosis, hypersensitivity & immunological tolerance.

Active and passive immunization techniques, Vaccines, their preparation, standardization and storage. Study of vaccines: diphtheria, tetanus toxoid, cholera, pertussis, plaque, BCG, rabies, polio, measles, typhoid, new generation vaccines-hepatitis, AIDS, Malaria, Diagnostic preparations, brief study of sera

2. Genetic Recombination

Introduction to Gene Expression of eucaryotics and procaryotics

Recombinant DNA Technology: Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies.

3. Fermentation

Historical development of antibiotics, methods used for their standardization, Screening of soil for organisms producing antibiotics, Isolation and preservation of pure cultures. Mutants, factors influencing rate of mutation. Fermenter, fermentation process and control of different parameters. Factors influencing fermentation process. Media, Sterilization(fermenter, media, air, etc.) Isolation of fermentation products. Detailed production of a) selected antibiotics: penicillins, erythromycin, streptomycins, tetracyclines b) vitamin B 12, Riboflavin c) others: citric acid, alcohol.

Microbial transformation and application, design of biotransformation processes and its improvements, biotransformation process with special reference to steroids

4. Biotechnological and blood products

Study of Hematopoietic growth factors, Interferon's & Interleukins, Insulin, Growth Hormones, Vaccines & Monoclonal antibody based pharmaceuticals, Recombinant coagulation factors and thrombolytic agents.

Preparation, uses and storage of whole human blood, frozen plasma, blood cells, ideal requirements of plasma substitutes like dextran and PVP.

5. Study of diagnostic aids produced by biotechnology

Total Lectures

45

Practicals

- 1 To prepare and evaluate various vaccines as per IP
- 2 To Study antigen-antibody reactions
- 3 Demonstration of fermenters and fermentation process
- 4 Isolation of antibiotic resistant bacteria and population various techniques
- 5 Isolation of plasmid DNA
- 6 To perform transformation of bacterial cells
- 7 Demonstration of genomic DNA extraction process and evaluation
- 8 To perform various enzyme based tests of bacteria for identification
- 9 To carry out alcohol fermentation by sugarcane juice

Total Hours

30

Books Recommended

1. Reed Gerald. Prescott and Dunn's Industrial Microbiology. 4th edition. Delhi: CBS Publishers & Distributors, 2004. Print
2. Vyas SP, Dixit VK. Pharmaceutical Biotechnology. Delhi: CBS Publishers & Distributors, 2003. Print
3. Klefenz Heinrich. Molecular Pharma-Biotechnology, in Industrial Pharmaceutical Biotechnology. Weinheim: Wiley-VCH Verlag GmbH, 2002. Print
4. Mansi EMT, Bryce CFA and Hartley BS. Fermentation Microbiology and Biotechnology. New York: Taylor & Francis, 2003. Print
5. Thiel Teresa. Biotechnology: DNA to Protein: a Laboratory Project in Molecular Biology. New Delhi : Tata McGraw-Hill Publishing Company Ltd., 2002. Print
6. Cronrnnelin Daan JA. Pharmaceutical Biotechnology : An Introduction for Pharmacists, and Pharmaceutical Scientists. London : Routledge, 2002. Print
7. Stanbury FP, Whitakar A, and Hall JS. Principles offermentation technology. New Delhi: Aditya books Ltd., 1997. Print
8. Chand Subhash. Fermentation Biotechnology: Industrial Perspective. New Delhi : All India Biotech Association, 2001. Print
9. Casida LEJR. Industrial Microbiology. New Delhi: New Age International Publishers, 2015. Print
10. Walsh G. Biopharmaceuticals: Biochemistry & Biotechnology. Wiley-Blackwell , 2003. Print

B. PHARM SEM V
**COURSE NAME: PHARMACEUTICAL DOSAGE FORMS-I(LIQUID,
SEMISOLID AND SOLID DOSAGE FORMS) [2PH512]**

Course Outcomes:

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

- Identify key ingredients for formulation of solid dosage forms.
- Understand manufacturing of various dosage forms in Pharmaceutical Industries.
- Demonstrates the concepts of microencapsulation and pelletization.
- Explain small scale and large scale manufacturing equipments used in Industry
- Correlate key ingredients and manufacturing of liquid and semisolid dosage forms
- Evaluate pharmacopoeia} requirements for various dosage forms

Theory (Detailed Syllabus)

LPC
3 3 5

1 Liquid dosage forms:

Types of additives, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

2 Semisolid dosage forms:

Types, mechanisms of drug penetration through skin, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, gels, manufacturing procedure, evaluation and packaging.

3 Solid Dosage Forms:

i: Tablets

Types of tablets, brief study of novel tablets, formulation of tablets with detailed study of excipients, theory of compression, process of compression, effect of friction, force - volume relationships in compression (Heckel's plot).

Tablet manufacturing techniques, machinery for small and large scale tablet manufacturing, in-process controls, processing problems, evaluation parameters and equipments.

Coating of tablets: Objectives, types of coating, film forming materials, formulation of coating solution, equipment for coating, coating process, evaluation of coated tablets, coating defects, specialized coating process.

ii: Capsules

Types of capsules, size of capsules, material for production of hard gelatin capsules, formulation of hard gelatin capsules, method of capsule filling, problems and remedies in capsule manufacturing Soft gelatin capsule: shell and capsule content, manufacturing equipments, importance of base absorption and minimum /gm factors in soft capsule Quality control, stability testing & storage of capsule dosage forms.

iii: Other Solid Dosage Forms

Brief study of effervescent powders and granules, pelletization technology and its applications.

4 Microencapsulation

Introduction, techniques of microencapsulation, characterization and applications.

Total Lectures

45

Practicals

- Preparation evaluation and packing of liquid and semisolid dosage forms like solutions, syrups, suspensions, emulsions, ointments, pastes, gels etc.
- Experiments for preparation and evaluation of pharmaceutical products like powders, capsules, tablets, and microcapsules including different types of tablets such as Soluble & Dispersible tablet, Chewable tablet, Mouth Dissolve tablets, film coated tablets etc.

Total hours

45

Books Recommended

1. Theory and Practice of Industrial Pharmacy by Lachman.
2. Remington's Pharmaceutical Sciences.
3. Pharmaceutical Dosage Forms: Tablets by Lachman and others.
4. Pharmaceutical Dosage Forms: Disperse Systems by Lieberman and others.
5. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
6. Encyclopedia of Pharmaceutical Technology, Swarbrick, James, Marcel Dekker, Inc. New York
7. Modern Pharmaceutics by Gilbert Banker & C. T. Rhodes
8. Microencapsulation by Benita.
9. Pharmaceutical Pelletization Technology by Isaac Ghebre-Sellassie Marcel Dekker, Inc., New York
10. Handbook of Pharmaceutical Granulation Technology by Dilip M. Parikh Marcel Dekker, Inc., New York
11. Aulton, Michael E., Pharmaceutics: The Science of Dosage Form Design, 2nd edition, Chrchill Livingstone, London, 2002

B. PHARM SEM V

COURSE NAME: MEDICINAL CHEMISTRY-I (DRUGS ACTING ON ANS, RESPIRATORY TRACT AND CVS) [2PH513]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand basic principles of medicinal chemistry
- Understand mechanism of action and uses of various therapeutic classes of drugs acting on acting ANS, CVS, and Respiratory Tract
- Discuss chemical classification and structure activity relationship studies
- Report synthetic protocol of some drugs
- Analyze organic binary mixtures qualitatively
- Synthesize some drug intermediates along with reaction monitoring using TLC

Theory (Detailed Syllabus)

LP C
3 3 5

- **Basic Principles of Medicinal Chemistry**
 - i) Introduction to Medicinal Chemistry and Structure Activity Relationship, History of Drug Discovery and Current Practice, Computer Aided Drug Design, Few Drug Discovery Case studies.
 - ii) **Drug metabolism:** Phase I and II Metabolic Reactions, Biological and Environmental Factors Affecting Drug Metabolism
 - iii) **Drug Receptor Interaction:** Types of Receptors, Forces Involved in Drug Receptor Interactions, Factors Affecting Drug Receptor Interactions

The following classes of drugs will be discussed in relation to Chemical classification (if any), Mechanism of action, Structure activity relationship (SAR) and Synthesis of drugs mentioned.

- **Drugs Acting on Autonomic Nervous System**
 - Cholinergics:
 - Anti - cholinergics and Anti - cholinesterases
 - Adrenergics
 - Sympatholytics
 - Neuro - muscular junction blocking agents

SAR!: Muscarinic agonist, Muscarinic antagonists, Phenylethanolamines

Synthesis: Carbachol, Bethanechol, Pralidoxime, Dicyclomine hydrochloride, Adrenaline, Isoproterenol, Clonidine, Metoprolol, Propranolol.

- **Drugs Acting on Respiratory Tract**
 - Anti - asthmatic
 - Anti - tussives, Expectorants & Mucolytic agents
 - Respiratory stimulants

SA : 2 agonists as anti-asthmatic agents

Synthesis: Salbutamol, Ambroxol, Terbutaline, Theophylline, Guifenesin, Doxapram

- **Drugs Acting on Cardio Vascular System**
 - Anti - hypertensives
 - Anti-arrhythmic agents
 - Anti-anginal agents
 - Anti-hyperlipidemic agents
 - Cardiotonics
 - Diuretics

- Anti-coagulants, thrombolytics, platelet aggregation inhibitors

SAR: Cardiac glycosides, ACE Inhibitors, Dihydropyridines, HMG CoA Reductase inhibitors, Thiazide diuretics, 5-Sulfamoyl benzoic acid derivatives

Synthesis: Atenolol, Verapamil, Captopril, Losartan, Flecainide, Nifedipine, Amlodipine, Dobutamine, Amrinone, Amiloride, Clofibrate, Atorvastatin, Ezetimibe, Chlorthiazide, Acetazolamide, Furosemide, Aspirin.

Total Lectures

45

Practicals

Practical(s) are related to theory section.

1. Organic spotting of binary mixtures of solid+ solid type along with identification of the type of mixture, micro-scale chemical separation, identification of the individual components, establishment of the identity of the separated components with the help of derivative preparation and TLC
2. Workshop on preparation of stereo models of some selected drugs.
3. Synthesis of some intermediates used in drug synthesis.

Total hours

45

Books Recommended

1. J. N. Delgado and W. A. R. Remers, Eds, Wilson and Giswold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, J. Lipponcott Co. Philadelphia.
2. W. C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia. H. E. Wolff, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York Oxford University Press, Oxford.
3. Daniel Lednicer, Strategies for Organic Drug Synthesis & Design, John Wiley & sons, USA.
4. B. N. Ladu, H. G. Mandel & E. L. Way, Fundamental of Drug Metabolism & Disposition, William & Wilkins co., Baltimore.
5. I. L. Finar, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
6. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London.
7. Mann & Saunders, Practical Organic Chemistry, Orient Longman, London.
8. Shriner, Hermann, Morrill, Curtin & Fuson, The Systematic Identification of Organic Compounds, John Wiley & Sons. USA.
9. R. M. Silverstein, G. Clayton Bassel's, T. C. Movvill, Spectroscopic identification of Organic compounds, John Wiley & Sons, USA

B. PHARM SEM V
COURSE NAME: BIOCHEMISTRY- I [2PH514]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand the general principles of biochemistry.
- Describe the structure and function of biomolecules and their roles in energy transduction.
- Discuss the basic metabolic pathways and mechanisms in biological energy transduction.
- Explain the role of major and minor minerals in the body
- Identify the enzyme catalysed reactions in the body with its kinetics.
- Evaluate the outcome of experiments that involve identification tests and separation of biomolecules and preparation of buffers.

Theory (Detailed Syllabus)

	LP	C
	2	2 3
1. Carbohydrates and its Metabolism: Introduction, nomenclature and classification, chemistry, biochemical importance of carbohydrates, carbohydrates metabolism pathway, regulation of metabolism pathways and related metabolic disorders.		
2. Proteins and its Metabolism: Introduction, classification, properties, biochemical importance and structures of proteins. Protein metabolism and errors of metabolism, Degradation of individual amino acids.		
3. Lipid and its Metabolism: Introduction, nomenclature, classification, properties and biochemical importance, pathways of lipid metabolism and regulation of these pathways, cholesterol biosynthesis, and synthesis of eicosanoids.		
4. Enzymes: Introduction, nomenclature, classification and properties of enzymes, factors affecting enzyme activity, enzyme kinetics, mechanism of enzyme action, inhibition of enzymes, isoenzymes and their clinical significance, regulation of enzymes, coenzymes and cofactors.		
5. Mineral Metabolism: Role of various minerals in the different tissues of the body.		
Total Lectures	30	

Practicals

1. Chemical tests for the identification of carbohydrates, proteins and lipids.	
2. Preparation of standard buffers and measurement of pH.	
3. Separation of amino acids by HPLC and paper chromatography.	
4. Study of factors affecting enzyme activity.	
Total hours	30

Books Recommended

1. E. E. Conn and P. K. Stumpf, Out lines of Biochemistry, John Wiley & Sons, New York.
2. A. L. Lehninger, Principles of Biochemistry, CBS Publishers and Distributors.
3. R. K. Murray, D. K. Granner, P.A. Mayes, V. W. Rodwell, Harper's Biochemistry, Prentice Hall International Inc., Latest Edition.
4. S. C. Rastogi, Biochemistry, Tata McGraw Hill, New Delhi, Latest Edition.
5. M. Cohn, K. S. Roth, Biochemistry and Disease, William and Wilkins Co., Baltimore, Latest Edition.
6. U. Satyanarayana, Biochemistry, Books and Allied (P) Ltd., Calcutta, Latest Edition.
7. G. F. Zubay, W. W. Parson, D. E. Vance, Principles of Biochemistry, WBC Publishers, England, Latest Edition.
8. S. Ramakrishnan, K. G. Prasanna, R. Rajan, Textbook of Medical Biochemistry, Orient Longman, Madras,

Latest Editon.

9. S. K. Sawhney, Randhir Singh Eds, Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
10. D. T. Plummer, An Introduction to Practical Biochemistry, Tata McGraw Hill, New Delhi.
11. J. Jayaraman, Laboratory Manual in Biochemistry, Willey, Eastern Limited, New Delhi.
12. Lehninger Principles of Biochemistry, 3rd ed London : Macmillan Press Ltd., 2000
13. Harper's Biochemistry, 25th ed New York : McGraw-Hill, Inc., 2002
14. A Text Book of Biochemistry for Medical Students, 9th ed. New Delhi : UBS Publisher's Distributors Ltd., 2003
15. Textbook of Medical Biochemis try, 5th ed. New Delhi : Jaypee Brothers Medical Publishers (P) Ltd, 2002
16. Varley's Practical Clinical Biochemistry, 6th ed. Delhi : CBS Publishers & Distributors, 2002
17. Practical Biochemistry: Principles and Techniques, 5th ed. Cambridge: Cambridge University Press, 2003
18. Biochemistry, 3rd ed. India : Pearson Education Asia Pte. Ltd., 2003
19. Theory and Problems of Biochemis try, 2nd ed. New Delhi : Tata McGraw-Hill Publishing Company Ltd., 2003
20. Biochemistry Terminology, Delhi: Lakshay Publicaton, 2003
21. Biochemistry and Molecular Biology, 2nd ed. New Delhi : Oxford University Press, 2003
22. Introductory Practical Biochemistry, New Delhi: Narosa Publishing House, 2002
23. Practicals and Viva in Medical Biochemistry, Amsterdam : Elsevier Science, 2004

B. PHARM SEM V
COURSE NAME: PATHOPHYSIOLOGY AND PHARMACOLOGY-II [2PH515]

Course Outcomes :

After successful completion of the course student will be able to :

- Understand the pathophysiology and clinical manifestations of CNS disorders.
- **Explain the detailed pharmacology of drugs in management of CNS diseases.**
- Know the pathophysiology, clinical manifestations and treatment of neurodegenerative disorders.
- **Describe the pathophysiology of endocrine disorders and detailed pharmacology of drugs used for management of diseases.**
- **Demonstrate animal models and instruments used for evaluation of various CNS disorders.**

Theory (Detailed Syllabus)

L P C
2 3 4

Central Nervous System

- **Neurohumoral transmission in the CNS**
- **Pathophysiology of neurologic and psychologic disorders**
Epilepsy, Parkinson's disease, Alzheimer's disease, migraine, Insomnia, Anxiety, Depression and Mania, Schizophrenia
- **Drugs acting on Central Nervous System**
General and Local Anaesthetics,
Sedatives, Hypnotics & Anxiolytics, Ethanol
Anti-Epileptic agents
Anti-Parkinsonian agents
Drugs used in Alzheimer's disease
Drugs used in migraine
Anti-psychotics, Anti-depressants and drugs used in mania
Opioid Analgesics
CNS and Respiratory stimulants
Drug addiction and drug abuse

2. Endocrine System

- **Pathophysiology of endocrine disorders**
Diabetes, Thyroid Disorders
- **Hormones and Hormone Antagonists**
Hypothalamic and pituitary hormones
Thyroid and anti-thyroid drugs
The Gonadal Hormones and Inhibitors
Adrenocorticosteroids and Adrenocortical Antagonists
Pancreatic Hormones and Anti-diabetic drugs
Agents that affect Bone Mineral Homeostasis

Total Lectures

30

Practicals

- 1 Evaluation of hypnotics and sedatives using mice.
- 2 Evaluation of anti-psychotic activity of Chlorpromazine using cook pole climbing apparatus in rats.
- 3 Evaluation of anti anxiety effect of various drugs by rota rod test.
- 4 Study of cataleptic activity of anti-psychotics.
- 5 Evaluation of anti-epileptics using chemically/electrically induced seizures.

- 6 Demonstration of CNS stimulant effect of caffeine on human volunteers.
- 7 Study of the effect of CNS stimulants and depressants on locomotor activity of mice using photoactometer.
- 8 Study of stereotypy behaviour using suitable animal models
- 9 Study of various anxiolytics using different models like open field arena test, light-dark model, maze apparatus etc.
- 10 Evaluation of local anaesthetic activity using various methods like surface, intra-dermal, conduction anaesthesia etc.
- 11 Evaluation of anti-ulcer agents using suitable animal model.
- 12 Study of prokinetic agents using charcoal meal test.
- 13 Study of general anaesthetics using suitable animal model.

Total hours

45

Books Recommended

- 1 Focus on Pathophysiology, Barbara A. Bullock and Reet L. Henze Lippincott Williams & Wilkins, Philadelphia.
- 2 Robbins' Pathologic Basis of Disease, Cotran R.S., Kumar V and Collins T. W.B. Saunders, Philadelphia
- 3 Pharmacotherapy : A pathophysiologic approach - Joseph T. DiPiro et. al. Appleton & Lange.
- 4 Sylvia A. Price, Lorraine M. Wilson et al. Pathophysiology: Clinical Concepts of Disease Processes. Elsevier Science Publishers.
- 5 Pathophysiology-Lippincott's Review Series Ed. Catherine Paradiso.
- 6 Goodman Gilman A., Rall T.W., Nies A.L.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics, McGraw Hill, Pergamon Press.
- 7 Rang, H.P. and Dale, M.M. Pharmacology, Publisher: Churchill Livingstone.
- 8 Katzung, B.G. Basic and Clinical Pharmacology, McGraw Hill, New York, 2001
- 9 Satoskar, R.S. and Bhandarkar, S.D. Pharmacology and Pharmacotherapeutics, Popular, Dubai
- 10 Kulkarni S.K. Handbook of experimental pharmacology, Vallabh Prakashan, New Delhi.
- 11 Goyal R.K. et al: Practical in Pharmacology, B.S. Shah Prakashan, Ahmedabad - 1.
- 12 Ghosh, M.N. Fundamentals of experimental pharmacology, Scientific Book agency, Kolkata.
- 13 H.G. Vogel et al. Drug Discovery and Evaluation. Pharmacological Assays. Springer-Verlag New-york.

B. PHARM SEM V
COURSE NAME: NATURAL PHARMACEUTICAL AGENTS [2PH516]

Course Outcomes :

After successful completion of the course student will be able to:

- Remember various natural class of excipients like polysaccharides and amino acid
Understand physico chemical properties and application of these ingredients in **pharmaceutical, cosmetic and nutraceutical products**
- Demonstrate application of plant based antioxidants as natural excipient
- Differentiate between natural and synthetic colours and their **regulatory aspects** in various categories of formulations
- Correlate the demand and supply of such ingredients and their **market potential**

Theory (Detailed Syllabus)

L P C
2 2

1. **Natural Polysaccharides derived from plants:** Introduction, classification, **applications** in **pharmaceutical, cosmeceutical** and **nutraceutical** products, chemistry, physico-chemical properties of each of the following classes:
 - A. Cellulose and its derivatives:
 - B. Gaur Gum and its derivatives
 - C. Glactomannans and other gum derivatives
 - D. Pectin
 - E. Mucilages and its derivatives
 - F. Inulin and alginate derivatives
 - G. Starch and its derivatives
 - H. Chitosan and its derivatives
 - I. Carrageenan
 - J. Miscellaneous products
2. **Natural Amino acids and protein based derivatives:** Introduction, Classification, **application** in pharmaceutical, cosmetic and nutraceutical products, chemistry, physico-chemical properties of some products with suitable example.
3. **Natural Colours:** Difference between natural and synthetic colours, **their application**, physico-chemical properties of colours.
4. **Plant based Antioxidants**
5. **Natural Ingredients sector and its market overview**

Total hours

30

Books Recommended

1. Handbook of Pharmaceutical Excipients. Ainley Wade , Pharmaceutical Society of Great Britain, American Pharmaceutical Association.
2. Pharmaceutical Excipients: Characterization by IR, Rahman , and NMR Spectroscopy David E. Bugay, W. Paul Findlay, Volume 94 of Drugs and the Pharmaceutical Sciences.
3. Natural Excipients, Nirali Prakashan, Dr. R.S. Gaud.
4. A Review & Research On Natural Excipients In Drug Delivery, Subas Chandra Dinda.

B. Pharm. Semester - V
COURSE NAME : CYBER SECURITY
(2SPPH115)

Course Outcome: (Supplementary Course)

- Remember various terminologies and concepts related to security aspects of website, credit card, Wi-fi, software, etc.
- Understand basic concepts of Networking
- Understand the importance of security related to crimes in cyber-world
- Describe the need for Security in day to day communications
- Use preventive steps to secure digital data

Theory (Detailed Syllabus)

L P C
1 -

Overview of Networking Concepts:

- Basics of Communication Systems
- Transmission Media
- Wireless Networks
- The Internet
- Software piracy
- Concepts of ethical hacking

Cyber Security and its Management

- Desktop Security
- Email security
- Web Security: web authentication
- Database Security
- Anti-virus software
- E-commerce Security
- Wi-fi security and Security of interconnection systems

Total Hours:

15

Books Recommended

1. How Personal and Internet Security Work by Preston Galla, Que Publications
2. Computer Security Concepts, Issues and Implementation by Alfred Basta and Wolf Halton, Cengage Learning
3. Hacking: The Art of Exploitation by Jon Erickson - SPD
Fundamentals of Network and Security by Eric Maiwald, TMH
4. Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives by Raghu Santanam, Sethumadhavan, Mohit Yirend ra, IGI Global
5. IT Auditing Using controls to protect Information Assets by Chris Davis, TMH

B. Pharm. Semester - V
COURSE NAME : SOCIAL EXTENSION ACTIVITY [2SPPH117]
(Supplementary Course)

Course Outcome:

After successful completion of the course student will be able to:

- Understand the community where we live in
- **Demonstrate pro-activeness** in terms of identifying and contributing to the problems of the society
- **Identify needs** of the community especially the less privileged class
- Develop sense of social responsibility and empathy
- **Set-up competence required for team work and social activity**

Tutorial (Detailed Syllabus)

L T C
1

Professionalization of Social work: Professional associations, Academic associations, Federations of social work.

Introduction of areas where social services is needed.

- o Children: Education, health awareness and basic needs
- o Women: Domestic violence and self-dependency
- o Physically challenged : Social, economical and mental support
Ideology of NGOs.

Identification of Non-government Organisation **working for noble cause** and m association with them provides services to society.

Concept of **Ethics and Values in** Social Work

Total Hours:

15

Books Recommended

1. Batra, Nitin (2004) Dynamics of Social Work in India, Raj Publishing House, Jaipur
2. Bhose, S.G.R. Joel (2003) NGOs and Rural Development, Concept Publishing Company, New Delhi
3. Dubey, M.K. (2000) Rural and Urban Development in India, Commonwealth Publishers, New Delhi
4. Prasad, B.K. (2003) Rural Development: Concept, Approach and Strategy, Sarup and Sons, New Delhi

L	T	P	C
3	1		4

Course Code	BP601T
Course Title	Medicinal Chemistry III -Theory

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, the 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 Learning Outcomes (CLO):

After successful completion of the course, student will be able to -

1. Understand basic concepts of prodrug, combinatorial chemistry and drug design
2. Describe history, chemical classification, mechanism of action, uses and degradation of different classes of chemotherapeutic agents
3. Explain stereochemistry and/or structure activity relationship studies of different classes of drugs
4. Report synthetic protocol of some drugs
5. Draw structures and reactions using software and determine physicochemical parameters of some drugs
6. Synthesize and/or analyze drugs and drug intermediates

Syllabus:**Teaching hours: 45 Hours**

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

UNIT I**Antibiotics****10 Hours**

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

- **P-Lactam antibiotics:** Penicillin, Cephalosporins, - 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

Anti-malarials

- Etiology of malaria.
- **Quinolines:** SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine
- **Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil
- **Miscellaneous:** Pyrimethamine, Artesunate, Artemether, Atovaquone

UNIT III

10 Hours

Anti-tubercular Agents

- **Synthetic anti tubercular agents:** Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid*
- **Anti-tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine, Streptomycin, 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, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir

UNIT IV

08 Hours

Antifungal Agents:

- **Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin
- **Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole, Tioconazole, 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, Oxarniquine, Praziquantel, Ivermectin

Sulphonamides and Sulfones

- **Historical development, Chemistry, Classification and SAR** of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, 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, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis
- Pharmacophore modeling and docking **techniques**

Combinatorial Chemistry:

- **Concept and applications** of Combinatorial chemistry
- Solid phase and solution phase synthesis

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus.

Suggested Readings": (Latest edition)

1. Wilson, C. O., Beale, J. M., & Block, J. H. *Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry*. Lippincott Williams & Wilkins.
2. Foye, W. O. *Foye's principles of medicinal chemistry*. Lippincott Williams & Wilkins.
3. Burger, A., & Abraham, D. J. *Burger's medicinal chemistry and drug discovery* (Vol. I-IV). Wiley.
4. Smith, H. J., & Williams, H. *Introduction to the principles of Drug design*. Elsevier.
5. Remington, J. P. *Remington: the science and practice of pharmacy* (Vol. 1 & 2). Lippincott Williams & Wilkins.
6. Reynolds, J.E. F., *Martindale: the extra pharmacopoeia*. Pharmaceutical Press, London.
7. Finar, I. L. *Organic Chemistry, Volume 2: Stereochemistry And The Chemistry Natural Product.*, Pearson Education India.
8. Lednicher, D. *The organic chemistry of drug synthesis* (Vol. 1-5). John Wiley & Sons.
9. Indian pharmacopoeia, Indian Pharmacopoeial Commission.
10. Furniss, B. S. *Vogel's textbook of practical organic chemistry*. Pearson Education India.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list

(B. Pharm)
(Semester - VI)

L	T	p	C
		4	2

Course Code	BP607P
Course Title	Medicinal Chemistry III - Practical

Syllabus:

Teaching hours: 60 Hours

IV. Preparation of drugs/ intermediates:

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

V. Assay of drugs:

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

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

VII. Drawing structures and reactions using ChemDraw®

VIII. 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 (Lipinski ROS)

(B. Pharm.)
(Semester - VI)

L	T	P	C
3	1		4

Course Code	BP602T
Course Title	Pharmacology-III - Theory

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, immunopharmacology and in addition, emphasis on the principles of toxicology and chronopharmacology.

Objectives:

Upon completion of the course the student should be able to-

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Outline the mechanism of drug action and its relevance in the treatment of respiratory system and gastrointestinal disorders.
2. Illustrate mechanism of action of various drugs with their pharmacological actions and therapeutic applications of anti-infectives and chemotherapeutic agents.
3. Relate mechanism of action, pharmacological actions and applications of immunotherapeutic agents and biosimilars.
4. Explain principles of toxicology and treatment of various poisoning
5. Discuss significance of chronopharmacology in various disease treatments.
6. Improve their skills of handling of instruments, animals and softwares for studying pharmacological effects of the drugs.

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

Pharmacology of drugs acting on Respiratory system

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

Pharmacology of drugs acting on the Gastrointestinal Tract

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

UNIT II

10 Hours

Chemotherapy

- a. General principles of chemotherapy.
- b. Sulfonamides and cotrimoxazole
- c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolide, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT III**10 Hours****Chemotherapy**

- d. Antitubercular agents
- e. Antileprotic agents
- f. Antifungal agents
- g. Antiviral drugs
- h. Anthelmintics
- i. Antimalarial drugs
- j. Antiamoebic agents

UNIT IV**08 Hours****Chemotherapy**

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

Immunopharmacology

- a. Immunostimulants
 - b. Immunosuppressant
- Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNITY**07 Hours****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, organophosphorus compound and lead, mercury and arsenic poisoning.

Chronopharmacology

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

Tutorials**Teaching hours: 15 Hours**

Tutorials will be based on above syllabus

Recommended books": (Latest Edition)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Oilman'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.

L= Lecture, T= Tutorial, P= Practical, C= Credit

A this is not an exhaustive list

(B. Pharm)
(Semester - VI)

L	T	P	C
		4	2

Course Code	BP608P
Course Title	Pharmacology III - Practical

Syllabus:

Teaching hours: 60 Hours

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) and LAL test
10. Determination of acute oral toxicity (LD50 and MTD) of a drug from a given data as per OECD guidelines.
11. Determination of acute skin irritation / corrosion of a test substance as per OECD guidelines.
12. Determination of acute eye irritation / corrosion of a test substance as per OECD guidelines.
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)
16. Demonstration of cell based efficacy and toxicity study and cell free assay.

**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, Churchill 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. proportion

(B. Pharm)
(Semester - VI)

L	T	P	C
3	1		4

Course Code	BP603T
Course Title	Herbal Drug Technology-Theory

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 the course the student shall 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 Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the processing of herbal raw materials and good agricultural practices
2. Describe the principles and applications of various complementary and alternative system of medicine
3. Discuss health benefits of nutraceuticals and herb interactions
4. Explain the use of herbal raw materials in herbal cosmetics and formulations
5. Demonstrate the scope of herbal drug industry, various regulatory guidelines for evaluation of herbal drugs & natural products
6. Formulate and analyze various Ayurvedic dosage forms, herbal cosmetics and herbal formulations

Syllabus:

Teaching hours: 45 Hours

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/Bioinsecticide s.

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, Chuma, Lehya and Bhasma.

UNIT II

07 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:

Hypericum, 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.**

Suggested Readings": (Latest Edition)

1. Evans, W.C. *Trease and Evans Pharmacognosy*. London, W.B. Saunders & Co.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E. *Pharmacognosy*. Philadelphia, Lea and Febiger.
3. Kokate, C.K. *Text Book of Pharmacognosy*. New Delhi, Nirali Prakashan.
4. Ansari, S.H. *Essentials of Pharmacognosy*. New Delhi. Birla Publications.
5. Rangari V.D. *Pharmacognosy & Phytochemistry*. Career Publications.
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*. New Delhi, Business Horizons Publishers.

L= Lecture, T= Tutorial, P= Practical, C= Credit

" this is not an exhaustive list

(B. Pharm)
(Semester - VI)

		L	T	P	C
				4	2
Course Code	BP609P				
Course Title	Herbal Drug Technology - Practical				

Syllabus:

Teaching hours: 60 Hours

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
10. To perform preliminary phytochemical screening of crude drugs.

L= Lecture, T= Tutorial, P= Practical, C= Credit

(B. Pharm.)
(Semester - VI)

L	T	P	C
3	1		4

Course Code	BP604T
Course Title	Biopharmaceutics and Pharmacokinetics - Theory

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 arising therein.

Objectives:

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

1. Understand 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 concepts of bioavailability & bioequivalence of drug products and significance.
4. Understand various pharmacokinetic parameters, their significance & applications.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the concept of ADME of drug in human body
2. Describe pharmacokinetics of drug after intravenous and oral administration
3. Explain development of BA-BE protocol for various formulation
4. Calculate pharmacokinetic parameters of drug by solving numerical
5. Determine various pharmacokinetic rate constants
6. Interpret various regulations related to BA-BE studies

Syllabus:

Teaching hours: 45 Hours

UNIT I

10 Hours

Introduction to Biopharmaceutics - Absorption: Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from non-peroral extra-vascular routes.

Introduction to Biopharmaceutics - 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

Introduction to Biopharmaceutics - 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 (IVIVC), bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT-III

10 Hours

Introduction to Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, non-compartment models, physiological models.

One compartment open model: Intravenous injection (Bolus), Intravenous infusion and extra vascular administrations. Pharmacokinetics parameters (i.e. elimination rate constant, half-life, volume of distribution, area under the curve, total clearance, and renal clearance) definitions, methods of estimations, understanding of their significance and applications.

UNIT-IV

08 Hours

Multi-compartment model: Two compartment open model for Intravenous Injection (Bolus).

Pharmacokinetics of multiple dosing: steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.

UNIV-V

07 Hours

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

Tutorials

Teaching hours: 15 Hours

Tutorials will be based on above syllabus

Suggested Readings": (Latest edition)

1. Gibaldi M. *Biopharmaceutics and Clinical Pharmacokinetics*, Pharmamed Press.
2. Notari R.F. *Biopharmaceutics and Pharmacokinetics -An Introduction*, Marcel Dekker.
3. Shargel L., *Applied Biopharmaceutics and Pharmacokinetics*. New York: Mc-Graw Hill.
4. Brahmankar M., D., Jaiswal B., S., *Biopharmaceutics and Pharmacokinetics A Treatise*, Delhi: Vallabh Prakashan.
5. Gibaldi M., Perrier D. *Pharmacokinetics*, Taylor & Francis
6. Gibaldi M., Prescott L.F. *Hand Book of Clinical Pharmacokinetics*, ADIS Health Science Press.
7. Rowland M., Tozer T.N., *Clinical Pharmacokinetics : Concepts and Applications*, Lippincott Williams & Wilkins
8. Abdou H.M. *Dissolution, Bioavailability and Bioequivalence*, Mack Publishing Company.
9. Notari R.F. *Biopharmaceutics and Clinical Pharmacokinetics-An introduction*, Marcel Dekker.
10. Remington: *The Science and Practice of Pharmacy*, Lippincott Williams and Wilkins.
11. Madan P.L. *Biopharmaceutics and Pharmacokinetics*, Jaypee Brothers Medical Publishers.
12. Venkateswarlu, V., *Biopharmaceutics and Pharmacokinetics*, India: Nirali Prakashan.
13. Jambhekar S.S., Breen P.J. *Basic Pharmacokinetics*, Pharmaceutical Press.

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^ this is not an exhaustive list

(B. Pharm) (Semester - VI)

L	T	P	C
3	1		4

Course Code	BP605T
Course Title	Pharmaceutical Biotechnology - Theory

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 this course the student should 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.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Relate microbial genetics with its applications
2. Understand importance of pharmaceutical biotechnology with its applications
3. Describe recombinant DNA technology with its applications
4. Discuss enzyme immobilization, biosensors, protein and genetic engineering
5. Explain fundamentals of immunology and preparation of immunological products
6. Recognize concepts of fermentation process, equipment and products

Syllabus:**Teaching hours: 45 Hours****UNIT I****10 Hours****Introduction to Pharmaceutical Biotechnology and its Applications:**

Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.

Enzyme Biotechnology- Methods of enzyme immobilization and applications.

Biosensors- Working and applications of biosensors in Pharmaceutical Industries.

Brief introduction to Protein Engineering.

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

Basic principles of genetic engineering

UNIT II**10 Hours****Recombinant DNA Technology and its Applications:**

Study of cloning vectors, restriction endonucleases and DNA ligase.

Recombinant DNA technology. Application of genetic engineering in medicine.

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

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

Brief introduction to PCR

UNIT III**10 Hours**

Immunology:

Types of immunity- humoral immunity, cellular immunity

Structure of Immunoglobulins

Structure and Function of MHC

Hypersensitivity reactions, Immune stimulation and Immune suppressions.

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

Storage conditions and stability of official vaccines

Hybridoma technology- Production, Purification and Applications

Blood products and Plasma Substitutes.

UNIT IV**08 Hours****Microbial Genetics and Biotransformation:**

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

Genetic organization of Eukaryotes and Prokaryotes

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

Introduction to Microbial biotransformation and applications.

Mutation: Types of mutation/mutants.

UNIT V**07 Hours****Fermentation Technology:**

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

Large scale production fermenter design and its various controls.

Study of the production of - Penicillins, Citric acid, Vitamin B12, Glutamic acid, Griseofulvin.

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

Tutorials**Teaching hours: 15 Hours**

Tutorials will be based on above syllabus

Suggested Readings/References: (Latest Edition)

1. Tortora, Gerard J; Funke, Berdell R; Case, Christine L., *Microbiology: An Introduction*, USA: Pearson Education Inc.
2. Carter, S. J., *Cooper and Gunn's Tutorial Pharmacy*, India: C. B. S. Publishers & Distributors.
3. Prescott and Dunn., *Industrial Microbiology*, India: CBS Publishers & Distributors .
4. Vyas, S. P., *Pharmaceutical Biotechnology*, India: CBS Publishers & Distributors.
5. El-Mansi, Mansi, *Fermentation Microbiology and Biotechnology*, USA: Taylor & Francis.
6. Stanbury F., P., Whitakar A., and Hall J., S., *Principles of fermentation technology*, India: Aditya books Ltd.
7. Glick B.R. and Pasternak J.J., *Molecular Biotechnology: Principles and Applications of Recombinant DNA*, USA: ASM Press.
8. Goding J.W., *Monoclonal Antibodies*, London: Academic Press Limited.
9. Walker J.M. and Rapley R., *Molecular Biology and Biotechnology*, UK: RSC Publication .

10. Zaborsky, *immobilized Enzymes*, USA: CRC Press.

11. Primrose S.B., *Molecular Biotechnology*, USA: Blackwell Scientific Publication.

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NIRMA UNIVERSITY
Institute of Pharmacy

(B. Pharm)
(Semester - VI)

L	T	P	C
3	1		4

Course Code	BP606T
Course Title	Pharmaceutical Quality Assurance - Theory

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, the student shall be able to-

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the aspects of quality assurance, total quality Management, ICH guidelines , QbD, relevant ISO and accreditation process in a pharmaceutical industry **EMP**
2. Describe the importance of organization, personnel, premises, equipment and raw material as per cGMP guideline **S**
3. Explain the quality control and GLP practices followed in Pharmaceutical Industry **S**
4. Appreciate the importance of documentation and complaint procedure **ENT**
5. Apply the principles of calibration and validation and follow good warehousing practices **ENT**

Syllabus:

Teaching hours: 45 Hours

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

Proposed

- **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

Suggested Readings/\: (Latest edition)

1. Quality Assurance Guide by Organisation of Pharmaceutical Producers of India.
2. Weinberg, S. (Ed.). Good laboratory practice regulations. CRC Press.
3. World Health Organization. Quality assurance of pharmaceuticals: A compendium of guidelines and related materials. Good manufacturing practices and inspection (Vol. 2). World Health Organization.

Proposed

4. Maitra, K. and Ghosh, S.K. A guide to total quality management. Oxford Publishing House.
5. Sharma, P. P. How to practice GMPs. Vandana publications.
6. Ghosh, S.K. Introduction to ISO 9000 and Total Quality Management. Oxford Publishing House.
7. World Health Organization.. International Pharmacopoeia. Vol. 1-4.
8. Good laboratory Practices - Marcel Dekker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

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B. PHARM SEM VI
COURSE NAME: PHARMACEUTICAL JURISPRUDENCE AND REGULATORY
GUIDELINES [2PH61 I]

Course Outcomes:

After successful completion of the course, student will be able to

- Identify functions of state and central pharmacy council
- Remember various schedules of Drug & Cosmetic Act
- Understand guidelines of various regulatory agencies
- Describe regulations related to manufacturing as per Drug & Cosmetic Act.
- Explain importance of Pharmaceutical laws in India
- Discuss laws related to manufacturing of Narcotic and Alcoholic preparation

Theory (Detailed Syllabus)

1. Introduction

Introduction to Pharmaceutical Legislation and Education

2. Pharmacy Act, 1948

Objective, definitions, constitutions and functions of state and central councils, education regulations, registration of pharmacists, renewal of license etc.

3. Code of Pharmaceutical Ethics

Principle and significance of professional ethics, Critical study of the code of pharmaceutical ethics

4. Drugs and Cosmetics Act 1940, and its Rules 1945

Importance, legal definitions, study of schedules, import, manufacture, sale, labeling & packing of drugs and cosmetics, administration of the act and rules, detailed study of Schedule Y and Schedule M, offences and penalties.

Provisions applicable to Ayurvedic, Unani, Homeopathic drugs and cosmetics.

Case studies relating to the act with its amendments.

5. Narcotic Drugs and Psychotropic Substances Act, 1985 and Rules

Objective, legal definitions, constitution and functions of narcotic & psychotropic consultative committee, national fund for controlling the drug abuse, prohibition, control & regulation, import, export and transshipments of these drugs. Powder to make search, seizure and warrant, offences and penalties, case studies.

6. Medicinal and Toilet Preparations (Excise Duties) Act, 1955 and Rules

Objective, legal definitions, licensing, manufacturing of alcoholic preparations including Ayurvedic, Homeopathic, Patent & proprietary preparation, bonded and non-bonded laboratory, warehousing, Export of alcoholic preparations offences & penalties case studies.

7. Drugs (Price Control) Order. 1995 and Pharmaceutical policy 2002

Objectives, definitions, sale price of bulk drugs and retail price of formulations. Importance & implication of this order in industry, case studies.

Pharmaceutical Policy 2002: Objective and review of the existing pharmaceutical policy, pricing policy

8. A brief overview of DCGI, FDA, WHO, ICH, EMA, COSCO and OECD regulatory guidelines.

9. Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954 & Rules

10. A brief study of Shops and Establishments Act, 1948

Total Lectures :

30

Note: The teaching of all the above acts should cover the latest amendments.

Books Recommended :

1. Malik, Vijay, Drugs and Cosmetics Act, 1940, 16th edition, Eastern Book Company, Lucknow, 2003
2. Jain, N. K., A Textbook of Forensic Pharmacy, 6th edition, Vallabh Prakashan, Delhi, 2003
3. Mithal, N. J., A textbook of Forensic Pharmacy 8th edition, Vallabh Prakashan, Delhi, 2002
4. <http://www.cdsc0.nic.in> Drug and Cosmetic Act, 1940.
5. DPCO 1995, Bare Act.

B. PHARM SEM VI
COURSE NAME : PHARMACEUTICAL DOSAGE FORMS - II (STERILE PREPARATIONS, AEROSOLS & COSMETICS) [2PH612]

Course Outcomes :

After successful completion of the course student will be able to:

- Identify critical process parameters for sterile manufacturing
- Choose ingredients for cosmetic formulation
- Understand formulation components of sterile and aerosol products
- Describe sterile manufacturing process and aerosol
- Apply knowledge of sterile and cosmetics preparation in formulation development.

Theory (Detailed Syllabus)

L P C
3 3 5

1 Sterile Preparations:

Parenteral products:

Preformulation factors, routes of administration, vehicles- aqueous, nonaqueous; pyrogenicity, Pyrogen testing, isotonicity and methods of its adjustment, Modern methods for preparing WFI Formulation details, containers and closures -types, characteristics, selection. Pre-filling treatment- washing of containers and closures, and introduction to glass, plastic and rubber as materials of containers and closures of parenteral products. preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacturing and evaluation of parenteral products. FFS technology, Aseptic techniques, sources of contamination and method of prevention, Design of aseptic area, Laminar flow benches, services and maintenance.

Ophthalmic Preparations:

Eye drops, Eye lotions, Eye ointments, Contact lens solutions etc.

2 Pharmaceutical aerosols:

Definition, propellants, general formulation, containers, Selection of components manufacturing and packaging methods, pharmaceutical applications, Evaluation of aerosols.

3 Cosmeticology and cosmetic preparations:

Fundamentals of cosmetic science, structure and functions of skin and hair, Formulation, preparation and packaging of cosmetics for skin - Sunscreen, moisturizers, cold cream, and vanishing cream, like nail polish, nail lacquers, lipsticks, anti-ageing products.

Formulation, preparation and packaging of cosmetics for hair - types of shampoo and conditioners.

Dentifrice products- powders, gels, paste.

Depilatories, Manicure preparations, eye liners and eye lashes

Total Lectures

45

Practicals

1. Preparation and evaluation of parenteral and ophthalmic products like Nutrient Replenisher, Isotonic supplements vitamin injections, injections using water miscible base, injections using oily base, eye ointment, etc.
2. Preparation of various cosmetics products for skin, hair, nail, and dentifrice.

Total Hours

45

Books Recommended

1. Theory and Practice of Industrial Pharmacy by Lachman.
2. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol- I & II, Lippincott Williams & Wilkins, New York.
3. Pharmaceutical Dosage Forms: Parenteral Medication by Lieberman and others.
4. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
5. Encyclopedia of Pharmaceutical Technology, Swarbrick, James, Marcel Dekker, Inc., New York
6. Text book of Pharmaceutics by Gilbert Banker
7. Cosmetics and Toiletries Industry by Williams and Schmitt.
8. Cosmetics by Poucher.
9. Cosmetics by Sagarin
10. Cosmetics: Formulation Manufacture and Quality Control by P.P. Sharma

B. PHARM SEM VI
COURSE NAME: MEDICINAL CHEMISTRY-II (DRUGS ACTING ON CNS, GIT AND HORMONAL DISORDERS) [2PH613]

Course Outcomes :

After successful completion of the course student will be able to:

- Remember chemical nomenclature of some important heterocycles
- Understand mechanism of action and uses of drugs acting on CNS, GIT and hormonal disorders
- Discuss chemical classification and structure activity relationship studies
- Report synthetic protocol of some drugs
- Analyze organic binary mixtures qualitatively
- Synthesize some drug intermediates along with reaction monitoring using TLC

Theory (Detailed Syllabus)

LP C
3 3 5

The following classes of drugs will be discussed in relation to Chemical classification (if any), Mechanism of action, Structure activity relationship and Synthesis of drugs mentioned.

Drugs Acting on Central Nervous System

- General and local anesthetics
- Hypnotics and sedatives
- Opioid analgesics
- Anti - convulsants
- Anti - Parkinsonism drugs
- CNS stimulants
- Neuroleptics
- Anti - depressants
- Anxiolytic

SARJ: Local Anesthetics-Benzoic acid and aniline derivatives, Barbiturates, Benzodiazepines, Morphine, Pethidine, Benzomorphan, Morphinan, Phenothiazines, Butyrophenones, Tricyclic antidepressants

Synthesis: Halothane, Thiopental Sodium, Lignocaine, Procaine, Phenobarbital, Diazepam, Alprazolam, Pethidine, Methadone, Loperamide, Carbamazepine, Phenytoin, Sodium Valproate, Nikethamine, Fluoxetine, Imipramine, Amitriptyline, Chlopromazine

Drugs Acting on Gastrointestinal Tract

- Anti - ulcerative agents
- Anti - emetics

SA : H₂ antagonists

Synthesis: Famotidine, Ranitidine, Pantoprazole, Omeprazole, Ondansetron, Metoclopramide.

Hormones

- Insulin and hypoglycemic agents
- Thyroid hormone and anti-thyroid agents
- Steroid hormones - adrenal cortex hormones and sex hormones including their synthetic analogues

analogues

SA : Sulfonyl ureas, Thyroid hormones, Nomenclature and Stereochemistry of Steroids, Glucocorticoids and Mineralocorticoids, Estrogens, Progestins, Androgens.

Synthesis: Metformine, Glipizide, Glimepiride, Methimazole, Carbimazole, Diethylstilbesterol, Clomifene, Anastrozole, Flutamide,

4. Autocoids

- Eicosanoids - Nomenclature and structural synthesis pathway

- NSAIDS
- Anti - allergic agents

SAR: H1 antagonists

Synthesis: Aspirin, Ibuprofen, Diclofenac, Indomethacin, Diphenhydramine, Cetirizine, Chlorpheniramine, Promethazine.

Total Lectures

45

Practicals

Practical(s) are related to theory section

1. **Organic spotting of binary mixtures** of liquid + solid type along with identification of the type of mixture, micro-scale chemical separation, identification of the individual components, establishment of the identity of the separated components with the help of derivative preparation and TLC.
2. **Workshop on preparation of stereo models** of some selected drugs.
3. **Synthesis of some intermediates** used in drug synthesis.

Total hours

45

Books Recommended

1. J. N. Delgado and W. A. R. Remers, Eds, Wilson and Giswold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, J. Lipponcott Co. Philadelphia.
2. W. C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia. H. E. Wolff, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York Oxford University Press, Oxford.
3. Daniel Lednicer, Strategies for Organic Drug Synthesis & Design, John Wiley & sons, USA.
4. B. N. Ladu, H. G. Mandel & E. L. Way, Fundamental of Drug Metabolism & Disposition, William & Wilkins co., Baltimore.
5. L. Finar, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
6. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London.
7. Mann & Saunder, Practical Organic Chemistry, Orient Longman, London.
8. Shriner, Hermann, Morrill, Curtin & Fuson, The Systematic Identification of Organic Compounds, John Wiley & Sons. USA.
9. R. M. Silverstein, G. Clayton Bassel's, T. C. Movvill, Spectrometric identification of Organic compounds, John Wiley & Sons, USA

B. PHARM SEM VI
COURSE NAME: BIOCHEMISTRY –II [2PH614]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand the name of vitamins and antioxidants and their role in the body.
- Describe the role of nucleic acid in the genetic makeup of the body.
- Discuss the consequences of a variety of metabolic and genetic diseases.
- Identify the biomarkers and biomaterials of various diseases and disorders.
- Report the biochemical reactions and calculate the bioenergetics of energy yielding biochemical reactions
- Analyze different biologicals and variety of food materials

Theory (Detailed Syllabus)

	L	P	C
	2	2	3
1. Nucleic Acids And Its Function: Introduction, structure and chemistry, biochemical importance, Metabolism of nucleic acids, genetic diseases associated with nucleic acids.			
2. Biological Oxidation: Electron transport chain, oxidative phosphorylation and its mechanism, electron carriers of respiratory chain, respiratory control of oxidative phosphorylation, inhibitors of oxidative phosphorylation, ATP synthesis, energy rich compounds, inborn errors of oxidative phosphorylation.			
3. Vitamins and Antioxidants: Classification, Biochemical Significance, Chemistry, Biochemical Role, Dietary Sources, Deficiency Diseases, and Antagonists (Wherever Applicable) of all the Vitamins, Biological pathways of free radicals, Method of scavenging and antioxidants.			
4. Biomarkers and Biomaterials: Introduction, classifications, biomedical importance, Tools for biomarker and biomaterials, Metabolic Profiling for biomarker and biomaterials, Biomarkers and biomaterials of various diseases.			

Total Lectures

30

Practicals

1. Study of techniques like spectrophotometry, centrifugation, electrophoresis and different types of chromatography.
2. Extraction and purification of nucleic acids.
3. Quantitative estimation of amino acids.
4. Quantitative estimation of proteins.
5. Quantitative estimation of serum glucose by various methods.
6. Quantitative estimation of serum creatinine, cholesterol, urea, etc
7. Quantitative estimation of SGOT, SGPT, BRN, etc.

Total Hours

30

Books Recommended

1. E. E. Conn and P. K. Stumpf, Out lines of Biochemistry, John Wiley & Sons, New York.
2. A. L. Lehninger, Principles of Biochemistry, CBS Publishers and Distributors.
3. R. K. Murry, D. K. Granner, P.A. Mayes, V. W. Rodwell, Harper's Biochemistry, Prentice Hall International Inc., Latest Edition.
4. S. C. Rastogi, Biochemistry, Tata McGraw Hill, New Delhi, Latest Edition.
5. M. Cohn, K. S. Roth, Biochemistry and Disease, William and Wilkins Co., Baltimore, Latest Edition.
6. U. Satyanarayana, Biochemistry, Books and Allied (P) Ltd., Calcutta, Latest Edition.

7. G. F. Zubay, W. W. Parson , D. E. Vance, Principles of Biochemistry, WBC Publishers, England, Latest Edition.
8. S. Ramakrishnan, K. G. Prasanna, R. Rajan, Textbook of Medical Biochemistry, Orient Longman, Madras, Latest Edition.
9. S. K. Sawhney, Randhir Singh Eds, Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
10. D. T. Plummer, An Introduction to Practical Biochemistry, Tata McGraw Hill, New Delhi.
11. J. Jayaraman, Laboratory Manual in Biochemistry, Wiley, Eastern Limited, New Delhi.
12. Lehninger Principles of Biochemistry, 3rd ed London: Macmillan Press Ltd., 2000
13. Harper's Biochemistry, 25th ed New York: McGraw-Hill, Inc., 2002
14. A Text Book of Biochemistry for Medical Students, 9th ed. New Delhi : UBS Publisher's Distributors Ltd., 2003
15. Textbook of Medical Biochemistry, 5th ed. New Delhi : Jaypee Brothers Medical Publishers (P) Ltd , 2002
16. Varley's Practical Clinical Biochemistry, 6th ed. Delhi : CBS Publishers & Distributors, 2002
17. Practical Biochemistry: Principles and Techniques, 5th ed. Cambridge : Cambridge University Press, 2003
18. Biochemistry, 3rd ed. India : Pearson Education Asia Pte. Ltd., 2003
19. Theory and Problems of Biochemistry, 2nd ed. New Delhi : Tata McGraw-Hill Publishing Company Ltd., 2003
20. Biochemistry Terminology, Delhi : Lakshay Publication, 2003
21. Biochemistry and Molecular Biology , 2nd ed. New Delhi : Oxford University Press, 2003
22. Introductory Practical Biochemistry, New Delhi : Narosa Publishing House, 2002
23. Practicals and Viva in Medical Biochemistry, Amsterdam : Elsevier Science, 2004.

B. PHARM SEM VI
COURSE NAME: PATHOPHYSIOLOGY AND PHARMACOLOGY-III [2PH615]

Course Outcomes :

After successful completion of the course student will be able to:

- Define basic principles of antimicrobial chemotherapy.
- Understand pathophysiology and clinical manifestations of various microbial diseases and cancer
- Discuss different types of toxicity testing
- Explain mechanism of actions of antimicrobial and anticancer agents
- Differentiate pharmacology of drugs used in infectious diseases, cancer and immunomodulation.
- Assess potency of different drugs using bioassay

Theory (Detailed Syllabus)

L P C
2 3 4

1. Methods and Measurements in Pharmacology:

Bioassay, Measurement of toxicity with special reference to discovery and development of new drugs

2. Infectious Diseases

- **Pathophysiology of Infectious diseases**
AIDS, Urinary Tract Infections (UTI), Pneumonia, Tuberculosis, Leprosy, Malaria, Dysentery: Bacterial & Amoebic Dysentery, Nosocomial Infections
- **Basic principles of chemotherapy**
- **Chemotherapy of microbial diseases**
Sulfonamides, co-trimoxazole, Quinolones
B-lactam antibiotics: Penicillins, cephalosporins and other B-lactam antibiotics
Macrolide antibiotics
Aminoglycoside antibiotics
Tetracyclines & chloramphenicol
- **Chemotherapy of tuberculosis, M. avium complex disease and leprosy**
- **Chemotherapy of parasitic infections**
Anti-malarial agents
Anthelmintic agents
Anti-protozoa} agents
- **Others:**
Anti fungal agents
Anti-viral and Anti-retroviral agents

3. Neoplasia

- Classification, difference between benign and malignant tumors, etiology and pathogenesis of important types of cancer invasions and metastasis etc.
- Chemotherapy of neoplastic diseases

4. Immunosuppressive agents, tolerogens and immuno-stimulant agents

Total Lectures

30

Practicals

- 1 Introduction to bioassay
- 2 Bioassay of agonists by graphical method using suitable isolated tissue preparation
- 3 Bioassay of agonists by matching method using suitable isolated tissue preparation
- 4 Bioassay of agonists by three point method using suitable isolated tissue preparation
- 5 Bioassay of agonists by four point method using suitable isolated tissue preparation
- 6 Bioassay of antagonists using suitable isolated tissue preparation

- 7 Study of various drugs on other Isolated Tissue preparation: fundus strip, vas deferens/uterus, anococcygeus muscle, tracheal chain, lung strip preparation, thoracic aorta
- 8 Pyrogen testing using animals
- 9 Determination of the median lethal dose (LD50) of a given drug and demonstrate the acute toxicity of the drug.
- 10 Bioassay of neuromuscular junction blockers by rabbit head drop method
- 11 Bioassay of oxytocin using suitable isolated tissue preparation

Total hours

45

Books Recommended

- Focus on Pathophysiology, Barbara A. Bullock and Reet L. Henze Lippincott Williams & wilkins, Philadelphia.
- 2 Robbin's Pathologic Basis of Disease, Cotran R.S., Kumar V and Collins T. W.B.Saunders, Philadelphia
 - 3 Phannacotherapy : A pathophysiologic approach - Joseph T. Dipiro et. al. Appleton & Lange.
 - 4 Sylvia A. Price, Lorraine M. Wilson et al. Pathophysiology: Clinical Concepts of Disease Processes. Elsevier Science Publishers.
 - 5 Pathophysiology-Lippincott's Review Series Ed.Catherine Paradiso.
 - 6 Goodman Gilman A., Rall T.W., Nies A.L.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics, Mc Graw Hill, Pergamon Press.
 - 7 Rang, H.P. and Dale, M.M. Pharmacology, Publisher : Churchil Livingstone.
 - 8 Katzung, B.G. Basic and Clinical PharmacologyMcGraw Hill, New York, 2001
 - 9 Satoskar, R.S. and Bhandarkar, S.D. Phannacology and Pharmacotherapeutics, Popular, Dubai
 - 10 Kulkarni S.K. Handbook of experimental pharmacology, Vallabh Prakashan, New Delhi.
 - 11 Goyal R.K. et al: Practical in Pharmacology, B.S.Shah Prakashan, Ahmedabad - 1.
 - 12 Ghosh, M.N. Fundamentals of experimental pharmacology, Scientific Book agency, Kolkata.
 - 13 H.G.Vogel et al. Drug Discovery and Evaluation. Pharmacological Assays. Springer-Verlag New-york.
 - 14 Immunology, immunopathology and Immunity by Stewart Sell, A.S.M. International USA, 2001
 - 15 Cellular and molecular immunology by Abbas, Abul, Saunders, Philadelphia, 2000
 - 16 CRC handbook of Toxicology by Michael Derelanko, CRC press, New York.
 - 17 Toxicology Testing Handbook: Principles, Applications and Data Interpretation by Jacobson-Kram, David, Marcel Dekker, Inc.: New York, 2001
 - 18 The Basics of Toxicity Testing by Ecobichon, Donald J., CRC Press: New York,

B. PHARM SEM VI

COURSE NAME: ELECTRO ANALYTICAL AND SEPARATION TECHNIQUES [2PH616]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand various electroanalytical techniques used in pharmaceutical analysis.
- Describe the principle, instrumentation and applications of potentiometric and conductometric methods.
- Explain the basic principle, instrumentation and applications of polarographic techniques.
- Apply the fundamentals of extraction and chromatographic separation
- Use various analytical methods for determination of optically active compounds, nitrogen content, moisture content and primary aromatic amine.
- Analyze various solutions and pharmaceutical ingredients using analytical techniques

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Introduction to Electrochemistry**
Redox reactions, Electrochemical cells, electrode potentials, calculation of potentials of electrochemical cells, experimental determination of potential of electrochemical cells, redox titration curves, potentiometric end points.
 2. **Potentiometry**
General principles, Nernst equation, reference and indicator electrodes, ion selective electrodes, liquid junction potentials, instrumentation, direct potentiometry and its variations, potentiometric titration, null point potentiometry, chronopotentiometry applications of potentiometry, potentiometric pH measurement with glass electrode.
 3. **Polarography, Stripping Voltammetry and Amperometric Techniques**
Diffusion currents, half wave potentials, characteristics of DME, quantitative analysis, modes of operation in polarography, pulse polarography, dissolved oxygen electrode, cyclic voltammetry, stripping voltammetry, amperometric titration, applications of polarography and amperometric titrations.
 4. **Conductometric Titration**
Principles, ionic conductances, conductivity cell, applications of conductometric titrations.
 5. **Solvent Extraction**
Liquid - liquid extraction, single and multiple extractions, efficiency of extraction, selectivity of extraction, extraction systems, methods of extraction, counter - current distribution, applications of solvent extraction.
 6. **Chromatographic Separations**
Description and classification, partition chromatography, adsorption chromatography, paper chromatography, thin-layer chromatography, column chromatography, band broadening and column efficiency, variables affecting column efficiency, column resolution, theories of chromatography, pharmaceutical applications.
 7. **Polarimetry**
Polarization of light, measurement of optical rotation, determination of angle of rotation, optical rotatory dispersion and circular dichroism, analytical applications.
 8. **Miscellaneous Methods**
Kjeldahl method of nitrogen estimation, Karl Fisher titration, diazotization titration
- Total Hours** 45

Practicals

1. Introduction to differential titrations such as $\text{Fe}^{2+} / \text{Fe}^{3+}$, $\text{HCO}_3^- / \text{CO}_3^{2-}$, $\text{OH}^- / \text{CO}_3^{2-}$, Winkler method, borax-boric acid, oxalic acid - sodium oxalate, Lugol's solution, magnesium-manganese

2. Potentiometric titration
3. Determination of end point of a neutralization reaction using a pH-meter
4. Conductometric titration
5. Estimations using a Polarograph
6. Identification and separation of mixtures using paper chromatographic technique
7. Identification and separation of pharmaceuticals from mixtures or dosage forms using thin layer chromatography
8. Estimation of various substances by column chromatography.
9. Miscellaneous methods like Kjeldahl nitrogen estimation and Karl-Fisher titration.

Total Hours

45

Books Recommended

1. D.A.Skoog, D.M.West, F.J.Holler, S.R.Crouch, Fundamentals of Analytical Chemistry, 8th edition, 2004, Thomson Asia Pvt. Ltd.
2. Kenneth A. Connors, A textbook of Pharmaceutical Analysis, 3rd edition, 2002, John Wiley & Sons, New York, USA.
3. F.W.Fifield, D.Kealey, Principles and Practice of Analytical Chemistry, 5th edition, 2000, Blackwell Science, Oxford, U.K.
4. Gary D. Christian, Analytical Chemistry, 6th edition, 2004, John Wiley & Sons, New York, USA.
5. R.A.Day, Jr, A L.Underwood, Quantitative Analysis, 6th edition, 2001, Prentice Hall of India.
6. Practical Pharmaceutical Chemistry Vol. - I & II - 4th Edition - 1986 - A.H.Beckett & J.B.Stenlake- CBS Publishers, New Delhi.
7. A. R. Gennaro, Remington: The Science and Practice of Pharmacy Vol. I & II - 20th Edition - 2001 - Lippincott, Williams & Wilkins, New York, USA.
8. The Indian Pharmacopoeia, Latest Edition, the Controller of Publications, Government of India, New Delhi
9. S.Ahuja, S.Scypinski, Handbook of Modern Pharmaceutical Analysis, 2001, Academic Press, New York, USA.
10. A.V.Kasture, K.R.Mahadik, S.G. Wadodkar, H.N.More, A Textbook of Pharmaceutical Analysis, Vol. I, 6th edition, 2002, Nirali Pprakashan, New Delhi.
11. D.C.Lee, M.L.Webb, Pharmaceutical Analysis, 2003, Blackwell Science, Oxford, U.K.
12. T.Higuchi, E.Brochmann-Hanssen, Pharmaceutical Analysis, 2002, CBS Publishers, New Delhi.
13. Lena Ohannesian, A.I.Streeter, Handbook of Pharmaceutical Analysis, 2002, Marcel Dekker, Inc. New York, USA.
14. P.Parimoo, Pharmaceutical Analysis, 2nd edition, 1991 CRC Press, New York.
15. The Indian Pharmacopoeia, Latest edition, the Controller of Publications, Government of India, New Delhi.
16. The British Pharmacopoeia.
17. The United State Pharmacopoeia.

B. PHARM SEM VI
COURSE NAME: INTRODUCTION TO IPR AND RESEARCH METHODS [2SPPH118]
(Supplementary Course)

Course Outcomes :

After successful completion of the course student will be able to:

- Identify standards for code of conduct and ethics in research
- Understand importance of IPR tools in pharmaceutical research
- Describe the procedure for filing patent in India and other countries
- Differentiate various patent system of WIPO, India, USA and other countries
- Recognize patents and exclusivity of innovator and generic players
- Apply knowledge of IPR tools in literature search and data mining

Theory (Detailed Syllabus)

L P C
1 -

- Introduction to Patents, Patentability Criteria
- Non-Patentable inventions in India (Section 3 of Indian Patent Act)
- A to Z of Patent document
- Filing a Patent in India and abroad
- Patent Infringement
- Overview of Indian Patent Act
- Overview of Hatch Waxman Act (Patents and Generic Players)
- Open access resources for patent searching
- Overview of the Research Methodology
- Drug Information Resources, Literature Review
- Data Presentation and Publications
- Project Design, Applications and Interpretation of Results
- Ethics in Research

Total Lectures:

15

Books Recommended

- ▶ Indian Patent Act 1970, revised on 11/03/2015
- ▶ The Patent Rules 2003, revised on 11/03/2015
- ▶ Prabuddha Ganguli, Gearing up for Patents: The Indian Scenario, University Press, 1998
- ▶ C. R. Kothari, Research Methodology: Methods and Techniques, New Age International (P) Limited, 2013
- ▶ C. Rajendra Kumar, Research Methodology, APH Publishing Corporation, 2008
- ▶ Manthan D Janodia, Basic Concepts of Intellectual Property Rights, Manipal University Press (MUP); First Edition, 2015.
- ▶ Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI Learning; 1 edition, 2014
- ▶ Feroz Ali Khader, The Law of Patents: With a special focus on Pharmaceuticals in India, Lexis Nexis India; Edition, 2011

B. PHARM SEM VII
COURSE NAME: INDUSTRIAL PHARMACY [2PH711]

Course Outcomes:

After successful completion of the course student will be able to:

- Identify factors affecting stability of drugs
- Understand validation parameters and interpret cGMP guidelines for manufacturing
- Explain concepts of QbD and PAT in pharmaceutical industry
- Apply knowledge of preformulation in various dosage forms
- Determine dissolution related parameters
- Select appropriate packaging and labelling for pharmaceuticals.

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Preformulation studies:**
 - a. Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability.
 - b. Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products.
 - c. Study of prodrugs in solving problems related to stability, bioavailability and elegance of formulations.
 2. **GMP and validation for pharmaceuticals**
 Brief introduction of cGMP and GLP. Practice of GMP and WHO guidelines, Quality Assurance and Quality Audit. Brief overview of validation and validation protocols. Validation of pharmaceutical operations involved in tablet manufacturing, Validation of sterilization processes.
 3. **Stability studies:**
 Kinetic principles and stability testing, order and reaction rate. ICH guidelines for stability testing. Accelerated stability testing procedures. Stability protocols for various pharmaceutical products.
 4. **Packaging of pharmaceutical products:**
 Packaging components: Types, specifications, and methods of evaluation. Stability aspects of packaging. Packaging equipments, legal and other official requirements for containers & package testing.
 5. **Labeling of pharmaceutical products:**
 Labeling and specific requirements of Indian and foreign agencies.
 6. **Dissolution Studies:**
 Introduction to methods, apparatus and interpretation of dissolution studies of various dosage forms. A brief study of application of statistical treatment for dissolution data.
 7. **Introduction to QbD and PAT**
 Brief overview with its significance in pharmaceutical industry
- Total Lectures 45**

Practicals

Practicals are related to preformulations studies, optimization of various excipients, stability studies of various dosage forms, validation protocols for equipment and active ingredients as mentioned under theory section

Total hours 45

Books Recommended

1. Physical Pharmacy by Alfred Martin Gennaro, Alfonso R., Remington: The Science and Practice of

- Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York
2. Pharmaceutics: The Science of Dosage from Design, Ed. by Michael E. Aulton, Churchill Livingstone, London
 3. Pharmaceutical Dosage Forms: Tablets: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York
 4. Pharmaceutical Dosage Forms: Disperse Systems - Vol.1, Vol. 2 and Vol.3, / Ed. by Herbert A. Lieberman, Martin M. Rieger and Gilbert S. Banker, Marcel Dekker Inc., New York
 5. Pharmaceutical Dosage Forms: Parenteral Medications - Vol.1, Vol. 2 and Vol.3, Ed. by Kenneth E. Avis, Herbert A. Lieberman and Leon Lachman, Marcel Dekker Inc., New York
 6. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, 4th ed., Marcel Dekker, Inc., New York

B. PHARM SEM VII
COURSE NAME : BIOPHARMACEUTICS & PHARMACOKINETICS [2PH712]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand concept of ADME of drug in human body
- Describe pharmacokinetics of drug after intravenous and oral administration
- Explain development of BA-BE protocol for various formulation
- Calculate pharmacokinetic parameters of drug by solving numerical
- Determine various pharmacokinetic rate constants by graphical method
- Interpret various regulations related to BA-BE studies

Theory (Detailed Syllabus)

L P C
2 - 2

1. **Biopharmaceutics:**
Basic concepts and study of various terminologies involved in Absorption, Distribution, Metabolism & Elimination (ADME) of drug; and various factors affecting ADME of drug in body.
 2. **Pharmacokinetics:**
Concepts of zero-order & first-order kinetics, types of various pharmacokinetic models, equation derivations and problem solving (manual & software) for determining various pharmacokinetic parameters from plasma concentration data as well as urinary excretion data for the drug following one compartmental model & multi-compartment model, non-linear pharmacokinetics, dose adjustments in hepatic & renal failure, pharmacokinetic drug interactions, multiple dosing regimen.
 3. **Bioavailability & Bioequivalence (BA-BE):**
Basic concept & terminologies involved in BA-BE studies, design of BA-BE studies for single dose, overview of regulatory guidelines, introduction to IVIVC.
- Total Lectures 30**

Books Recommended

1. Shargel L., Applied Biopharmaceutics and Pharmacokinetics and Mc-Graw Hill, New York.
2. Brahmankar M., D., Jaiswal B., S., Biopharmaceutics and Pharmacokinetics A Treatise, Vallabh Prakashan, Delhi
3. Venkateswarlu, V., Biopharmaceutics and Pharmacokinetics, Nirali Prakashan.
4. Notari, E., Robert, Biopharmaceutics and Clinical Pharmacy- An Introduction by Marcel Dekker Inc., New York.
5. Biopharmaceutics and Pharmacokinetics by P. L. Madan
6. Basic Pharmacokinetics by Sunil S. Jambhekar and Philip J. Breen
7. Khan A., Mansor, Reddy K., Indra, Pharmacokinetic and Clinical Calculation by Technomic Publishing Company Inc., Pennsylvania, USA.
8. Rowland M., Tozer N., Thomas, Clinical Pharmacokinetics- Concepts and Application by Tozer, B. I. Waverly Pvt. Ltd., New Delhi.
9. Wagner G., John, Pharmacokinetics for the pharmaceutical scientist, Technomic Publishing Company Inc., Pennsylvania, USA.
10. Kimki C., Hui, Duffull B., Stephen, Simulation for the designing clinical trials by Marcel Dekker Inc., New York.
11. Handbook of Basic Pharmacokinetics by Wolfgang A. Ritchell and Gregory L. Keams
12. Pharmacokinetics: Regulatory-Industrial-Academic Perspectives Ed by Peter G. Welling and Francis L. S. Tse
13. Pharmacokinetics in Drug Development: Regulatory and Development Paradigms. Vol. 2 Ed by Peter L. Bonate and Danny R. Howard

B. PHARM SEM VII

COURSE NAME: MEDICINAL CHEMISTRY - III (CHEMOTHERAPEUTIC AGENTS) [2PH713]

Course Outcomes:

After successful completion of the course student will be able to:

- Understand mechanism of action and uses of various chemotherapeutic agents used for the treatment of infectious diseases, cancer, AIDS etc.
- Understand drug resistance and its causes
- Discuss chemical classification and structure activity relationship studies.
- Report synthetic protocol of some drugs.
- Identify various organic binary mixtures based on solubility and chemical tests.
- Synthesize some drug intermediates through conventional and/or microwave method along with reaction monitoring using TLC.

Theory (Detailed Syllabus)

LP C
3 3 5

The following classes of drugs will be discussed in relation to Chemical classification (if any), Mechanism of action, Structure activity relationship and Synthesis of drugs mentioned.

1. Sulphonamides
2. Fluoroquinolones
3. Anti-malarials
4. Anti-mycobacterials (Anti-leprotic & Anti-tubercle agents)
5. Anti-fungal agents
6. Anti-viral drugs including Anti-HIV drugs
7. Anti-neoplastic agents
8. Anti-amoebic agents

9. Antibiotics (B-lactam, Aminoglycosides, Tetracyclines, Macrolides, Chloramphenicol)

SAR!: Su Ifonamides, Flouroquinolones, 4-amino quinolines, 8-amino quinolines, Azoles, Chemistry of 13-Iactam antibiotics: Penicillins, Cephalosporins, Carbapenems, Monobactams, 13-lactamase inhibitors, Tetracyclins, Aminoglycosides, Chloramphenicol, Macrolides, Polyene antibiotics

Synthesis: Sulfamethoxazole, Sulfasalazine, Sulfacetamide, Trimethoprim, Ofloxacin, Ciprofloxacin, Chloroquine, Mefloquine, Primaquine, Pyrimethamine, Isoniazide, Ethambutol, Pyrazinamide, Dapsone, Ketokonazole, Fluconazole, Nitrofurantoin, Amantidine, Acyclovir, Zidovudine, Cyclophosphamide, Chlorambucil, 5-fluoro uracil, Methotrexate, Carmustine, Tamoxifen, Metronidazole, Albendazole, Methicillin, Ampicillin, Amoxycillin, Oxacillin, Cefadroxil, Cefotaxime, Cefoxitin, Cefamandole, Choramphenicol.

Total Lectures

45

Practicals

1. Practical(s) are related to theory section.
2. Organic spotting of binary mixture of solid+ solid, solid+ liquid and liquid+ liquid types including eutectic mixtures along with identification of the type of mixture, micro scale chemical separation, identification of individual components with the help of derivative p_{max} and TLC.
3. Microwave assisted organic synthesis of few drugs/drug intermediate
4. Conventional synthesis of some drugs using two to three step synthesis

Total Hours

45

Books Recommended

1. J. N. Delagardo and W. A. R. Remers, Eds, Wilson and Giswold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, J. Lipponcott Co. Philadelphia .
2. W. C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.

3. H. E. Wolff, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York, Oxford University Press, Oxford.
4. Graham L. Patrick. An Introduction to Medicinal Chemistry. Fourth Edition, Oxford University Press, New Delhi, India
5. Daniel Lednicer, Strategies for Organic Drug Synthesis & Design, John Wiley & sons, USA.
6. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London
7. Mann & Saunder, Practical Organic Chemistry, Orient Longman, London.
8. V K Ahluwalia and Renu Aggarwal. Comprehensive Practical Organic Chemistry: Preparation and Quantitative analysis . University Press, Hyderabad, India

B. PHARM SEM VII
COURSE NAME: CLINICAL PHARMACY [2PH714]

Course Outcomes:

After successful completion of the course student will be able to:

- Define basic principles of specific critical care disease states, rational drug use and essential drugs
- Recognize medication charts, medication errors, prescription and patient non-compliance.
- Describe iatrogenic diseases, drug utilizations and clinical trials.
- Explain about drugs and poison information
- Express during ward rounds and counselling of patients
- Interpret clinical laboratory data and solve case studies related to the course

Theory (Detailed Syllabus)

L P T C
2 - 2 4

1. **Definition, development and scope of Clinical Pharmacy Practice**
 2. **Introduction to daily activities of a Clinical Pharmacist**
 - Medication chart review, clinical review, pharmacist interventions
 - Ward round participation
 - Taking medication histories
 - Patient counseling (to improve patient compliance on appropriate drug use)
 - Iatrogenic diseases
 - Drug utilization evaluation (DUE) and review (DUR) (Prescription Benefit management/Pharmacoeconomics)
 3. **Interpretation of clinical laboratory tests, as markers of major organ damage and their impact on drug therapy decisions**
 - Hematological, liver function, Renal function, thyroid function tests
 - Tests associated with cardiac disorders
 - Fluid and electrolyte balance
 - Pulmonary Function Tests
 4. **Drug and Poison Information**
 To gain knowledge on
 - History
 - Functions
 - Duties
 - Policies and Procedures of the drug & poison control center
 5. **Critical Care and Emergency Medicine:**
 - Basic principles of specific critical care disease states & their treatment including Total Parenteral Nutrition (i.e. managing ICUs and monitoring emergency department patients)
 6. **Concept of Essential Drugs and Rational Drug Use.**
 7. **Clinical Trials**
- Total Lectures** **30**

Tutorials

- Laboratory investigations for the diagnosis of the cardiovascular, central nervous system, gastrointestinal and hematological disorders.
- Methods for patient counseling
- Prescription audit
- Case studies pertaining to drug-drug interactions and adverse drug reactions
- Therapeutic drug monitoring in specialized populations like geriatrics, pediatrics and pregnant women, hepatic patients and renal impaired patients.

Total Tutorials

30

Books Recommended

- Clinical Pharmacy and Therapeutics - Roger Walker and Clive Edwards, Third Ed. 2003, Churchill Livingstone Publication
- 2 Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
 - 3 Clinical Pharmacology. P. N. Bennett and M. J. Brown, Churchill livingstone
 - 4 Principles of Clinical Pharmacology- Arthur J. Atkinson, Jr; Charles E. Daniels, Robert L. Dedrick, Charles V. Grudzinskas, Sanford P. Markey. Academic Press.
 - 5 Pathology and Therapeutics for Pharmacists: A basis for Clinical Pharmacy Practice Greene and Harris, Chapman and Hall publication

B. PHARM SEM VII
COURSE NAME : CHEMISTRY OF NATURAL PRODUCTS [2PH715]

Course Outcomes:

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

- Understand the chemistry, **isolation and characterization** techniques of different class of natural products
- Describe the concept, sources and **uses of various dietary supplements**
- Explain **market potential and regulatory status** of nutraceuticals
- Relate the applications of various **chromatographic and spectroscopic techniques** for standardization of herbal extracts/formulations
- **Analyze** the content of some important **secondary metabolites** from crude drugs
- **Develop hands on experience** for isolation and estimation of some phytoconstituents

Theory (Detailed Syllabus)

L PC
2 3 4

1. **Phytochemistry, Isolation and characterization techniques, therapeutic uses** of the **constituents from following classes:**
Alkaloids: Ephedrine, Reserpine, Morphine, Ergotamine, Quinine, , Camptothecin, Vincristine and Atropine
Glycosides: Diosgenin, Sennosides, Digoxin, Glycyrrhithinic acid and Ginsenoside
Flavonoids: Rutin, Quercetin.
Terpenoids: Menthol, Citral, Artemisinin, Taxol and Capsaicin
Carotenoids : Carotene
Phytosterols : Sitosterol, Guggulusterones
Lignans: Podophyllotoxin, Silymarin, SDG
2. **Nutraceuticals:**
 Classification, Phytonutrients from the class of fatty acids, organo sulphurs, polyphenolics, polysaccharides and terpenoids,
 Formulations of phytonutrients as **dietary supplements and complimentary nutraceuticals**
Regulatory guidelines
3. **Analysis of Bioactive Components of Natural Sources:**
 Phyto-chemical **standardization** of raw herbal extracts and their formulation by using various **chromatographic and spectroscopic** techniques.

Total Lectures

30

Practicals

1. Experiment on **isolation techniques** for some phyto constituents and their **estimation** in natural sources using chromatographic and other recommended methods.
2. Isolation of important phytoconstituents like caffeine, nicotine, quinine, piperine, sennosides, capsaicin, curcumin, rutin, podophyllotoxin
3. **Determination** of constituents like caffeine, quinine, sennosides and curcumin using UV spectroscopic **techniques**
4. **Determination** of phytoconstituents like phenolics and total vasaka alkaloids using titrimetry
5. **Experiment on raw material** standardization, purification of extracts with **chromatographic techniques**.

Total Hours

45

Books Recommended

1. Quality Control of Herbal Drugs: an approach to Evaluation of Botanicals; by Pulok K. Mukherjee, Business Horizons, New Delhi
2. Quality Standards of Indian Medicinal Plants; Vol. 1 ; by A.K. Gupta, Indian Council of Medical Research, New Delhi

3. Herbal Drug Technology by S.S. Agrawal and M. Paridhavi, Universities Press
4. Phytochemical Methods by J.B. Harbome, Chapman and Hall, London
5. Plant Drug Analysis: A Thin Layer Chromatography Atlas; by Hildebert Wagner and Sabine Bladt, New Delhi: Springer (India) Pvt. Ltd., 2nd ed 1996
6. Pharmacognosy, Phytochemistry of Medicinal Plants; by Jean Bruneton, Lavoisier Publishing, France, 2nd ed. 2001.
7. Chemistry of natural products a laboratory handbook: Krisnaswamy N.R. Universities press Hyderabad, 2003
8. Organic Chemistry: Finar I.L Volume 2 Stereochemistry and the chemistry of Natural Products, ELBS Publication, 5th edition 1996
9. Advances in Natural Product Chemistry: Rahman, A.U., Tyler & Francis Inc, 1998
10. Gurdeep R. Chatwal Organic chemistry of Natural Products (Vol.I), Himalaya Publishing House, 2007
11. O.P.Agarwal, Chemistry of Natural Products, Krishna Prakashan Media, 2006.
12. Chemistry of Natural Products by Sujata V. Bhat, Bhimsen Nagasampagi and Meenakshi Sivakumar; New Delhi , Narosa Publishing House, 2005.
13. Modern Methods of Plant Analysis, K. Peach (Ed), M. V. Tracey (Ed), Publisher Apringer-Verlog, 1956
14. Phannacognosy: WC.Evans, W.B. Saunders, Edinburgh, 15th Edition, 2002
15. Phannacognosy: C.K.Kokate, A.P.Purohit and S.B.Gokhale, Nirali Prakashan, Pune, 17th Edition, 2001.
16. Phannacognosy: Jean Bruneton, Intercept Ltd., Paris, 2nd Edition, 1999.

B. PHARM SEM VII
COURSE NAME: SPECTROSCOPIC METHODS OF ANALYSIS [2PH716]

Course Outcomes:

After successful completion of the course student will be able to:

- Explain the fundamentals of UV Visible spectroscopy, instrumentation and its applications
- Understand the molecular vibrations in IR spectroscopy, instrumentation and its applications
- Describe the theory, principle, instrumentation and applications of fluorescence and phosphorescence
- Discuss about ionization principle and separation of ions in mass spectrometry.
- Express the fundamentals and applications of NMR spectroscopy
- Analyse the pharmaceutical substances with different spectroscopic techniques and predict the structure with spectroscopic data

Theory (Detailed Syllabus)

L P C
3 3 5

1. **Ultraviolet/Visible Molecular Absorption Spectroscopy**
Electromagnetic radiation - its properties and absorption by molecules, factors affecting absorption of radiation by molecules, Beer's Law and its deviations, instrumentation, sample handling techniques and pharmaceutical applications.
2. **Infrared Spectrometry**
Theory of Absorption of Infrared Radiation by molecules, Infrared sources and Transducers, Instrumentation, Fourier Transform Infrared Spectroscopy, sample handling techniques and applications.
3. **Structure Elucidation of Molecules**
Prediction of the structure of molecules with the help of Ultraviolet/Visible and Infrared spectral data.
4. **Molecular Luminescence Spectrometry**
Theory of Fluorescence and Phosphorescence, Factors affecting the intensity of chemiluminescence, Instrumentation and analytical applications.
5. **Nuclear Magnetic Resonance Spectroscopy**
Magnetic properties of nuclei, Origin of NMR spectrum, Environmental effects on NMR spectra, NMR spectrometers - instrumentation and sample handling, applications of Proton NMR, Brief introduction to application of NMR to other nuclei.
6. **Molecular Mass Spectroscopy**
Origin of mass spectra, Ion sources, Mass Spectrometers - instrumentation and applications.

Total Lectures

45

Practicals

Practicals are related to theory.

1. Pharmacopoeial Standards for Tablet Dosage Form
2. Analysis of drugs in various dosage forms like tablets, capsule, ointment, syrup and injection by UV Spectrophotometer as per IP, BP, and USP.
3. Identification of pharmaceutical compounds by FT-IR Spectrophotometer.
4. Estimation of sodium and potassium ion by Flame Photometry.
5. Interpretation of structure by UV, IR, Mass and NMR

Total Hours

45

Books Recommended

1. R. M. Silverstein, G. C. Bassler and T. C. Morrill, Spectrometric Identification of Organic Compounds, John Wiley, New York.
2. Jag Mohan, Organic Spectroscopy- Principles and Applications, Narosa.
3. D. Rendell, Fluorescence and Phosphorescence AOCL, Wiley.
4. D. A. Skoog, E. J. Holler and T. A. Nieman, Principles of Instrumental Analysis.
5. G. D. Christian, Analytical Chemistry, Wiley.
6. P. S. Kalsi, Spectroscopy of Organic Compounds, New Age Publication.
7. Instrumental Methods of Chemical Analysis, BK Sharma
8. Instrumental Methods of Analysis, Willard, Merritt, Dean
9. Practical Pharmaceutical Chemistry, A.H. Beckett & J.B. Stenlake Vol I & II
10. Text book of quantitative chemical analysis by Vogel
11. Introduction to Spectroscopy by Pavia, Lampman and Kriz
12. The Indian Pharmacopoeia, The British Pharmacopoeia, The United State Pharmacopoeia.

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B.Pharm. Semester - VII

1. Formulation, Design & Development

Course Code	Course Name	Lecture	Practical	Credits
2PH701	Formulation, Design & Development	3	3	5

Theory (Detailed Syllabus)

1. **Preformulation studies:**
 - a. Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability.
 - b. Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products.
 - c. Study of prodrugs **in** solving problems related to stability, bioavailability and elegance of formulations.
2. **Introduction to validation:**

Brief overview of validation and validation protocols. Validation of pharmaceutical operations involved in tablet manufacturing, Validation of sterilization processes.
3. **Good Manufacturing Practice For Pharmaceuticals:**

Brief introduction of cGMP and GLP. Practice of GMP and WHO guidelines, Quality Assurance and Quality Audit
4. **Stability studies:**

Kinetic principles and stability testing, order and reaction rate. ICH guidelines for stability testing. Accelerated stability testing procedures. Stability protocols for various pharmaceutical products.
5. **Packaging of pharmaceutical products:**

Packaging components: Types, specifications, and methods of evaluation. Stability aspects of packaging. Packaging equipments, legal and other official requirements for containers & package testing.
6. **Labeling of pharmaceutical products:**

Labeling and specific requirements of Indian and foreign agencies.

7. **Dissolution Studies:**

Introduction to methods, apparatus and interpretation of dissolution studies of various dosage forms. A brief study of application of statistical treatment for dissolution data.

Total Lectures

45

PRACTICALS (SYLLABUS)

Practicals are related to preformulations studies , optimization of various excipients, stability studies of various dosage forms, validation protocols for equipment and active ingredients as mentioned under theory section

Total hours

45

Books Recommended

1. Physical Pharmacy by Alfred Martin
2. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York
3. Pharmaceutics: The Science of Dosage from Design, Ed. by Michael E. Aulton, Churchill Livingstone, London
4. Pharmaceutical Dosage Forms: Tablets: Vol.I, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel dekker Inc., New York
5. Pharmaceutical Dosage Forms: Disperse Systems - Vol.I, Vol. 2 and Vol.3, / Ed. by Herbert A. Lieberman, Martin M. Rieger and Gilbert S. Banker, Marcel dekker Inc., New York
6. Pharmaceutical Dosage Forms: Parenteral Medications - Vol.I, Vol. 2 and Vol.3, Ed. by Kenneth E. Avis, Herbert A. Lieberman and Leon Lachman, Marcel dekker Inc. , New York
7. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, 4th ed, Marcel Dekker, Inc., New York

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B.Pharm. Semester - VII

2. Biopharmaceutics & Pharmacokinetics

Course Code	Course Name	Lecture	Practical	Credits
2PH702	Biopharmaceutics & Pharmacokinetics	3		3

Theory (Detailed Syllabus)

1. Introduction to pharmacokinetics and Biopharmaceutics:

History and their role in formulation development & therapeutics and clinical setting.

2. Biopharmaceutics:

- a. Absorption, distribution, metabolism (biotransformation) and excretion (elimination) of drugs. Physicochemical, biological and pharmaceutical factors altering biopharmaceutical performance of drugs. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
- b. Factors influencing absorption- physiochemical, physiological and pharmaceutical. Drug distribution in the body, plasma protein binding.

3. Pharmacokinetics:

- a. Scope and significance of plasma drug concentration measurement.
- b. Compartment model: Importance & applications
- c. Pharmacokinetics of drug absorption using zero and first order models
- d. Volume of distribution and distribution coefficient.
- e. Compartment kinetics: One compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data as applied to i.v. bolus and oral administration.
- f. Curve fitting (Method of Residuals), regression procedures.
- g. Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance.
- h. Hepatic elimination of drugs, first pass effect, extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.
- i. A brief study of Non-linear pharmacokinetics: Concepts and applications

4. Clinical pharmacokinetics :

Scope, Dosage adjustment in patients with renal and hepatic failure, significance of pharmacokinetic drug interactions.

5. **Bioavailability and Bioequivalence:**
 - a. Concept and significance
 - b. Methods of determining bioavailability, C_{max}, t_{max}, AUC,
 - c. Design of single dose bio-equivalent statistics
 - d. Overview of regulatory requirement of bio-equivalence study.

Total Lectures

45

Books Recommended

1. Notari, E., Robert, Biopharmaceutics and Clinical Pharmacy- An Introduction by Marcel Dekker Inc., New York.
2. Khan A., Mansor, Reddy K., Indra, Pharmacokinetic and Clinical Calculation by Technomic Publishing Company Inc., Pennsylvania, USA.
3. Rowland M., Tozer N., Thomas, Clinical Pharmacokinetics- Concepts and Application by Tozer, B. I. Waverly Pvt. Ltd., New Delhi.
4. Shargel L., Applied Biopharmaceutics and Pharmacokinetics and Mc-Graw Hill, New York.
5. Wagner G., John, Pharmacokinetics for the pharmaceutical scientist ,Technomic Publishing Company Inc., Pennsylvania, USA .
6. Kimki C., Hui, Duffull B., Stephen, Simulation for the designing clinical trials by Marcel Dekker Inc., New York.

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B.Pharm. Semester - VII

3. Medicinal Chemistry-III (Chemotherapeutic Agents)

Course Code	Course Name	Lecture	Practical	Credits
2PH703	Medicinal Chemistry - III (Chemotherapeutic Agents)	3	3	5

Theory (Detailed Syllabus)

The following classes of drugs will be discussed in relation to:

- h) Introduction to the rational development of the drug (if any)
including the principles of isosterism
Chemical nomenclature
- j) Chemical classification
- k) Mechanism of action
- l) Synthesis of at least one agent from each chemical class
- m) Structure activity relationship
- n) Prodrug approach

- 1 Sulphonamides and fluoroquinolones
- 2 Anti-malarials
- 3 Anti-mycobacterials (Anti-leprotic & Anti-tubercle agents)
- 4 Anti-fungal agents
- 5 Anti-viral drugs including Anti-HIV drugs
- 6 Anti-neoplastic agents
- 7 Immunosuppressive agents
- 8 Anti amoebic and Anthelmentic agents
- 9 Antiseptics and Disinfectants
- 10 Antibiotics
(B-lactum, Aminoglycosides, Tetracyclines, Macrolides,
Polyene & Polypeptide antibiotics, Chloramphenicol.)

Total Lectures

45

PRACTICALS (SYLLABUS)

Practicals are related to theory section.

1. Organic spotting of binary mixture of solid + solid, solid + liquid and liquid + liquid types including eutectic mixtures along with identification of the type of mixture, micro scale chemical separation, identification of individual components with the help of derivative preparation and TLC.
2. Workshop on preparation of stereo models of some selected drugs.
3. Synthesis of some drugs using two to three step synthesis

Total hours

45

Books Recommended

1. J. N. Delagardo and W. A. R. Remers, Eds, Wilson and Giswold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, J. Lipponcott Co. Philadephia.
2. W. C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
3. H. E. Wolff, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York,
4. Oxford University Press, Oxford.
5. Daniel Lednicer, Strategies for Organic Drug Synthesis & Design, John Wiley & sons, USA.
6. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London
7. Mann & Saunder, Practical Organic Chemistry, Orient Longman, London.

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B.Pharm. Semester - VII

4. Pharmaceutical Analysis - III

Course Code	Course Name	Lecture	Practical	Credits
2PH704	Pharmaceutical Analysis - III	3	3	5

Theory (Detailed Syllabus)

- Ultraviolet/Visible Molecular Absorption Spectroscopy**
Electromagnetic radiation - its properties and absorption by molecules, factors affecting absorption of radiation by molecules, Beer's Law and its deviations, instrumentation, **sample handling techniques** and pharmaceutical applications.
- Infrared Spectrometry**
Theory of Absorption of Infrared Radiation by molecules, Infrared sources and Transducers, Instrumentation, Fourier Transform Infrared Spectroscopy, **sample handling techniques** and applications.
- Structure Elucidation of Molecules**
Prediction of the structure of molecules with the help of Ultraviolet/Visible and Infrared spectral data.
- Molecular Luminescence Spectrometry**
Theory of Fluorescence and Phosphorescence, Factors affecting the intensity of chemiluminescence, Instrumentation and **analytical applications**.
- Nuclear Magnetic Resonance Spectroscopy**
Magnetic properties of nuclei, Origin of NMR spectrum, Environmental effects on NMR spectra, NMR spectrometers - instrumentation and sample handling, applications of Proton NMR, Brief introduction to **application of NMR** to other nuclei.
- Molecular Mass Spectroscopy**
Origin of mass spectra, Ion sources, Mass Spectrometers instrumentation **and applications**.
- X - Ray Crystallography**
Introduction, X-ray absorption and X-ray diffraction methods, Instrumentation for relevant instruments.

Total Lectures

45

Practicals (Syllabus)

Practicals are related to theory section.

1. Analysis of drugs and raw materials using official pharmacopoeial methods based on modern instrumental techniques
2. Extraction techniques for the extraction of drugs from different dosage forms and their subsequent analysis

Total Hours

45

Books Recommended

1. R. M. Silverstein, G. C. Bassler and T. C. Morrill, Spectrometric Identification of Organic Compounds, John Wiley, New York.
2. Jag Mohan, Organic Spectroscopy - Principles and Applications, Narosa.
3. D. Rendell, Fluorescence and Phosphorescence AOCL, Wiley.
4. D. A. Skoog, E. J. Holler and T. A. Nieman, Principles of Instrumental Analysis, Harcourt Asia Pte Ltd.
5. G. D. Christian, Analytical Chemistry, Wiley.
6. P. S. Kalsi, Spectroscopy of Organic Compounds, New Age Publication.

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B.Pharm. Semester - VII

5. Clinical Pharmacy-I

Course Code	Course Name	Lecture	Practical	Credits
2PH705	Clinical Pharmacy-I	3		3

Theory (Detailed Syllabus)

1. Definition, development and scope of Clinical Pharmacy Practice
2. **Introduction to daily activities of a Clinical Pharmacist**
 - ▶ Drug therapy monitoring for safety and efficacy (medication chart review, clinical review, pharmacist interventions)
 - Ward round participation
 - Taking medication histories
 - Patient counseling (to improve patient compliance on appropriate drug use)
 - Adverse drug reaction management
 - Drug utilization evaluation (DUE) and review (DUR) (Prescription Benefit management)
 - Quality assurance of clinical pharmacy services
3. **Interpretation of clinical laboratory tests, as markers of major organ damage and their impact on drug therapy decisions**
 - Hematological, liver function, Renal function, thyroid function tests
 - Tests associated with cardiac disorders
 - Fluid and electrolyte balance
 - Microbiological culture sensitivity tests
 - Pulmonary Function Tests
4. **Drug and Poison Information**
 - To gain knowledge on
 - History
 - Functions
 - Duties
 - Policies and Procedures of the drug & poison control center
 - Critical evaluation of drug information and literature
 - Preparation of written and verbal reports to enhance their communication skills
 - Utilization of information resources like online journals, CD-Rom disks information systems, the internet and pharmacy bulletin boards
5. **Pharmaceutical Care:**
 - Novel drug delivery systems with specific reference to targeted and controlled delivery (their bio-pharmaceutic, pharmacokinetic and pharmacoeconomic considerations)

Nuclear pharmacy (clinical use of diagnostic and therapeutic radio pharmaceuticals, regulatory compliance etc.)

Substance Abuse (diagnosis, complications and treatment)

6. **Critical Care and Emergency Medicine:**
Basic principles of specific critical care disease states & their treatment (i.e. managing ICUs and monitoring emergency department patients)

Total Lectures

45

Books Recommended

- 1 Clinical Pharmacy and Therapeutics - Roger Walker and Clive Edwards, Third Ed. 2003, Churchill Livingstone Publication
- 2 Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
- 3 Clinical Pharmacology. P. N. Bennett and M. J. Brown, Churchill livingstone
- 4 Principles of Clinical Pharmacology- Arthur J. Atkinson, Jr; Charles E. Daniels, Robert L. Dedrick, Charles V. Grudzinskas, Sanford P. Markey. Academic Press.
- 5 Pathology and Therapeutics for Pharmacists: A basis for Clinical Pharmacy Practice Greene and Harris, Chapman and Hall publication

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B.Pharm. Semester - VII

6. Herbal Technology

Course Code	Course Name	Lecture	Practical	Credits
2PH707	Herbal Technology	3	3	5

Theory (Detailed Syllabus)

- General Introduction:**
Definition, source of herbal raw materials, identification, authentication, standardization of medicinal plants as per WHO guidelines & different herbal pharmacopoeias. Collection and processing of herbal drugs. Seasonal & geographical variations; natural & artificial drying methods. Packaging & labeling of herbal drugs prior to extraction.
 - Standardizations:**
Determination of physical and chemical constants such as extractive values, moisture content, volatile oil content, ash values, bitterness value, determination of microbial load, pesticides, heavy metals and radio active contaminants, foreign matters applicable to the various herbal drugs.
 - Nutraceuticals:** Introduction, classification and regulatory requirements
 - Analysis of Bioactive Components of Natural Sources:**
Phyto-chemical standardization of raw herbal extracts and their formulation by using TLC, HPTLC, GC, HPLC, UV & IR techniques .
 - Glycosidal Phytoconstituents:**
Chemistry, isolation, estimation and pharmaceutical importance of Diosgenin, Sennosides, Digoxin, Andrographolides, Glycyrrhithinic acid, Asiaticoside and Ginsenoside.
 - Alkaloidal Phyto-constituents:**
Chemistry, Isolation, Estimation and Importance of Ephedrine, Reserpine, Caffeine, Morphine, Papaverine, Ergotamine, Quinine, Solasodine, Camptothecin Vincristine and Vinblastine.
- Total Lectures**

45

PRACTICALS

Practicals are related to theory section.

1. Experiment on various inoculation methods over liquid and semi solid culture media.
2. Experiments on production of ethanol by yeast cells.
3. Determination of ascorbic acid (vitamin C) by UV spectroscopic method in various herbal formulations.
4. Determination of atropine in Datum species by UV Spectroscopic method.
5. Experiment on isolation of some phyto constituents and their estimation in natural sources using chromatographic and other recommended methods.
6. Experiment on raw material standardization, purification of extracts with chromatographic techniques. Preparation and standardization of single and poly herbal drug formulations.

Total Hours

45

BOOKS RECOMMENDED:

1. Herbal Drug Technology by S.S. Agrawal & M. Paridhavi
2. Modern Methods of Plant Analysis by Peach & Tracey
3. Biotechnology by S.S. Purohit
4. Quality control of herbal drugs: an approach to evaluation of botanicals by Pulok K. Mukherjee.
5. Pharmacognosy by C.K. Kokate, A.P. Purohit and S.B. Gokhale

B. PHARM. SEM. VIII
COURSE NAME : NOVEL DRUG DELIVERY SYSTEMS [2PH811]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand the concepts of modified drug delivery systems.
- Compare various approaches for development of sustained release formulations.
- Explain types of drug targeting and its applications.
- Discuss various approaches for site specific drug delivery systems.
- Analyze oral, parenteral and topical novel formulations.
- Describe various techniques for formulation development.

Theory (Detailed Syllabus)

L P C
3 3 5

1. Fundamentals of modified drug delivery systems: Fundamentals, rational of modified release drug delivery, factors influencing the design and performance, pharmacokinetic & pharmacodynamic basis for modified drug delivery systems, estimation of initial and maintenance dose.
2. Design and development of oral modified release dosage forms: Matrix & Reservoir systems, microspheres, hydrogels, ion exchange, osmotic pressure controlled, gastro retention, colon targeting.
3. Fabrication of parenteral drug delivery systems: Parenteral emulsions & parenteral suspensions, implants, microparticulates, liposomes, niosomes, nanoparticles.
4. Formulation of Transdermal drug delivery systems using various technologies. Advances in methods for permeation enhancement for TDDS.
5. A brief study of site specific and targeted drug delivery systems, Buccal, Nasal, Pulmonary & Ocular drug delivery systems

Total Lectures

45

Practicals (Syllabus)

Practicals are related to formulations and evaluation of Novel Drug Delivery Systems as below

1. Controlled release formulations like Sustained release matrix tablets, Gastroretentive drug delivery systems, Bilayer tablets, microspheres etc
2. Fast releasing formulations like films, microemulsions etc.
3. Demonstration of various techniques like fluidized bed processing, spray drying, freeze drying etc.

Total Hours

45

Books Recommended

- 1 Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York
- 2 Pharmaceutical Dosage Forms: Tablets: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York
- 3 Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker, Inc., New York
- 4 Sustained and controlled drug and delivery by Joseph R. Robinson, Marcel Dekker Inc., New York

- 5 Bioadhesive Drug Delivery Systems: Fundamentals, Novel Approaches and Development, Ed. by Edith Mathiowitz, Donald E. Chickering and Claus-Michael Lehr, Marcel Dekker Inc., New York.
- 6 Drug Delivery and Targeting for Pharmacists and Pharmaceutical Scientists, Ed by Anya M Hillery, Andrew W. Lloyd and James Swarbrick, Taylor & Francis, London.
- 7 Transdermal and Topical Drug Delivery: From Theory to Clinical Practice, By Adrian C. Williams Pharmaceutical Press,
Freeze drying - Lyophilization of pharmaceutical and biological products, by Louis Rey and Joan C. May
Informa healthcare, New York
- 8 Modified release drug delivery technology, Volume 1 & 2, by Michael J. Rathbone, Michael S. Roberts, Informa Healthcare, UK

B. PHARM. SEM. VIII
COURSE NAME: MEDICINAL CHEMISTRY - IV
(MOLECULAR MODELLING & DRUG DESIGN) [2PH812]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand principle and methodology of combinatorial chemistry
- Describe the flow of drug discovery and development process along with the challenges
- Explain the various concepts and applications of ligand based and structure based drug design techniques
- Practice the simple computational modelling tasks using different software
- Synthesize some drug intermediates along with reaction monitoring using TLC

Theory (Detailed Syllabus)

LP C
2 3 4

1. Strategies in the Search for New Lead Compounds

Introduction, improvement of existing drugs, systematic screening including extensive screening, random screening and High-throughput screening, screening of synthetic intermediates, selective optimization of side activities (SOSA) approach, new use for old drugs - An illustrative study with suitable examples.

2. Quantitative Structure Activity Relationship (QSAR)

Introduction, SAR versus QSAR, linear regression and multiple linear regression analysis, Hansch analysis, Free-Wilson analysis, Mixed Approach, Parameters used in QSAR, Experimental and theoretical approaches for the determination of physicochemical parameters, Parameter interdependence, Case Studies, Extrapolation versus interpolation, linearity versus non-linearity, the importance of biological data in correct form, 2D QSAR, 3D QSAR- examples, CoMFA and CoMSIA.

3. Introduction to Structure and Ligand Based Drug Design

Basic theory of Pharmacophore Mapping, Virtual Screening, Docking and Scoring

4. Combinatorial Chemistry

Introduction & Principle of Combinatorial Chemistry, synthetic methodologies including solid-phase synthesis (SPS) and solution phase chemistry, Library Purification Methodology

Total Lectures

30

Practicals

Practical(s) are related to theory section.

1. Drawing of the organic chemical structures and synthesis mechanisms using chemistry drawing software.
2. Calculation of physicochemical properties using various freeware.
3. Hands on training with some selected software related to the topics covered in theory.
4. Synthesis of few drug/drug intermediates using conventional/microwave mode.

Total Hours

45

Books Recommended

- 1 Graham L. Patrick. An Introduction to Medicinal Chemistry. Fourth Edition, Oxford University Press, New Delhi, India
- 2 Fundamentals of Medicinal Chemistry- Gareth Thomas, John Wiley & Sons.
- 3 A Textbook of Drug Design and Development edited by Pov! Krogasgaard.
- 4 Computer - Aided Drug Design Edited by Thomas J. Perum. C. L. Propst
- 5 Advanced Computer Assisted Techniques in Drug Discovery by Han Vande Waterbeemd .
- 6 A Guidebook on Molecular Modeling and Drug Design by Cohen

B. PHARM. SEM. VIII
COURSE NAME: PHARMACOTHERAPEUTICS [2PH813]

Course Outcomes :

After successful completion of the course student will be able to:

- Identify prevalence, etiology, clinical manifestation, diagnosis and therapeutic management of CNS, CVS and pulmonary disease.
- Explain prevalence, etiology, clinical manifestation, diagnosis and therapeutic management of, GI and endocrine disease.
- Relate the pharmacology of drugs with their use in specific conditions musculoskeletal disorders.
- Evaluate special pharmaceutical care for patients undergoing dialysis, renal transplant renal disease.
- Design the therapeutic plan for management of infectious and oncological disease..

Theory (Detailed Syllabus)

LP T C
2 - 2 4

Phannacotherapy of the following disease will be covered.

1	Cardiovascular Disorders: Hypertension, Angina Pectoris & Myocardial Infarction, Atherosclerosis Heart failure and Cardiac arrhythmias.	
2	Renal Disorders: Electrolyte and acid-base imbalance, acute renal failure, chronic renal failure, and special pharmaceutical care considerations for patients undergoing dialysis and renal transplant therapy.	
3	Nervous Systems Disorders: Epilepsy, Parkinsonism , Schizophrenia, Depression, Insomnia, Anxiety, Migraine etc.	
4	Pulmonary Disorders: Bronchial asthma, COPD	
5	Gastrointestinal Disorders: Peptic ulcer disease, Inflammatory bowel disease, Hepatitis, Cirrhosis.	
6	Endocrine Disorders: Diabetes Mellitus, Thyroid & parathyroid diseases	
7	Hematology and Oncology Disorders: Anemias, Leukemias, Hodgkin's disease and carcinomas.	
8	Musculoskeletal Disorders: Rheumatoid arthritis, Gout and hyperuricemia.	
9	Infectious Diseases: Tuberculosis, Urinary Tract Infections, Enteric infections, Upper respiratory tract infections, and AIDS.	
	Total Lectures	30

Tutorials

- Case studies for identification of disorders of cardiovascular system, gastrointestinal system, central nervous system, renal system as well as infectious diseases and cancers
 - Therapeutic managements of various disorders .
 - Parental nutrition
 - Critical care and Emergency medicines
- Total Tutorials** **30**

Books Recommended

- 1 Clinical Pharmacy and Therapeutics - Roger Walker and Clive Edwards, Churchill Livingstone Publication
- 2 Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
- 3 Clinical Pharmacology. P. N. Bennett and M. J. Brown, Churchill livingstone
- 4 Principles of Clinical Pharmacology- Arthur J. Atkinson, Jr; Charles E. Daniels, Robert L. Dedrick, Charles V. Grudzinskas, Sanford P. Markey. Academic Press.
- 5 Pathology and Therapeutics for Pharmacists: A basis for Clinical Pharmacy Practice
Greene and Harris, Chapman and Hall publication

- 6 Phannacotherapy- Joseph T Dipiro, McGraw Hill Publications.
 7 Applied therapeutics by Koda-Kimble MA, Young LY, Kradjan WA, Gugliemo BJ. Lippincott Williams & Wilkins.

B. PHARM. SEM. VIII
COURSE NAME : HERBAL FORMULATIONS AND COMPLIMENTARY THERAPEUTICS [2PH814]

Course Outcomes :

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

- Understand scope, **current status and market potential** of regulatory aspects of herbal formulations and herbal cosmetics
- Explain use of natural sources and herbs used in formulation of hair care and skin care products
- Describe sources, pharmacognosy and pharmacology of different traditional drugs
- Differentiate between principles and applications of various complementary and alternative systems of medicine
- **Formulate different ayurvedic dosage forms and herbal formulations**

Theory (Detailed Syllabus)

L P C
2 3 4

1. **The scope, historical background and present status and regulatory aspects of herbal cosmetics.**
 2. **Herbal cosmetics for skin care:**
 Anatomy and physiology of skin, Herbs used in skin care and study of their phytochemical constituents, formulation aspects of herbal extracts in various preparations like skin care creams, deodorants, antiperspirants, lotions
Herbal cosmetics for haircare: Anatomy and physiology of hair, herbs used in hair care and study their phytochemical constituents, Formulation aspects of herbal extracts in various preparations like shampoo, hair tonics, hair growth promoters
Miscellaneous herbal cosmetics
 3. **Herbal Formulations:**
 Principle, methods, single herb formulation, poly-herbal formulation & their merits and demerits. Standardization of various herbal formulations.
 4. **Complimentary and Alternative Therapeutics:**
 General aspects of complimentary and alternative system of medicines & their importance. Principles of Ayurveda and introduction to different **Ayurvedic dosage forms**. Toxicity studies of different complimentary medicine. Rules and **regulatory requirements** for the production of the complimentary medicines as per FDA.
 5. **Phytopharmacological Study of Traditional Drugs:**
 Satavari, Guduchi, Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Neem, Kali Mush, Tylophora, Rasna, Jatamansi, Nirgundi, Bhilama, Malkagni
- Total Lectures 30**

Practicals

Demonstration of various traditional dosage forms and their evaluation

Formulation & standardization of various herbal cosmetic products like cream, gel, shampoo, moisturizeriiio

Identification & authentication of traditional crude drugs using **pharmacognostic techniques**.

Physicochemical characterization in whole form, separation and identification of active principles, excipients and their **estimation** in various cosmetic preparations using different **modern techniques**.

Formulation and evaluation of important ayurvedic dosage forms like chyawanprasha and triphala and trikatu churna.

Preparation and evaluation of polyherbal formulations

Morphological and microscopical characteristics of herbs used in hair care

Total Hours

45

Books Recommended

1. Herbal cosmetics hand book, H. Panda, Asia Pacific Business Press, New Delhi, 2000
2. Cosmetics formulation, manufacturing and their quality control, P.P. Sharma, Vandana Publications, 2008
3. Edwin Jerald E, Sheeja Edwin Jerald. Text book of Phannacognosy and Phytochemistry, CBS Publisher and Distributors. 2007.
4. The Ayurvedic Encyclopedia - Natural Secretes to healing.
5. Herbs, Spices and Medicinal Plants Vol. I, II, III, IV by Kyle E. Craker & James E. Simon, 1991
6. Pharmacognosy: W C.Evans, W.B. Saunders, Edin burgh, 15th Edition, 2002
7. Pharmacognosy: C.K.Kokate, A.P.Purohit and S.B.Gokhale, Nirali Prakashan, Pune, 17th Editi on, 2001.
8. Pharmacognosy: Jean Bruneton, Intercept Ltd., Paris, 2nd Edition, 1999.
9. James A.Duke, Mary Jo BG, Judiducellier, Peggy AM K.Duke. Hand book of medicinal herbs, 2nd edition, CRC Press. 2006.
10. Ram P Rastogi, Mehrotra BN. Compendium of Indian medicinal plants, CORI, Lucknow and NISC, New Delhi, 1998.
11. Nadkami KM. Indian material medica, Vol-I, Bombay Popular Prakashan Pvt.Ltd, 1976.
12. Textbook of Industrial Pharmacy by Usha Rani Hiremath
13. Pharmacopoeal Standards of Herbs by Dr.C.R.Kamik
14. Cosmetic analysis- selective methods and techniques by P. Bore
15. Anonymous . The wealth of India- A dictionary of Indian raw materials and industrial products, First supplementary series , vol-4, J-Q, NISCAIR nad CSIR, New Delhi, 2003

B. PHARM. SEM. VIII
COURSE NAME: PHARMACEUTICAL ANALYSIS & QUALITY ASSURANCE [2PH815]

Course Outcomes :

After successful completion of the course student will be able to:

- Understand the basic concepts, instrumentation and applications of various chromatographic techniques.
- Describe the use of inert gases and its applications in gas chromatography.
- Discuss the fundamentals of HPTLC and SFC.
- Explain the basic concepts, instrumentations and applications of Atomic Absorption Atomic Emission Spectroscopy and X-Ray Crystallography.
- Apply the principles of quality management, quality control and quality assurance in pharmaceutical field.
- Analyse the pharmaceutical substances with different spectroscopic and chromatographic techniques.

Theory (Detailed Syllabus)

		L	P	C
		2	3	4
1	High Performance Liquid Chromatography Introduction, theory - migration equation, theoretical plate, measurement of column performance and its optimization, instruments for liquid chromatography including column packing for various types of chromatography, mobile phase characteristics for normal and reversed phases, polarity and selectivity of the solvents, scope and applications.			
2	Gas Chromatography Introduction, principles of Gas - Liquid Chromatography, instruments for Gas - Liquid Chromatography, columns and stationary phases, qualitative and quantitative applications to pharmaceuticals, brief introduction to hyphenated techniques like GC-MS, LC-MS, etc.			
3	Quantitative Thin - Layer Chromatography Introduction, HPTLC, Quantitation - scraping and elution, visual comparison, area management, densitometry and applications.			
4	Supercritical fluid chromatography Basic principle, Instrumentation and Applications.			
5	Atomic absorption and atomic emission spectroscopy Basic Principles, Instrumentation and applications.			
6	X - Ray Crystallography Introduction, X-ray absorption and X-ray diffraction methods, Instrumentation for relevant instruments.			
7	Quality Control And Quality Assurance Basic principles and concepts of quality management, good control laboratory practice, brief introduction to statistical procedures applied to quality assurance, Importance and application of ISO-9000 & 14000, Quality review & documentation in QC laboratory and analytical method validation (ICH Q2R1).			
	Total Lectures			30

Practicals

- Practicals are related to theory section.
1. **Pharmacopoeial Standards for Capsule Dosage Form**

2. Analysis of various dosage forms like tablet, capsule using the UV Spectrophotometer and colorimeter as per IP, BP, USP.
3. Identification of some drugs by TLC.
4. Demonstration of HPLC, HPTLC, SFC, GC.

Total hours

45

Books Recommended

- A D. A. Skoog, E. J. Holler and T. A. Nieman, Instrumental Analysis, Harcourt Asia Pte Ltd.
- A P.A. Sewell and B. Clarke, Chromatographic Separation, AOCL, Wiley.
- A S. Lindsay, High Performance Liquid Chromatography, Analytical Chemistry by Open Learning (ACOL), Wiley.
- A J. E. Willett, Gas Chromatography, Wiley.
- A Veronika Meyers, Practical High Performance Liquid Chromatography
- A Stahl E.; Thin Layer Chromatography, A Laboratory Handbook
- A High Performance Liquid Chromatography: Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi
- A High Performance Thin Layer Chromatography: Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi
- A High performance liquid chromatography: Theory, instrumentation, and pharmaceutical applications. In; Pharmaceutical analysis modern methods part B, by Munson JW.
- A Guidelines for Laboratory Quality Auditing - Donald C. Singer, Ronald P. Upton
- A Good Manufacturing Practices for Pharmaceutical : A plan for total quality control- Sidney H Willing, James R. Stoker
- A Good Laboratory Practice Regulations - Ed. by Sandy Weinberg
- A ISO 9001: 200 Document Development Compliance Manual: A Complete guide by Syed Imtiaz Haider
- A The Indian Pharmacopoeia, Latest edition, the Controller of Publications, Government of India, New Delhi.
- A The British Pharmacopoeia.
- A The United State Pharmacopoeia.

B. PHARM. SEM. VIII
COURSE NAME : FUNDAMENTALS OF BIOSTATISTICS [2PH816]

Course Outcomes :

After successful completion of the course student will be able to:

Remember various statistical formulas used for Pharmaceutical sciences

- Understand basic concepts of statistics, probability, hypothesis testing, parametric and non-parametric tests, importance of correlation, regression, ANOVA, etc.
- Apply biostatistics in formulation development, pre-clinical and clinical research, drug discovery etc.
- Analyze scientific data by using correct statistical tools and spreadsheets
- Evaluate various types of charts used for experimental data analysis
- Create various experimental design for scientific problems

Theory (Detailed Syllabus)

L P C
2 2 3

1 . Fundamentals of Permutations and Combinations

2 Basic Concepts of Statistics:

Frequency and relative frequency, Presentation of ungrouped and group data - Frequency distributions, Graphical representation of group data.

3 Measures of Central Tendencies and Dispersion:

Measures of Central Tendencies, Quartiles, Deciles and Percentiles, Measures of Dispersions, coefficient of variation and skewness, the concept of significant figures.

4 Probability:

Introduction, Classical definition of Probability, Theorems on probability, Conditional Probability and Multiplication theorem of Probability, Bayes Theorem. Study of Binomial, Poisson and Normal Distributions, Overview of Maximum Likelihood Estimation.

5 Sampling:

Population and Sample, Parameters and Statistics, Sampling methods: Simple random sampling – lottery method and Table of random number method, Systematic Sampling, Stratified Sampling, multistage sampling, Sampling distribution, standard error.

6 Hypothesis Testing - Statistical inference:

Tests of hypothesis, Some related terms and concepts, Tests of Significance for Small Samples: One sample t-test, t-test concerning difference between two means, paired sample t-test, t-test for testing the significance of Correlation coefficient, Fisher's F-test for equality of two variances, Chi-square test, Contingency table, Tests of Significance for large samples: Z-test.

7 Correlation and Regression:

Definitions, Types of Correlation, Coefficient of Correlation, Methods of Studying Correlation. Regression: Regression lines and Regression curves, methods of finding regression lines and regression curve, Examples of all methods for Correlation and regression, overview of various types of regression analysis.

8 ANOVA (Analysis of Variance):

Assumptions of ANOVA, ANOVA for one-way and two-way classification.

9 Experimental Designs in Clinical Research:

Introduction, Some basic principles of Experimental Designs and Research: Inductive and deductive reasoning, Error and bias, absence of bias and systematic errors, adequate precision, choice of patients, simplicity and symmetry, variable, measurement scales, Experimental designs, Sample and sampling, Types of distribution - Gaussian and Non-Gaussian, Parallel Designs, Cross over designs, Merits and Demerits of all methods, Carryover or residual effect.

Non - Parametric Tests: Introduction, advantages of non-parametric tests, The sign test, Wilcoxon signed rank test, Wilcoxon rank-sum test, the Kruskal - Wallis or H-test. Examples of all three non-parametric tests.

Total Lectures

30

Practicals

Practicals related to theory topics and exercises should be of pharmaceutical interest.

1. Calculations based on Mean, standard deviation, coefficient of variance, standard error of mean, t-test, chi-square test, ANOVA, regression and correlation analysis using spread sheet.
2. Plotting of various graphs for data analysis etc. using spread sheet.
3. Detailed study of data analysis tool for handling statistical data and methods for solving pharmaceutical problems using spread sheet.
4. Pharmaceutical problem solving using spread sheet.

Total hours :

30

Books Recommended

1. Applied Mathematics (Biostatistics) for Pharmacy by K.R. Kachot. 2nd Edition, 2004, Mahajan Publishing House, Ahmedabad.
2. Statistical Methods, By S. P. Gupta. 42nd Edition 2013, Sultan Chand & Sons., New Delhi .
3. Business Statistics by J.K. Shanna, 1st Edition (2004), India Pearson Education Asia Pvt. Ltd., New Delhi.
4. Elements of Probability & Statistics by Baisnab AP & M.Jas. 13th Reprint, 2006, Tata Mcgraw Hill Publishing Co., New Delhi.
5. Remedial Mathematics for Pharmacy, Second Edition by Dr. K.R. Kachot. 2nd Edition, 2009, Mahajan Publishing House, hmedabad .

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B.Pharm. Semester - VIII

1. Novel Drug Delivery Systems

Course Code	Course Name	Lecture	Practical	Credits
2PH801	Novel Drug Delivery Systems	3	3	5

Theory (Detailed Syllabus)

Sr.No.

Contents

1. Fundamentals of modified drug delivery systems: Fundamentals, rational of modified release drug delivery, factors influencing the design and performance, pharmacokinetic & pharmacodynamic basis for modified drug delivery systems, estimation of initial and maintenance dose.
2. Design and development of oral modified release dosage forms: Matrix, microspheres, hydrogels, ion exchange, osmotic pressure controlled, gastro retention, colon targeting.
3. Fabrication of parenteral drug delivery systems: Parenteral emulsions & parenteral suspensions, implants, microspheres, liposomes, niosomes
4. Formulation of Transdermal drug delivery systems using various technologies
5. A brief study of site specific and targeted drug delivery systems, transmucosal & ocular drug delivery systems

Total Lectures

45

PRACTICALS (SYLLABUS)

Practicals are related to formulations and evaluation of various Novel Drug Delivery Systems as mentioned under theory section

Total Hours

45

Books Recommended

- 1 Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York
- 2 Pharmaceutical Dosage Forms: Tablets: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York
- 3 Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker, Inc., New York
- 4 Sustained and controlled drug and delivery by Joseph R. Robinson, Marcel Dekker Inc., New York
- 5 Bioadhesive Drug Delivery Systems: Fundamentals, Novel Approaches and Development, Ed. by Edith Mathiowitz, Donald E. Chickering and Claus-Michael Lehr, Marcel Dekker Inc., New York.
- 6 Drug Delivery and Targeting for Pharmacists and Pharmaceutical Scientists, Ed by Anya M Hillery, Andrew W. Lloyd and James Swarbrick, Taylor & Francis, London.
- 7 Transdermal and Topical Drug Delivery: From Theory to Clinical Practice, By Adrian C. Williams Pharmaceutical Press,

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B.Pharm. Semester - VIII

2. Medicinal Chemistry - IV (Molecular Modelling & Drug Design)

Course Code	Course Name	Lecture	Practical	Credits
2PH802	Medicinal Chemistry - IV (Molecular Modelling & Drug Design)	3	3	5

Theory (Detailed Syllabus)

1. Strategies in the search for new lead compounds

Introduction, improvement of existing drugs, systematic screening including extensive screening, random screening and **High-throughput screening**, screening of synthetic intermediates, selective optimization of side activities (SOSA) approach, new use for old drugs - An **illustrative study with suitable examples**.

2. QSAR

Introduction, SAR versus QSAR, linear regression and multiple linear regression analysis, Hansch analysis, Free-Wilson analysis, Mixed Approach, Parameters used in QSAR, Experimental and theoretical approaches for the determination of physicochemical parameters, Parameter inter-dependence, **Case Studies**, Extrapolation versus interpolation, linearity versus non-linearity, **The importance of biological data in correct form**, 2D QSAR, 3D QSAR- examples, CoMFA and CoMSIA.

3. Introduction to structure and ligand based drug design

Pharmacophore model, Complementary-based docking, Molecular-dynamics and **Monte-Carlo based docking**, **Fragment based methods**, Build-up methodology & bridging methodologies with suitable case studies.

4. Combinatorial Chemistry

Introduction & Principle of Combinatorial Chemistry, **synthetic methodologies** including solid-phase synthesis (SPS) and solution phase chemistry, **Library Purification Methodology**.

5. Introduction to recent advances in drug design

Quantitative structure pharmacokinetic relationship (QSPR), **Bioinformatics**, **Genomic & Proteomics**

Total Lectures

45

PRACTICALS (SYLLABUS)

Practicals are related to theory section.

1. Organic spotting of binary mixture of solid + solid, solid + liquid and liquid + liquid types including eutectic mixtures along with identification of the type of mixture, micro scale chemical separation, identification of individual components with the help of derivative preparation and TLC.
2. Synthesis of some drugs using two to three step synthesis.
3. Hands on training with some selected software related to the topics covered in theory.

Total Hours

45

Books Recommended

- 1 Fundamentals of Medicinal Chemistry- Gareth Thomas, John Wiley & Sons.
- 2 A Textbook of Drug Design and Development edited by Povl Krogsgaard.
- 3 Computer - Aided Drug Design Edited by Thomas J. Perum. C. L. Propst
- 4 Advanced Computer Assisted Techniques in Drug Discovery by Han Vande Waterbeemd.
- 5 A Guidebook on Molecular Modeling and Drug Design by Cohen

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B.Pharm. Semester - VIII

3. Pharmaceutical Analysis & Quality Assurance

Course Code.	Course Name	Lecture	Practical	Credits
2PH803	Pharmaceutical Analysis & Quality Assurance	3	3	5

Theory (Detailed Syllabus)

1. Collection and Storage of Biological Samples for Analysis
Introduction, Preparation of blood samples, urine samples and fecal samples for analysis, Preparation of other specimens for analysis.
2. **High Performance Liquid Chromatography**
Introduction, theory - migration equation, theoretical plate, measurement of column performance and its optimization, instruments for liquid chromatography including column packing for various types of chromatography, mobile phase characteristics for normal and reversed phases, polarity and selectivity of the solvents, scope and applications.
3. **Gas Chromatography**
Introduction, principles of Gas - Liquid Chromatography, instruments for Gas - Liquid Chromatography, columns and stationary phases, qualitative and quantitative applications to pharmaceuticals, brief introduction to hyphenated techniques like GC-MS, LC-MS, etc.
4. **Quantitative Thin - Layer Chromatography**
Introduction, HPTLC, Quantitation - scraping and elution, visual comparison, area management, densitometry and thermal methods, applications.
5. Quality Control And Quality Assurance
Basic principles and concepts of quality management, good control laboratory practice, brief introduction to statistical procedures applied to quality assurance, Importance and application of ISO-9000 & 14000, Quality review & documentation in QC laboratory and analytical method validation.

Total Lectures

45

Practicals (Syllabus)

- Practicals are related to theory section.
1. **Complete analysis of various dosage forms using the modern analytical techniques.**
 2. Raw material analysis following the various **pharmacopoeial monographs**

Total Hours

45

Books Recommended

1. D. A. Skoog, E. J. Holler and T. A. Nieman, Principles of Instrumental Analysis, Harcourt Asia Pte Ltd.
2. P. A. Sewell and B. Clarke, Chromatographic Separation, AOCL, Wiley.
3. S. Lindsay, High Performance Liquid Chromatography, Analytical Chemistry by Open Learning (ACOL), Wiley.
4. J. E. Willett, Gas Chromatography, Wiley.
5. Veronika Meyers, Practical High Performance Liquid Chromatography

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B.Pharm. Semester - VIII

4. Clinical Pharmacy-II

Course Code	Course Name	Lecture	Practical	Credits
2PH804	Clinical Pharmacy-II	3		3

Theory (Detailed Syllabus)

Pharmacotherapeutics, complications, treatment and prognosis of the following diseases. At the conclusion of the course, students should be able to explain the rationale for use of specific drug categories in the treatment of below mentioned disorders. In addition, the course content will also emphasize on drug structure activity relationships, mechanisms of drug action, drug mechanisms related to the occurrence of adverse effects, recognition and management of medication related problems; and decision making processes including utilization of laboratory tests to monitor drug efficacy and toxicity. Case studies should be used to assist students in monitoring a pharmaceutical care plan for the patient.

This Pharmacotherapy course will cover the following diseases:

1. Cardiovascular Disorders:
Hypertension, Angina Pectoris & Myocardial Infarction, Congestive Heart failure, Cardiac arrhythmias and atherosclerosis.
2. Renal and Urologic Disorders:
Renal and Urological diseases, electrolyte abnormalities, acid-base disorders, acute renal failure, chronic renal failure, and special pharmaceutical care considerations for patients undergoing dialysis and renal transplant therapy.
3. Nervous Systems Disorders:
Epilepsy, Parkinsonism, Schizophrenia, Depression, Insomnia, Anxiety, Migraine etc.
4. Pulmonary Disorders:
Bronchial asthma.
5. Gastrointestinal Disorders:
Peptic ulcer disease, Chronic inflammatory Bowel disease, Hepatitis, Cirrhosis.
6. Endocrine Disorders:
Diabetes Mellitus, Thyroid & parathyroid diseases
7. Hematology and Oncology Disorders:
Anemias, Leukemias, Hodgkin's disease and carcinomas.
8. Musculoskeletal Disorders:

- Rheumatoid arthritis, Gout and hyperuricemia.
9. Infectious Diseases:
Tuberculosis, Urinary Tract Infections, Enteric infections, upper respiratory tract infections, sexually transmitted diseases and AIDs.

Total Lectures

45

Books Recommended

1. Clinical Pharmacy and Therapeutics - Roger Walker and Clive Edwards, Churchill Livingstone Publication
2. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
3. Clinical Pharmacology. P. N. Bennett and M. J. Brown, Churchill livingstone
4. Principles of Clinical Pharmacology- Arthur J. Atkinson, Jr; Charles E. Daniels, Robert L. Dedrick, Charles V. Grudzinskas, Sanford P. Markey. Academic Press.
5. Pathology and Therapeutics for Pharmacists: A basis for Clinical Pharmacy Practice Greene and Harris, Chapman and Hall publication

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B.Pharm. Semester - VIII

5. Herbal Formulations & Complimentary Therapeutics

Course Code	Course Name	Lecture	Practical	Credits
2PH808	Herbal Formulations & Complimentary Therapeutics	3	3	5

Theory (Detailed Syllabus)

- Herbal Cosmetics:**
The scope, historical background and present status of herbal cosmetics. The sources and description of raw materials of herbal origin like fixed oils, waxes, gums, hydrophilic colloids, colours, perfumes, protective agents, bleaching agents, preservatives, antioxidants and other ancillary agents used in the cosmetic formulations.
- Herbal Cosmetic Preparations:**
Formulation aspects of herbal extracts in various preparations like skin care creams, deodorants, antiperspirants, hair preparations, lotions, nail polishes, lipsticks and toiletries etc. and their analysis.
- Herbal Formulations:**
Principle, methods, single herb formulation, poly-herbal formulation & their merits and demerits. Standardization of various herbal formulations.
- Complimentary Therapeutics:**
General aspects of complimentary medicines & their importance.
Principles of Siddha, Ayurveda, Homeopathy, Unani & Naturopathy systems of medicine.
Introduction for different Ayurvedic dosage forms.
Toxicity studies of different complimentary medicine.
Rules and regulatory requirements for the production of the complimentary medicines as per FDA.
- Phytopharmacological Study of Traditional Drugs:**
Amala, Kantakari, Satavari, Guduchi, Punamava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Guggul, Shilajit, Brahmi, Neem, Kali Musli, Tylophora, Rasna, Arjuna, Jatamansi, Chirata, Nirgundi, Bavchi

Total Lectures

45

PRACTICALS

Sr.No.	Contents	
1.	Demonstration of various traditional dosage forms	
2.	Formulation & standardization of various herbal cosmetic products, physicochemical characterization in whole form, separation and identification of active principles, excipients and their estimation in various cosmetic preparations using different modern techniques.	
3.	Identification & authentication of traditional crude drugs & their formulations.	
4.	Finger printing techniques for various traditional drug extracts.	
	Total Hours	45

BOOKS RECOMMENDED

1. Herbal cosmetics, hand book by H. Panda
2. Cosmetic analysis- selective methods and techniques by P. Bore
3. Cosmetics formulation, manufacturing and their quality control by P.P. Sharma
4. Textbook of Pharmacognosy and Phytochemistry by Edwin Jarald and Sheeja Jarald
5. Textbook of Industrial Pharmacy by Usha Rani Hiremath

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B.Pharm. Semester - VIII

6. Pharmaceutical Economics & Industrial Management

Course Code	Course Name	Lecture	Practical	Credits
2PH806	Phannaceutical Economics & Industrial Management	3		3

Theory (Detailed Syllabus)

1. **Concept of Management:**
Administrative Management (Planning, Organizing, Staffing, Directing and Controlling) entrepreneurship development, Operative Management (Personnel, Materials Production, Financial Marketing, Time/Space Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, Leadership, Innovation, Creativity, Delegation of Authority / Responsibility Record Keeping). Identification of key points to give maximum thrust for development and perfection, Total Quality Management (TQM).
2. **Accountancy**
Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, Profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes and hundies documentary bills.
3. **Economics:**
Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.
4. **Pharmaceutical Marketing:**
Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.
5. **Salesmanship:**
Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing.
6. **Market Research:**
Recruitment, training evaluation, compensation to the pharmacist pre-requisition: Basic information services
7. **Materials Management:**
A brief exposure of the basic principles of Materials, Management, Purchase,

stores and inventory control (Eligibility, Efficiency, Evaluation, Recruitment Methodology, Service Conditions, Termination, Performance Evaluation, etc.).

8. **Production Management:**

A brief exposure of the different aspects of Production Management, Visible and Invisible inputs, Methodology of Activities, Performance Evaluation Technique, Process-Flow, Process know-how, Maintenance Management.

Total Lectures

45

Books Recommended

1. J. A. Stoner, R.E. Freeman & D. R. Gilbert, 'Management' Prentice Hall, New Delhi, Latest edition.
2. P. Kotler, "Marketing Management analysis, planning, implementation & control, Prentice hall. Delhi, Latest edition.
3. H. A. Smith, Principles and Method of Phannacy Management, Lea & Febiger, Philadelphia, Latest edition.
4. P. Gopalkrishan and M. Sundaresan Material management: An integrated approach Prentice hall, New Delhi.
5. C. B Mannoria, Personal management, Himalaya publishing house Bombay, Latest edition.
6. L. Lachman, H. A. Liberman and J. L. Kanic, Theory & practice of Industrial Pharmacy", Lea & Febiger, U.S.A., Latest edition.
7. P. Kotler, Principles of marketing, Prentice Hall, New Delhi, Latest Edition.

B. PHARM. SEM. VIII
COURSE NAME : PROJECT WORK (2PH817)

Course Outcomes:

After successful completion of the course student will be able to:

1. Identify the need/problem related to project work
2. Review the available literature related to project topic
3. Apply and plan various methodologies to achieve the set objectives
4. Analyze the compilation/result of the study to conclude the important findings
5. Organize the project report in a structured manner

B. PHARM SEMESTER VII
COURSE NAME : FOOD & FORENSIC ANALYSIS [2EP7A02]

Learning Outcomes:

After successful completion of the course student will be able to :

- Acquire knowledge of fundamentals of standards and quality for food products and additives.
- Acquire comprehensive knowledge of various chemical and instrumental techniques used in forensic analysis of samples with its scope in forensic science.
- Understand the need of legislation and punishment for various sections of Indian Penal Code for homicide.
- Analyse and differentiate spurious food and additives from authentic food.

Theory (Detailed Syllabus)

LPC
2 -- 2

1. Food Analysis

Legislation for food, Food safety act, Food standards and nutrition, General chemical and instrumental methods for food analysis.

Contaminants in food: Different types of adulterants and contaminants in food material and food additives. Standards for food additives.

Analysis of sugar, preservatives, starch products, beverages, chocolate, herbs, spices, cereals, oils and fats, dairy products.

Sophisticated instrumental methods for analysis of food and additives

2. Forensic Analysis

Forensic Drug Analysis and Toxicology - Analysis of Commonly abused drugs in their solid dosage form and in biological media. General chemical and instrumental methods with special emphasis on modern instrumental methods and interpretation of results.

Collection and preparation of samples from different specimens for forensic analysis, preservation of the samples and report filing for forensic evidence analysis.

Poisons: Definitions, Types, Forensic analysis of poisons, legislation for poisons and homicides

Total Lectures

30

Books Recommended :

1. D.G.Watson, Pharmaceuticals Analysis: A Textbook of Pharmacy Students and Pharmaceutical Chemists, 2nd Edition, Churchill Living Stone Publishers, London, 2005.
2. D. A. Skoog, F. J. Holler and T. A. Nieman, Principles of Instrumental Analysis, 6th Edition (Indian Edition), USA Brooks / Cole Publishing Company, 2007.
3. W. D. Ehmann and D. E. Vance, Radiochemistry and Nuclear Methods of Analysis, Wiley-Interscience, New York, 1991.
4. R. S. Kirk and R. Sawyer, Pearson's Composition and Analysis of Foods, 9th Edition, Addison- Wesley Longman Limited, 1999.
5. A.C. Moffat and M. D. Osselton, Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, Body Fluids and Postmortem Material, Volume 1 & 2, 3rd Edition, Pharmaceutical Press, London, 2004.
6. F.P. Smith, Handbook of Forensic Drug Analysis, Elsevier Academic Press, 2005.

B. PHARM. SEMESTER- VII

COURSE NAME: COMPUTER AIDED DRUG DESIGN [2EP7M01]

Learning Outcomes :

After successful completion of the course, student will be able to

- Remember various drug design terminologies.
- Understand different approaches of drug discovery through computer aided drug design.
- Apply their drug design knowledge by access of various CADD software.
- Analyse various drug discovery case studies.
- Create various *in-silica* models of pharmacophore, QSAR, docking etc.

Theory (Detailed Syllabus)

LPC

2 -- 2

1. Introduction to Computer-Assisted Drug Design
Introduction to Computer-Assisted Drug Design, Basic terminologies of Drug Design, Introduction to ligand-based and structure-based methods
2. Receptors and Drug Receptor Theories
Structure & classification of receptors, Introduction to ligand-receptor theories
3. Pharmacophore
Introduction to pharmacophore mapping, Pharmacophore features, 2D and 3D approaches for pharmacophore, Criteria and methodology of pharmacophore model generation, Applications of pharmacophore
4. Virtual Screening
Introduction to virtual screening, Ligand and structure based virtual screening, Substructure searching, Hit identification
5. Structure-Activity Relationship and Quantitative Structure-Activity Relationship
Introduction to structure activity relationships, Structure property relationships, Structure toxicity relationships QSAR, Historical development of QSAR, Physico-chemical parameters, Hansch approach, Free Wilson's de novo approach, 3D-QSAR (CoMFA, CoMSIA)
6. Case Studies Related to CADD
Success stories of drug development through CADD for following: Antihypertensive agents, Anti-HIV agents, Anticancer Agents, Anti-diabetic agents

Total Lectures :

30

Books Recommended

1. Manfred E. Wolff and Burger's - Medicinal Chemistry and Drug Discovery 1995
2. Graham L. Patrick - An Introduction to Medicinal Chemistry, 2008, Oxford University Press, New Delhi
3. E.J. Ariens - Drug Design, 1971, Academic Press, New York
4. Hugo Kubing - QSAR: Hansch Analysis and Related Approaches, Vol. 1, 2008
5. Alan L. Hammett - Advances in drug discovery techniques, 1998, John Wiley & Sons, Inc.
6. Thomas J. Perum and C. L. Propst - Computer Aided Drug Design: Methods and Applications, 1989, CRC Press

NIRMA UNIVERSITY
Institute of Pharmacy
(B.Pharm)
(Semester-VII)

L	T	P	C
2			2

Course Title	Course on Wheels - Applications of Pharmaceutical Sciences [2EP7C01]
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Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

- Understand the scope of various departments of pharmaceutical industry **EMP**
- Understand the processing of formulation development **EMP**
- Know GMP and GLP practices **S**
- Relate theoretical background to the industrial processes **ENT**

Syllabus:**Teaching hours:** 30 hours

- a) Orientation to production unit and inventory management
- b) Understanding of various aspects to quality assurance functions
- c) Orientation to pharmaceutical packaging concepts and practices in pharmaceutical industry.
- d) Various functions of quality control department at pharmaceutical industry.
- e) To observe implementation of various guidelines to be followed in pharmaceutical industry and procedures for drug approvals
- f) Understanding research activities related to drug development and commercialization.
- g) Interacting with patients and health care providers to gain better understanding of hospital pharmacy.

Suggested Readings":

1. Vogel, A. I., Jeffery, G. H., & Vogel, A. I. (Latest edition). *Vogel's textbook of quantitative chemical analysis*. Harlow, Essex, England: Longman Scientific & Technical.
2. Avis, K. E., Lieberman, H. A., & Lachman, L. (Latest edition). *Pharmaceutical dosage forms: parenteral medications*. New York: M. Dekker.
3. Gad, S. C. (Latest edition). *Statistics and experimental design for toxicologists and pharmacologists*. Boca Raton: CRC Press.
4. Lachman, L. (Latest edition). *Theory and practice of industrial pharmacy*. Philadelphia.
5. Lieberman, H. A. (Latest edition). *Pharmaceutical dosage forms: tablets: in three volumes*. New York: Dekker.
6. Skoog, D. A., West, D. M., & Holler, F. J. (Latest edition). *Fundamentals of analytical chemistry*. Fort Worth: Saunders College Pub.
7. Vogel, A. I., Furniss, B. S., & Vogel, A. I. (Latest edition). *Vogel's Textbook of practical organic chemistry*. London: Longman Scientific & Technical.

L= Lecture, **T=** Tutorial, **P=** Practical, **C=** Credit

" this is not an exhaustive list

B. PHARM. SEMESTER- VII
COURSE NAME: FUNDAMENTALS OF TOXICOLOGY [2EP7L02]

Learning Outcomes :

After successful completion of the course student will be able to:

- Understand general principles and treatment of acute and chronic poisoning of various drugs and chemicals.
- Analyze various regulatory guidelines for toxicity studies.
- Evaluate and analyze various acute, subacute and other toxicity studies.
- Create protocols for various toxicity testing.

Theory (Detailed Syllabus)

LPC
2 -- 2

1. Scope, definition and general principles of toxicology
2. Various guidelines of toxicology
3. General principles and treatment of acute and chronic poisoning with special reference to barbiturates, opioids, organophosphorus, atropine, alcohol, Benzodiazepines, Anti-depressants, Neuroleptics etc.
4. Heavy metals poisoning (Iron, lead, Mercury, Arsenic) and heavy metal antagonists
5. Toxicity Testing:
 - a. Acute toxicity studies
 - b. Subacute toxicity studies
 - c. Chronic toxicity studies,
 - d. Toxicity studies for mutagenicity and carcinogenicity testing, teratogenicity
 - e. Immunotoxicity, genotoxicity and other toxicity studies
6. Target organ toxicity like kidney, liver, cardiac and endocrine toxicity.
7. Environmental toxicants:
 - a. Sources of toxicants
 - b. Types of toxicants
 - c. Antidotes for toxicants

Total Lectures

30

Books Recommended :

1. CRC handbook of Toxicology by Michael Derelanko, 3rd Edition (2014), CRC press, New York,
2. Toxicology Testing Handbook: Principles, Applications and Data Interpretation by Jacobson-Kram, David. 2nd Edition (2001), Marcel Dekker, Inc.: New York,
3. Goodman Gilman A., Rall T.W., Nies A.L.S. and Taylor, P. Goodman and Gilman's. The pharmacological Basis of therapeutics, 10th Edition (2001), Mc Graw Hill, Pergamon Press.
4. Rang, H.P. and Dale, M.M. Pharmacology, 5th Edition (2003), Churchill Livingstone.
5. Craig, C.R. and Stitzel, R.E. Modern Pharmacology, 6th Edition (2008), Little Brown and Company.
6. Katzung, B.G. Basic and Clinical Pharmacology, 8th Edition (2001), McGraw Hill, New York.
7. Animal models in toxicology by Shayne Cox Gad and Christopher P. Chengelis, 2nd Edition (2006), Informa HealthCare.
8. Principles and methods of toxicology by Hayes. 4th Edition (2001), Taylor & Francis.
9. CRC Handbook of toxicology by Derelanko and Hollinger. 2nd Edition (2001), CRC Press.
10. www.oecde.org (OECD Guidelines)

B. PHARM SEMESTER VII
COURSE NAME : NUTRACEUTICALS [2EP7G01]

Learning Outcomes:

- After successful completion of the course student will be able to :
- Understand sources of health foods and their dietary importance.
- Analyze regulatory aspects and global market and scope of nutraceuticals.
- Understand emerging and recent trends in the field of nutrition and cosmetics.
- Remember the mechanism of action of nutraceuticals for different systems of human body.

Theory (Detailed Syllabus)

L	P	C
2		2

1. Nutraceuticals and dietary supplements: Origin and development of nutraceuticals, Classification of different nutraceuticals families, Contemporary nutraceuticals and recommended daily intake, global scenario and current market trend in nutraceuticals industry
2. Phytonutraceuticals and Herbs as Health Food
3. Omega fatty acids and organo sulfur compounds
4. Dietary fibers, prebiotics and probiotics for gastrointestinal health
5. Herbal beverages and drinks: Emerging market and scope
6. Toxicity studies and Regulatory guidelines for nutraceutical products, DSHEA act and Global regulatory agencies and bodies for nutraceuticals in different countries
7. Nutricosmetics and cosmeceuticals: Definition, scope and advances in the global nutricosmetics market, food supplements as nutricosmetic ingredients, oral and topical nutricosmetics

Total Lectures:

30

B. PHARM. SEMESTER- VI

COURSE NAME: PACKAGING FOR PHARMACEUTICALS [2EP7T02]

Learning Outcomes :

After successful completion of the course, student will be able to

- Remember packaging materials used for various dosage forms
- Understand the important parameters for selection of suitable package
- Apply knowledge of packaging in stability of pharmaceuticals
- Analyze packaging material as per regulatory requirements

Theory (Detailed Syllabus)

L P C

2 -- 2

1. Introduction, scope and role of Pharmaceutical packaging
2. Packaging Materials: Classification, Types of packaging material, packaging materials for solids, liquids and semisolid dosage forms, quality control testing and stability of packaging materials including latest packaging materials
3. Overview of various packaging processes
4. Labeling and legal requirements of Pharmaceutical packaging
5. Regulatory aspects of pharmaceutical packaging

Total Lectures

30

Books Recommended:

1. Pharmaceutical Packaging technology, D. D. Dean, Taylor and Francis, CRC Press, London, UK, 2005
2. Pharmaceutical Packaging technology, U. K. Jain, Pharmamed Press, Hyderabad, India, 1st edition, 2008.
3. Packaging of Pharmaceuticals and Healthcare Products, H. Lockhart and F. A. Paine, Blackie A&P, London, 2006.
4. Pharmaceutical Packaging Handbook, E. J. Bauer, Informa Healthcare, UK, 2009.

B. PHARM SEMESTER VII

COURSE NAME: PHARMACEUTICAL PROCESS SCALE-UP 2EP7T03

Learning Outcomes :

After successful completion of the course, student will be able to

- Remember and correlate different principles of physical sciences in scale up of dosage forms and processes.
- Understand the important process parameters for small and large scale manufacturing.
- Apply the methodology & process scale up of various formulations.
- Analyze the practical problems of process scale up and developing robust formulation.
- Create a strategy to handle issues related to technology transfer in global market.

Theory (Detailed Syllabus)

LPC
2 -- 2

1. Introduction to Scale-Up and Dimensional Analysis
Fundamentals & applications of scale-up in Pharmaceutical manufacturing. Concept of dimensional analysis in research.
2. Scale up of dosage forms
Overview of scale up of solid, semisolid, liquid and parenteral dosage forms with suitable case studies.
3. Scale up considerations of various processes & biotechnology derived products
Process scale-up of film coating, extrusion-spheronization & upstream and downstream processing of biotechnology derived products.

Total Lectures :

30

Books Recommended :

1. Pharmaceutical Process Scale-Up, by Michael Levin, Taylor & Francis, 3rd Edition, 2011, CRC Press, USA.
2. Pharmaceutical Process Engineering by Anthony Ricky & David Ganderton, 2nd Edition, 2009, Informa Healthcare, USA
3. Pharmaceutical Dosage Forms: Tablets Vol. 1, Vol. 2 and Vol. 3, Lieberman, Leon Lachman and Joseph B. Schwartz, 2nd Edition, 2008, Informa Healthcare, New York, USA.
4. Encyclopedia of Pharmaceutical Technology Vol. 1, Vol. 2 and Vol. 3, by James Swarbrick and James C. Boylan by Banker, Gilbert S. Rhodes, Christopher T., 3rd Edition, 2006, Informa Healthcare, USA
5. Pharmaceutical Dosage Forms: Disperse Systems: Vol. 1, Vol. 2 and Vol. 3, Lieberman, Herbert, Rieger, Martin, Banker, GS. 2nd Edition, 2008, Informa Healthcare, USA

University Electives

Course Code	Course Name
UEIT001	Applied Literature

Nirma University
Institute of Technology
Department of Mathematics & Humanities
University Elective
Sem- V/VI
UEIT001, Applied Literature

[3 0 0 3]

Course Learning Outcome

Students completing this subject will:

- be able to explore the importance of textual traditions in shaping responses to other places, peoples, cultures;
- gain a knowledge and understanding of the social, political and intellectual forces contributing to imperial, third world and migrant writing;
- develop a knowledge and appreciation of the subject matter, styles and narrative conventions

Syllabus

Non-fictional Prose Works (Excerpts)

New Branded World by Naomi Klein

From the Gutenberg Elegies: The Fate of Reading in the Electronic Age by Sven Birkets

Decolonising the Mind by Ngugi wa Thiong'o

Idea of India by Sunil Khilnani

Wings of Fire by APJ Kalam

Poems

Night of the Scorpion by Nissim Ezekiel

Little Red-Cap, by Carol Ann Duffy

Hunger by Jayanta Mahapatra

The Dacca Gauzes by Agha Shahid Ali

The Howl by Allen Ginsberg

If you forget me by Pablo Neruda

Still I rise by Maya Angelou

If by Rudyard Kipling

"Hope" is the thing with feathers by Emily Dickinson

All You who Sleep Tonight by Vikram Seth

The Unknown Citizen by W. H Auden

Song of Myself, I, II, VI & LI by Walt Whitman

Short Stories

Short Story: "Seventeen Syllables" by Hisaye Yamamoto

Short Story: "The Gift of the Magi" by O. Henry

Criticism

Towards a Feminist Poetics by Elaine Showalter

Movies

The Prestige
To Sir, With Love
The Namesake
Sherlock - TV series
Troy
Jobs

References:

1. Widdowson, Peter. *Literature*. London: Routledge, 1999.
2. Miller, J. Hillis. *On Literature: Thinking in Action*. London: Routledge, 2002.
3. Mulhern, Francis, *Culture/Metaculture*. London: Routledge, 2000.
4. During, Simon, *The Cultural Studies Reader*. London: Routledge, 1993.
5. Leitch, Vincent B. *The Norton Anthology of Theory and Criticism*. Norton: New York, 2001.
6. Stam, Robert; Alessandra Raengo, *A Companion to Literature and Film*. Blackwell: Oxford, 2004.

Course Learning Outcome:

After successful completion of this course, student will be able to

- understand the statistical inferences of data and take decision based on it.
- derive the distributional results needed for statistical inference
- demonstrate understanding of theory of linear models
- analyze data and fit linear regression models using R
- understand the concept of big data.

Syllabus:

Introduction to data: Data structures, variables, summaries, graphics, and basic data collection techniques.

Probability: The basic principles of probability such as conditional probability, random variables, Bayes theorem

Distributions of random variables: Introduction to the normal distribution model, geometric distribution, Bernoulli distribution, Binomial distribution, Poisson distribution

Foundations for inference: Variability in estimates, Confidence Intervals, Hypothesis testing, Central Limit Theorem

Inference for numerical data: Paired data, Inference for one or two sample means using the normal model and t distribution, and also comparisons of many means using ANOVA.

Inference for categorical data: Inference for proportions using the normal and chi-square distributions, as well as simulation and randomization techniques.

Introduction to linear regression: An introduction to regression with two variables, line fitting and correlation, least square regression,

Multiple regression: An introduction to multiple regression

Classification & Prediction: Definition of Classification & Prediction, issue regarding Classification & Prediction, Classification by decision tree induction, Bayesian Classification by Back propagation, Classification based on concept from Association rule mining, prediction, classifier accuracy.

Cluster analysis: Definition of cluster analysis, types of data in cluster analysis, a categorization of major clustering methods.

Introduction to Big Data: Introduction to BigData Platform, Challenges of Conventional Systems, Intelligent Data Analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting, Modern Data Analytic Tools, Statistical Concepts: Sampling Distributions, Re-Sampling, Statistical Inference - Prediction Error

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

References:

1. David M Diez, Christopher D Barr and Mine C Rundel, OpenIntro Statistics, CreateSpace Independent Publishing Platform
2. J A Rice, Mathematical Statistics and Data Analysis, Wadsworth Publishing Co Inc
3. D.D. Wackerly, W. Mendelhall and R.L. Scheaffer, Mathematical Statistics with Applications, Brooks / Cole
4. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons.
5. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons
6. Pete Warden, Big Data Glossary, O'Reilly
7. J. Han & M. Kamber, Data Mining Concepts and Techniques, Elsevier Publication
8. Witten & Frank, Data Mining Practical Machine Learning Tools and Techniques, Morgan Kaufmann Publishers

Mech. Engg. Dept. University Elective Highlighted

UEIT008 Introduction to Renewable Energy Sources [3 0 0 3]

Course Learning Outcomes:

After successful completion of the course , student will be able to

- develop an understanding of the energy scenario and need of renewable energy sources.
- learn the concepts of power generation from hydropower plants.
- understand the solar radiation geometry and concepts of solar energy utilization .
- Learn the concept of power generation from wind and biomass energy sources.
- understand the concept of power generation from ocean and geothermal sources.

Syllabus

Energy scenario: Current status and need of renewable energy sources

Hydropower: Hydropower plants and its classification, small hydropower, Main components of hydropower plants, Concept of power generation, Hydro turbines: Pelton/Francis/Kaplan , Governing principle

Solar energy: Extraterrestrial and terrestrial radiations, Radiation geometry, Solar thermal applications: flat plate collector, concentrating collectors, air heaters , power generation etc., Solar photo-voltaic power generation: theory and applications

Wind energy: Sources of wind formation , Site selection parameters, Different types of wind turbines

Energy from biomass and biogas: Energy plantation Different processes of biomass conversion , Biomass gasifiers, Biogas plants

Geothermal energy: Geothermal resources, Concept of power generation

Energy from oceans: Concept of power generation from Tidal, wave and ocean thermal energy conversion plants

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

- 1 G . D . Rai, Solar Energy Utilization, Khanna Publishers.
- 2 G.D. Rai, Non-conventional Energy Sources, Khanna Publishers.
- 3 J. Twidell and T. Weir, Renewable Energy Resources, Taylor and Francis Publication.
- 4 S. P. Sukhatme, Solar Energy, Tata McGraw-Hill Education.
- 5 J. F. Walker and N. Jenkins Wind Energy Technology, John Wiley & Sons.

Civil Engineering Department

University Electives offered by Civil Engineering Department to be made effective from academic year 2015-16

UEIT009 **Environmental Conservation for Sustainable Development** **[3 0 0 3]**

Course Learning Outcome:

After successful completion of the course, student will be able to

- identify and analyse environmental issues related to developments and address suitable mitigation measures
- comprehend and formulate appropriate environmental pollution control methodology
- identify and assess environmental hazards, consequences and safety provisions
- select and evolve appropriate environmental monitoring and management strategies

Syllabus:

Developmental Activities and Environmental Issues: Environmental issues arising from developmental activities, nature and characteristics of environmental impacts of urban and industrial developments. Need for technological inputs addressing the multi-disciplinary nature of environment leading to sustainable development.

Environmental Pollution - Assessment and Control: Constituents, types, assessment and control of environmental pollution. Environmental indices and modelling tools for prediction and assessment of environmental quality. Fundamental pollution control systems, methodologies, operation and maintenance.

Environmental Health and Safety: Basic concepts and terms of environmental risk, identification and assessment procedures. Consequence and analysis of environmental and health hazards.

Environmental Monitoring and Management for Sustenance: Environmental management systems, monitoring and control of undesirable environmental implications. Linkages between technology, emission trading, economic gain and societal goals for sustainable development. Environmental cost benefit analysis, decision methods for evaluation of environmentally sound alternatives. Environmental regulations and legislation, international resource sharing issues, treaties and protocols.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, Environmental Engineering, McGraw-Hill International Editions-Civil Engineering Series
2. Larry W. Canter, Environmental Impact Assessment, McGraw-Hill International Editions
3. Environmental Concerns and Sustainable Development: Some perspectives from India, Sakarma Somayaji, Ganesha Somayaji, TERI Press
4. G. Bruce Wiersma, Environmental monitoring, CRC Press
5. Nicholas P. Cheremisinoff, Madelyn L. Graffia, Environmental Health and Safety Management: A Guide to Compliance, Jaico Publishing House

UEIT004 Information and Communication Technology (ICT) [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, the students will be able to

- understand autonomous and discerning use of ICT and emerging technologies
- test and evaluate ICT systems
- evaluate impact of current and new technologies for working in the outside world and on social, economic, ethical and moral issues
- apply ICT-based concept to solve problems
- recognize potential risks when using ICT

Syllabus:

Types and Components of Computer Systems: : Hardware and software, the main components of computer systems ,operating systems, types of computer, impact of emerging technologies

Input and Output Devices : Input devices and their uses, direct data entry and associated devices output devices and their uses

Storage Devices, Media & Networks: Network basics, issues and communication

The Effects of Using IT: Effects of IT on employment, effects of IT on working patterns within organizations, microprocessor-controlled devices in the home , potential health problems related to the prolonged use of IT equipment

ICT Applications : Case studies- communication applications, data handling applications, measurement applications, microprocessors in control applications, modeling applications, applications in manufacturing industry, school management systems, booking systems ,banking applications, computers in medicine, computers in libraries, expert systems, computers in the retail industry, recognition systems, monitoring and tracking systems, satellite systems

The Systems Life Cycle : Analysis, design, development and testing, implementation, documentation, evaluation

Safety and Security : Physical safety, e-safety, security of data

Audience : Audience appreciation, legal, moral, ethical and cultural appreciation

Communication : Communicate with other ICT user s using email, effective use of the internet

File Management : Manage files effectively, reduce file sizes for storage or transmission Images, Layout , Styles Proofing : software tools proofing techniques, Graphs and Charts, Document production, Presentations

Data Manipulation : Create a database structure , manipulate data , present data

Data Analysis : Create a data model , test the data model , manipulate data , present data

Website Authoring : Web development layers, create a web page, use style sheets, test and publish a website

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. Stephen Doyle, Essential ICT A Level: A2 Student Book, Oxford University Press
2. Stephen Doyle, Complete ICT, Oxford University Press
3. Prof. Satish Jain, Shashank Jain, 'O' Level made simple Internet Technology and Web Design, BPB Publication
4. Satish Jain, 'O' Level Introduction to ICT Resources, BPB Publication

NIRMA UNIVERSITY
Institute of Management
University Elective

Course Title: Human Resource Management

Credit Hours: 3

Course Number: UEIM006

Course Objectives

- To introduce the students to human resource management function.
- To understand the people management role in organizations.

Learning Outcomes

At the end of the course, students will:

1. acquire an insight into the role and responsibilities of the HRM function.
2. learn about the different systems within HRM viz. Recruitment and Selection, Performance Management, Compensation Management, Employee Relationship Management and recognize their strategic contribution to business and organizations
3. carry out job and role analysis and write job descriptions.

Syllabus

Module I: Introduction

- An Introduction to Human Resource Management
- Skills and Competencies of a Human Resource Manager
- Corporate Strategy and Human Resource Management

Module II: Manpower Planning and Talent Acquisition

- Manpower Planning and Deployment
- Job Analysis, Design and Redesign of Jobs
- Recruitment & Selection

Module III: Managing and Rewarding Employee Performance

- Performance Management
- Compensation Management
- Learning & Development

Module IV: Managing Employee Relations

- Employee Relationship Management
- Industrial Disputes & Conflicts
- Labour Legislation
- Managing Employee Exit and Separations

Module V: Contemporary issues in Human Resource Management

Suggested Readings

- Dessler, G. Varkkey, B. (2011). Human Resource Management. (12th Edition). New Delhi: Pearson Education.
- Bernardin, J. H. (2007). Human Resource Management -An Experiential Approach. New Delhi: Tata McGraw Hill Publishing Company Limited.
- Singh B.D. (2004). Industrial Relations, Emerging Paradigms. New Delhi: Excel Books.
- Varkkey, B., Dutta, R. and Rao, G. P. (Eds). (2000). Value Creation: The Challenge of HR in the New Millennium. New Delhi: Tata McGraw-Hill Publishing Company Limited.
- Ramaswamy, E.A. (2000). Managing Human Resources: A Contemporary Text. New Delhi: Oxford University Press.
- Pande, S. and Basak, S. (2012). Human Resource Management. (15th Edition). New Delhi: Pearson Education.

NIRMA UNIVERSITY
Institute of Management

University Elective

Course Title: Introduction to Strategic Management

Credit Hours: 3

Course Number: UEIM002

Course Objectives

- To introduce the students to strategic management
- To provide knowledge about concepts & frameworks required to analyse a firm in business context

Learning Outcomes

At the end of the course, students shall be able to:

1. Understand the role of strategy in business,
2. Develop an understanding of the basic strategy framework,
3. Apply frameworks regarding how firms gain advantage in the marketplace.

Syllabus

Module 1: INTRODUCTION TO STRATEGY
<ul style="list-style-type: none">• Meaning & Scope of Strategy• The process of strategic management• Introduction to the Vocabulary of Strategy: Vision, Mission, Goals, Objectives, Values, Strategy, Resources and Capabilities
Module 2: THE BUSINESS LANDSCAPE
<ul style="list-style-type: none">• Sectors & Industries• Analysing A Company's External Environment• Understanding A Company's Strategy, Resources, Capabilities• Phases In Industry 's Development

NIRMA UNIVERSITY
Institute of Management
University Elective

Course Title: Financial Management

Credit Hours: 3

Course Number: UEIM007

Course Objectives

- To provide students with the basic understanding of financial management in an organizational context
- To help them understand the working of financial markets
- To enable them to use spreadsheets to perform financial analysis

Learning Outcomes

At the end of the course, students shall be able to:

1. Understand the significance of financial management to firm performance
2. Identify the variables important to making financial decisions
3. Perform primary investment decision analysis
4. Describe sources of funds and their costs
5. Perform basic financial analysis using spreadsheets

Syllabus

Module 1: Basics of Financial Management
<ul style="list-style-type: none">• Introduction to Financial Management• Role and Functions of the Finance function• Time Value of Money• Basics of Risk and Return
Module 2: Financial Markets and Instruments
<ul style="list-style-type: none">• The Financial System• Introduction to Financial Markets and Instruments• Sources and Cost of Capital

Module 3: Major Financial Decisions

- The Investment Decision
- The Funding Decision
- The Distribution of Profit Decision
- Introduction to Working Capital Management
- Managing Risk

Module 4: Using Spreadsheets in Finance

- Introduction to Financial functions in Spreadsheets
- Spreadsheet Application Exercises

Suggested Readings

1. Chandra, P. (2010). Fundamentals of Financial Management. New Delhi: Tata McGraw Hill.
2. Khan, M. Y. & Jain, P. K. (2012). Fundamentals of Financial Management. New Delhi: Tata McGraw Hill.
3. Pandey, I. M. (2011). Essentials of Financial Management. New Delhi: Vikas Publishing House.
4. Ross, S., Westerfield, R. & Jordan, B. (2012). Fundamentals of Corporate Finance. New Delhi: Tata McGraw Hill.
5. Rustagi, R. P. (2011). Financial Management: Problems & Solutions. New Delhi: Taxmann.
6. Wachowicz J. M. & Van Horne, J. C. (2009). Fundamentals of Financial Management. New Delhi: PHI Learning

NIRMA UNIVERSITY
Institute of Management
University Elective

Course Title: Fundamental of International Business
Credit Hours: 3
Course Number: UEIM003

Course Objectives

- To introduce the students various concepts and issues in international business and related activities.
- To evaluate global business opportunities and develop skills to deal with various issues involved in cross-border transaction of goods, services and other resources between two or more nations.

Learning Outcomes

At the end of the course, students shall be able to:

1. understand and evaluate the basis of international trade and business.
2. explain the various methods of entry into foreign markets and assess the suitable mode for international business.
3. understand the concept of globalization and discuss the implications of GATT/WTO in international business.
4. understand the India's institutional and policy framework for international business.

Syllabus

Module 1: AN OVERVIEW TO INTERNATIONAL BUSINESS
Introduction <ul style="list-style-type: none">• Evolution Of International Business• Stages Of Internationalization• International Business Approaches• Importance Of Cross Cultural Differences In International Business• Modes Of Entry Into International Markets• Advantages And Problems Of International Business

Module 2: CONCEPTUAL FRAMEWORK: INTERNATIONAL TRADE, INVESTMENT, BALANCE OF PAYMENT AND TERMS OF PAYMENT

- **Mercantilism**
- Theory Of **Absolute Cost And Comparative Cost Advantage**
- **Relative Factor Endowment Theory**
- **Product Life Cycle Theory**
- Porter's National **Competitive Advantage Theory**
- **Foreign Collaboration/Technology Transfer Related Issues**
- **Factors Influencing FDI**
- Reasons And **Cost And Benefits Of FDI**
- Concept Of **Balance Of Payments** And Its Components
- **Terms Of Payment**

Module 3: GLOBALISATION, WORLD TRADE ORGANISATION AND REGIONAL ECONOMIC INTEGRATION

- Concept Of Globalization
- **Drivers Of Globalization**
- **Globalization Of Markets, Production, Investment, Technology**
- Advantages And Disadvantages Of Globalization
- **General Agreement Of Tariff And Trade**
- **Uruguay; Round, Establishment Of WTO And Various Agreement Of WTO**
- **GATS - Trade In Services**
- Concept Of **Regional Integrations** And Regional Blocks

Module 4: INDIA'S INSTITUTIONAL AND POLICY FRAMEWORK FOR INTERNATIONAL BUSINESS

- **Policy And Service Support** Organizations
- Commodity Specialization
- **Training** And Research **Institutions**
- Trading / Service Corporations
- **Risk Covering Institutions**
- **Financial Institutions**
- Institutions Especially For **SSIs and State Participation**
- An Overview Of **India's Foreign Trade Policy And Procedure**

Suggested Readings

- Carbaugh J. R. International Economics. Bangalore: Thompson South-Western, Latest Edition.
- Chugan, P. K. International Technology Transfer. Mumbai: Himalaya Publishing House.
- Czinkota R.M., Ronkained I.A. and Moffet, M.H. International Business. Bangalore: Thompson South-Western. Latest Edition.
- Foreign Trade Policy and Handbook of Procedures. New Delhi: Centax Publications. Latest Edition.
- Francis C. International Business Environment. New Delhi: Prentice-Hall India, Latest Edition
- Joshi, R. M. International Business. New Delhi: Oxford University Press. Latest Edition.
- Mithani, D.M. International Economics. Mumbai: Himalaya Publishing House. Latest Edition.
- Paras R. Export - What, Where and How. New Delhi: Anupam Publications. Latest Edition.
- Paul, Justin. International Business. New Delhi: PHI Learning Pvt. Ltd. Latest Edition
- Rao, S. P. International Business; Text and Cases. Mumbai: Himalaya Publishing House. Latest Edition.

NIRMA UNIVERSITY
Institute of Management
University Elective

Course Title: Elements of Management

Credit Hours: 3

Course Number: UEIM004

Course Objectives

- To familiarize the students with the Management Discipline.
- To understand the role of a manager in managing people and organizational activities.

Learning Outcomes

At the end of the course, students will be able to:

1. Understand the major functions of management viz. Planning, Organizing, Leading and Controlling,
2. Describe the interrelationship among the various functions of Management
3. Develop a general management perspective, and

Syllabus

Module 1: NATURE & EVOLUTION OF MANAGEMENT

- Meaning & Scope of Management
- Management a Science and/or Art?
- Management Vs Administration
- Management as a Profession
- Evolution of Management Thought
- Early Classical Approaches Scientific Management, Administrative Management, Bureaucracy
- Neo-Classical Approaches Human Relations Movement, Behavioural Approaches
- Modern Approaches - Quantitative Approach; Systems Approach; Contingency Approach
- Management Process
- Functional Areas of Management
- Global Applications
- Management Practices in India

Module 2: MANAGERIAL ROLE & EXTERNAL ENVIRONMENT
<ul style="list-style-type: none"> • Role of Managers • Mintzberg's Ten Managerial Roles • Functions of Various Levels of Management • Managerial Skills • External Environment of the Organization & Its Impact on Organizational Operations • Globalization and Business Environment
Module 3: PLANNING AND ORGANIZING
Planning <ul style="list-style-type: none"> • Planning: Meaning, Need & Importance • Planning Process • Types of Plans; Objectives, Policies, Procedures and Methods • Nature and Type of Policies • Types of Planning; Advantages & Limitations • Forecasting: Need & Techniques •
Organizing <ul style="list-style-type: none"> • Division of Work • Departmentation; Definition; Departmentation by Function, Territory, Product/Service, Customer Group; Matrix Organization • Line & Staff; Span of Control • Authority; Delegation of Authority; Centralization & Decentralization; Formal and Informal Organizations
Module 4: Coordination and Control
Coordination <ul style="list-style-type: none"> • Need for Coordination • Types and Techniques of Coordination • Coordination Process • Coordination Characteristics • Coordination: Advantages and Limitations • Distinction between Coordination and Co-operation
Controlling <ul style="list-style-type: none"> • Concept of Controlling • Types of Controls • Design of Control Process • Control Methods - Financial; Budgetary; Operational; Quality; Information Systems & Control • Responsibilities of Managers

Module 5: Current Trends in Management

- Managing Diversity
 - Technology Management
 - Capability Development
 - Management of Family Owned Businesses
 - Relevance of Management to Modern Industries and Government
-
- Management Lessons from Indian Ethos

Suggested Readings

1. Stoner, J. A. F. & Freeman, R. E. Management, (6th Ed). Prentice Hall, 1995.
2. Prasad, L. M. Principles and Practice of Management. (7th Ed). Delhi: Sultan Chand & Sons. 2008.
3. Drucker, P. The Practice of Management. Elsevier Ltd. 1955, Reprint 2007.
4. Hampton, D.R. Contemporary Management. (2nd Ed). McGraw Hill. 1981, Reprint 2008.
5. Tripathi, P. C. & Pandey, P. N. Principles of Management. (5th Ed). New Delhi: Tata McGraw Hill. 2012.
6. Koontz, H., Weihrich, H. & Aryasri, R. Principles of Management. Tata McGraw Hill. 2004.

**NIRMA UNIVERSITY
INSTITUTE OF LAW**

**University Elective Course
Academic year 2015-16**

Forensic Science and Law

Teaching Hours: 45

Credit: 3

I INTRODUCTION:

The functioning of a criminal justice system depends on the principle of proving the guilt beyond reasonable doubt. It is believed that punishment should be awarded only when there is substantial proof that the person being convicted has an established guilt in the matter concerned. For this purpose, evidence is generated that provides for the involvement of a person in a particular act. Evidence is the arena wherein the concept of forensic science comes into play. Forensic science is that branch of science which provides practical application of scientific technology to investigate criminal or legal matters. The Indian Criminal Justice system is an adversarial system which means there are two parties, and both of them present their cases and the court decides the case on the basis of evidence provided by the parties. Forensic science is resorted to for the purpose of attaining a lead as to involvement of the person in question or for that matter identification of any other person who may have been involved. This course tries to analyse involvement of forensic science in criminal justice system with relate to Quality in Forensic Science, Importance of crime scene, Preservation of crime scene. Issue of admissibility, the increasing role of scientific technique, admissibility standards for expert evidence, to name a few.

II COURSE LEARNING OUTCOME:

After the completion of the course the students will be able to:

1. Understand and describe the underlining concepts of forensic science
2. Identify and articulate the emerging issues in forensic evidence.
3. Analyse the benefit and cost of using new scientific technique in criminal investigation .
4. Evaluate the issues relating to admissibility of forensic evidence in a court of law.

III S LLABUS:

1. Scene of crime and sight of Law

This unit examines a number of critical issues associated with the collection of forensic evidence at the crime scene such as Quality in Forensic-Science, importance of crime scene, preservation of crime scene. Exploring these areas by keeping in mind that the crime scene is one of the most crucial aspects of an investigation and that the scene of the crime is where collection of forensic evidence begins.

Two handwritten signatures and initials are present at the bottom of the page. The signature on the left appears to be 'Ravi' and the one on the right appears to be 'Ravi' with a large 'R' and 'V'.

2. **Proved beyond doubt? Scientific Technique in Criminal Investigation**

This unit examines the science of DNA identification, Brain fingerprinting, Lie Detector Test, Narco Analysis Test and its use during criminal investigations and in criminal proceedings, including criminal trials, appeals and post-conviction proceedings. This unit try to analyse the main benefits and costs of the increasing role of scientific technique in the criminal justice system with special emphasis to India and the challenges of these technologies in future.

3. **Scientific Evidence in Court of Law**

Development of scientific and technical expert testimony in the complex and technical issues has flooded the judicial system, the question of its reliability and admissibility has also plagued the courts and engendered much debate. This unit try to analyse the issue of admissibility which has attracted the attention of countless commentators and the offered arguments supporting greater or lesser barriers to the admissibility of scientific expert evidence.

4. **Need for caution: Problematizing Pitfalls**

This unit discusses *Daubert* in a new context, using the Indian case of *State of Maharashtra v. Sharma* as an example of how unreliable, questionable evidence can penetrate the courtroom when admissibility standards for expert evidence do not keep it at bay. This unit also analyses *Daubert* against the backdrop of rapidly emerging technologies and highlights the fact that courts can expect to confront increasing amounts of technical expert evidence in the future.

5. **Scientific race and legal pace: struggle of catching up**

In addition to the conventional areas of study mentioned in the above units, this unit tries to explore the field of forensic science which constantly expands to include many additional areas of expertise include analyses of bloodstain pattern interpretation; forensic engineering, forensic cyber technology, and criminal personality profiling; forensic economics, forensic photography, forensic radiology, and forensic accounting. Further this unit also tries to understand emerging specialty known as forensic security with which today's loss prevention manager must become quite familiar if he or she is to successfully respond to the growing challenge of premises liability for negligent security litigation facing today's businesses, corporations, and commercial/ residential landlords from a broader perspective.

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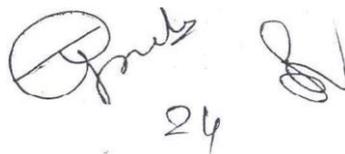
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**NIRMA UNIVERSITY
INSTITUTE OF LAW**

**University Elective Course
Academic year 2015-16**

Energy and Law

Teaching Hours: 45

Credit: 3

I Introduction

Energy has become one of the most essential needs of our lives. It is critical in the process of evolution, growth and survival of human beings and also in the socioeconomic development of a nation. The economy of the nation is dependent on abundant and uninterrupted supply of energy in all sectors, particularly electricity. It has become as a 'strategic commodity'. Most of the countries do not meet its current energy requirements and it is believed that the energy demand will manifestly increase in the future. It is expected that the worldwide energy demand will be doubled by 2050. Thus it becomes a great concern for most of the countries how they will satisfy their huge rising energy demand. This energy demand should also be met in an environmentally friendly way. Meeting energy demands is not only aimed at achieving economic growth but is also aimed at alleviation of poverty, unemployment and to meet other goals. Every country, therefore, undertakes a strategic plan to meet its energy demands, and to address the energy poverty and also the environmental effects of energy growth. With wide variety of sources available to choose from, the outcome is really complex as the problems that come to the fore-front makes the analysis of the subject even more interesting to ponder upon the challenges that this basic need of life throws upon us.

II Course Learning Outcomes

After the completion of the course the students will be able to:

1. Identify the challenges that legal regulations face in specific sectors in terms of consumption, production and conservation of energy
2. Classify the role and responsibility of the various stakeholders to conserve and preserve energy using tools of audit and management
3. Analyze the impact of the consumption of energy by the stakeholders in context of societal norms

III SYLLABUS

0. Energy from Non-renewable sources (Coal, oil and natural gas)

A. The goal that India seeks to achieve is to secure availability of coal to meet the demand of various sectors of the economy in an eco-friendly, sustainable and cost effective manner. This unit seeks to study as to why coal is such an important sector under energy law regime and how is the production of this non-renewable source of energy regulated? What do we understand by the

concept of power generation? What are the main components of a thermal power plant and what sort of an effect does this energy production and use have on the climate?

How are coal blocks allocated? Discussion as to their allocation procedures and existing discrepancies with lessons to be learnt from the past scams will be explored in the light of the Coal Mines (Nationalisation) Act, 1973 and the most recent Coal Mines (Special Provisions) Bill, 2014.

The coal mining industry is not free from hazards and it has been claimed by the ministry that the coal mine safety legislation in India is one of the most comprehensive and pervasive statutory framework for ensuring occupational health and safety. Directorate-General of Mines Safety (DGMS) under the Union Ministry of Labour & Employment (MOL&E) is entrusted to administer these statutes. It is through this unit, it will be studied that whether or not the statutes framed under the Mines Act, 1952; Mine Rules, 1955, and Coal Mine Regulation, 1957 have effective provisions as to mines safety and occupational health?

B. The Petroleum and Natural Gas Regulatory Board Act, 2006 establishes the Petroleum and Natural Gas Regulatory Board to regulate the various activities in the production chain of petroleum products and natural gas. This Unit studies the need for Oil and Natural gas as a source of non-renewable energy and the alternatives that are available to this energy source. How the energy resource is generated and made available for consumers? Whether or not the laws relating to this energy source are adequate to address the issues relating to the pricing of oil and regulation of prices in the domestic market in accordance to the prices fluctuation in the international market? How does the Government of India make provisions for subsidies in this sector?

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3. The Coal Mines (Special Provisions) Bill, 2014
4. Coal Mines (Conservation & Development) Amendment Rules, 2011 and CM(C&D) Second Amendment Rules, 2011
5. Colliery Control Rules, 2004
6. Oil Industry Act, 1974
7. Petroleum Rules, 1976
8. The Oil Fields Act, 1948
9. The Petroleum Act, 1934

10. Safety in Offshore Operations Rules, 2008

1. Nuclear energy

Nuclear energy is being seen as the new-age source of energy. But the issue that exists here is regarding the determination of the fact that whether the potential danger of nuclear power plant is ignored by India to find a shortcut to meet its energy demand when it does not have effective laws to regulate the atomic energy sector?

How did the nuclear energy come to be used for civil purposes? What are the international atomic energy agencies? Do they effectively regulate the civil uses of nuclear energy? How has the past disasters and accidents been instrumental in framing stricter safety norms both in the international and domestic levels? What are the causes and effect of Indo-US nuclear deal? What are the factors that led to the enactment of Civil Liability for Nuclear Damage Act? Is this Act exhaustive, effective and constitutionally valid? How effective is atomic energy laws in India? Whether foreign direct investment should be encouraged in the atomic energy sector? What is the concept of power generation and thermo-nuclear fusion versus fission reaction in terms of nuclear energy?

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5. IAEA Handbook on Nuclear Law (2003)
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2. Hydropower

Hydropower is considered to be a very viable source of energy. However, due to uncertain monsoons in a country like India, there is a growing concern as to the reliability on hydropower as a source of energy. It has been seen that most of the potential is in Himalayan States as river-based projects and in other States on irrigation canals. The small hydropower programme is now essentially private investment driven.-Projects are normally economically viable and private sector is showing lot of interest in investing in it. Through this unit a number of aspects in relation to hydropower would be analysed.

How can hydropower plants be classified and what are their functions? What are the main components of hydropower plants? What is the concept of power generation with respect to hydropower plants? How do hydro turbines function and what are its governing principles?

Do the laws relating to hydro power generation effectively deal with the issues relating to rural electrification? What is the solution to soil conservation and environment management which are

impacted as a consequence of such hydropower generation? What are the infrastructural challenges to building hydropower projects?

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1. Electricity Act, 2003

3. **Solar energy**

What is meant by Radiation geometry? What are the various solar thermal applications, in the light of flat plate collector, air heaters, power generation etc.? What are the theories and applications surrounding solar photo-voltaic power generation: theory and applications? What are the legal challenges in the tariff structure? Is solar energy 'actually' clean?

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4. **Wind energy**

Tapping into the huge potential of wind by setting up infrastructure can be considered to make it one of the most favourable source of energy. Though present in abundance but in order to get the right amount of energy from this source requires one to first answer some pertinent issues. What is/are the source(s) of wind formation? What are the Site selection parameters to harness this form of energy? In case of innovation how does one seek protection for the

'novelty'? How to overcome issues in financing and set cost-efficient standards? What is the regulatory compliance with respect to Renewable Purchase Obligations?

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- Ernest Smith, *Wind Energy: Siting Controversies and Rights in Wind* 1 ENVTL. & ENERGY L. & POL'Y J. 281 (2005-2007)

5. Energy from biomass an biogas

Considered to be as one of the cleanest forms of fuels this source of energy is converted into the using different processes of biomass conversion. In the process *gasifiers* are used and plants have to set up for the same. This source of energy though is widely accepted but has suffered from the typical mindset that people have and also the stiff competition that it faces from the other sources. What are the tariff issues and role of Renewable Energy Certificates? Do these create conflicts? How can Open Access prevent the Legal Wrangle in the power generation under the Electricity Act, 2003? Does the use of this fuel have a positive impact upon climate change?

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6. Geothermal energy

What are Geothermal resources? How can power be generated from the use of geothermal energy? How are tariffs and incentives regulated in this sector?

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7. Preserving Energy: Energy Audit and Management

Though this whole idea seems to be a bit astonishing as to why should we conserve energy when there are so many sources available but the reason for the conservation is two-fold: save one's own cost and save unwanted depletion of sources. The Ministry of Power through its agency Bureau of Energy Efficiency has taken up the task to sensitize the need of conservation of energy and highlighted the various standards and procedure that is required to be followed in conserving energy through its models of audit and reporting. Integrated Resource Planning is one of the said methods which suggests such a step in this direction. But can the success found in US in adopting this model, be repeated here? Also given the various models of auditing and with the lack of compulsion or incentives, does the role of the authorities become less predominant and rather passive? What is the role of corporations and industries in conserving energy? Is climate change an inevitable process?

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V Additional References

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NIRMA UNIVERSITY
INSTITUTE OF LAW
Academic Year: 2016-17
University Elective
Introduction to the Indian Constitution

Credit: 3
Hours: 45

L	T	PW	C
3	-	-	3

Introduction:

India is a democracy and her Constitution seeks to establish its fundamental organs of government and administration, describe their structure, composition, powers and principal functions, define democracy through relationship of the organs with one another and with the people. The Constitution also guarantees certain Fundamental Rights to its citizens that are not to be infringed by the Government. A good understanding of the Constitution and the law, which has developed through constitutional amendments, judicial decisions, constitutional practice and conventions is, therefore, absolutely necessary for a student of law.

The purpose of teaching constitutional law is to highlight its never-ending growth. Constitutional interpretation is bound to be influenced by one's social, economic or political predilections. A student must, therefore, learn how various interpretations of the constitution are possible and why a significant interpretation was adopted in a particular situation. Such a critical approach is necessary requirement in the study of Constitutional law.

Course Learning Outcomes:

After the completion of the course the students will be able:

1. To understand the nature, scope and extent of the Fundamental rights
2. To understand the Composition, Role and Functions of Executive, Legislature and Judiciary.
3. To analyze and critic the interrelationship between the different organs of Government i.e. Executive, Legislature and Judiciary.
4. To apply the knowledge of the constitutional provisions in solving the emerging challenges posed to the constitution.

Unit 1: Introduction to Indian Legal System

- Constitution, Constitutionalism, Constitutional Law, Constitutional Conventions

- Historical evolution of the Constitution of India during British Raj
- Formation of Constituent Assembly
- Working of Constituent Assembly
- Salient Features of Indian Constitution

Unit II: Goal, Values, Ideals & Aspirations from the Constitution

- Objectives Resolution
- Preamble to Indian Constitution
- 42nd Amendment Act & the

Preamble Unit III: Nature of

Indian Union

- Indian Union
- Formation, Creation and Establishment of new States under the Union
- Citizenship

Unit IV: Fundamental Rights

- Definition of State
- Definition of Law
- Right to Equality
- Fundamental Freedoms
- Right to Life & Personal Liberty
- Right against Exploitation
- Right to Religion
- Right to Constitutional

Remedies Unit V: Organs of

the Government

- Union Executive
- Union Parliament
- Union Judiciary

Unit VI: Emergency Provisions

- National Emergency
- State Emergency
- Financial Emergency

Unit VII: Amendment to the Constitution

- Need for Amendment
- Types of Amendment
- Procedure for Amendment

Unit VIII : Constitutional Bodies

- Comptroller & Auditor General of India

- Finance Commission of India
- Election Commission of India

Unit IX: Panchayati Raj Institutions

- Committees
- .. 73rd & 74th Amendment Act
- Rural Local Bodies
- Urban Local Bodies
- PESA Act

Text Book:

1. M. P. Jain, Constitutional Law, 6th Edition Lexis Nexis Butterworths.
2. V. N. Shukla's, Constitution of India, 12th Edition, Eastern Book Company
3. J.N. Pandey, The Constitutional Law of India, 50th Edition, Central Law Agency

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6. Granville Austin, Working a Democratic Constitution • A History of the Indian Experience (1999)

-L,-

University Elective Course Briefs (IL-NU)**UEIL014 – Intellectual Property Rights**

L	T	PW	C
3	-	-	3

Introduction to concept of property and intellectual property, introduction to TRIPS. Patent Law, concept and basis of protection, criteria of patentability and procedures of patent registration. Introduction to copyright law, subject matter of copy right and other related rights. Concepts and justification for trademarks protection, types of trademarks, procedure for registration, rights of trademark owner and infringement. Design law – basic and design justification, rights of design owners and protection against infringements. Concept of traditional knowledge, bio-piracy and bio-prospecting.