

## Contents of each course–Core Pharmacy Courses (Theory and Practical's)

SUBJECT CODE	SUBJECT
PYT.1.101	ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION
<b>COURSE OUTCOMES:</b>	
<b>Upon completion of the syllabus students should be able to</b>	
CO1. Impart fundamental knowledge on basic terminologies, Structure & functions of various tissues of human body.	
CO2. Describe the various homeostatic mechanisms, Explain anatomy & Physiology of different system of human body.	
CO3. Explain Anatomy & Physiology of different systems of human body.	
CO4. Explain anatomy & Physiology of different system of human body.	
CO5. Acquire knowledge regarding health education in human life. Illustrate various family planning methods & Explain diseased & Pathological process disturbances of metabolism & repair mechanisms of various systems.	

### Unit –I

**Introduction:** Anatomical terms in relation to parts of the body, system and organs. Elementary knowledge of the human skeleton; Tissues of the body –properties and functions of epithelial, connective, muscular, nervous and osseous (bone) tissues; General principles of membrane permeability, diffusion, transport, membrane potentials and action potentials.

### Unit –II

**Nervous Systems:** Neuron, Synapses, ganglion, plexus, physiology of nerve impulse, neurotransmission, reflex arc, central nervous system (parts and functions) and autonomic nervous system. Cardiovascular System and Blood: Heart, blood vessels, cardiac cycle, circulation, blood pressure and its regulations. Blood (composition and function).

### Unit –III

**Respiratory System:** Gross anatomy of respiratory passages, physiology of respiration, nervous control of respiration, vital capacity, respiratory volume, introduction to terms such as anoxia, hypoxia & dyspnoea. Digestive System: Gross anatomy of alimentary canal, movements of alimentary canal, gastric secretions and the enzymes involved in digestion.

Endocrine System: Mechanisms of hormonal secretion, Physiological considerations of thyroid, pancreas, pituitary, parathyroid, adrenal glands & gonads; Disorders of hypo & hyper secretion.

#### **Unit –IV**

**Urino genital System:** Various parts, structure and functions of the kidney and urinary tract. Physiology of urine formation, output and factors controlling it. Physiology of Special Senses: basic anatomy and physiology of the eye (vision), ear (hearing), taste buds (Tongue), nose (smell) and skin (touch and pain).

#### **Unit –V**

**Health Education (Epidemiology) and Family Planning. Elementary pathology –** Diseased and pathological processes. Inflammation and repair, Retrograde changes including disturbances of metabolism, circulation like haemorrhage, thrombosis and growth including various tumours (Neoplasm's). Embolism, infarction, Oedema and shock. Nutritional disorder (Vitamin deficiency)

**Examination:** One question from each unit with internal choice.

#### **Text Books:**

1. Principles of anatomy and physiology by Tortora G.J., and N.P. Anagnokokos,
2. Principles of Anatomy and Physiology by Ross & Wilson.

#### **Reference Books:**

1. Human Physiology by C.C. Chatterjee, Medical Allied Agency, India.
2. Text Book of Medicinal Physiology by A.C. Guyton, W.B. Prism Books Pvt. Ltd.,

SUBJECT CODE	SUBJECT
PYT.1.102	PHARMACEUTICAL INORGANIC CHEMISTRY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. List out the classification of inorganic pharmaceuticals. Evaluate the impurities in inorganic pharmaceuticals & drugs through limit test. Analyze cations & anions through systematic qualitative analysis.

CO2. Define & explain the preparation and assay methods of G.I, Electrolytes. Understand the importance of acid base regulation & Dialysis fluids.

CO3. Acquire knowledge on definition, preparation & assay procedures of Mineral Nutrients & Pharmaceutical aids.

CO4. Explain the definition, preparation & assay methods of expectorants, emetics, antidotes & inhalants & know their usefulness in medicine

CO5. Acquire knowledge on Topical agents, dental products & other medicinal agents & Explain their preparation, assay properties & uses.

**Unit –I**

- a) Classification of Inorganic Pharmaceuticals based on their applications, therapeutic classes with example and uses.
- b) Quality control and tests for purity, qualitative tests for anions and cations.
- c) Limit test for Arsenic, heavy metals, Mercury, lead, iron, chloride and Sulphate and Pharmacopoeial Standards.

**Note: following units all the compounds are of IP except which are mentioned as BP.**

**Unit –II**

**Definition, Preparation, Properties, Assay methods, Limit tests and Uses**

a) **Gastro –intestinal agents:** i. Acidifiers and Antacids: IP: Dilute hydrochloric acid, sodium acid phosphate, sodium bicarbonate, sodium citrate, Potassium citrate, Aluminium hydroxide gel, Dried Aluminium hydroxide gel, Magnesium oxide (Magnesia), Magnesium-hydroxide mixture, Magnesium carbonate, Magnesium trisilicate, Calcium carbonate.

ii. Adsorbents and Related Drugs: Light kaolin, Heavy kaolin, Activated charcoal.

Laxatives: Magnesium Sulphate and sodium phosphate.

**b) Electrolytes:** Sodium, Potassium and Calcium replenishers.

(i) Sodium and Potassium replenishers: Sodium chloride (compound, injection and Ringer solution), Sodium chloride and dextrose injection, Potassium chloride and oral electrolytes.

(ii) Calcium Replenishers: Calcium chloride, Calcium gluconate, dibasic calcium phosphate.

**c) Acid base Regulators:** Sodium bicarbonate, sodium lactate injection, sodium citrate / Potassium citrate, sodium acetate, Ammonium chloride, Ammonium chloride injection.

**d) Dialysis fluids:** Haemodialysis fluids and intraperitoneal dialysis fluids.

### Unit –III

#### Definition, Preparation, Properties, Assay methods, Limit tests and Uses

**(a) Mineral Nutrients:** i.Haematinics: Ferrous Sulphate, Ferrous fumarate, Ferrous gluconate, Ferric ammonium citrate, iron and dextrose injection.

ii.Metallics: Copper, Manganese and Zinc compounds (zinc chloride);

iii.Phosphates: Sodium acid phosphate and Sodium phosphate,

iv.Halogens: Iodine and Iodides or fluorides.

**(b) Pharmaceutical aids:** i.Adsorbents & Absorbents: Activated charcoal, aluminium sulphate, and aluminium phosphate.

ii.Antioxidants: Sodium Sulphite, sodium bisulphate and sodium metabisulphite.

iii.Desiccants: Silica gel.

iv.Excipients: Dicalcium & Tricalcium Phosphate, Magnesium stearate, Talc & ppted chalk.

v.Suspending agents: Bentonite, colloidal silica, aluminiumstearate,.

vi.Colourants: Titanium oxide, ferric oxide

vii.Solvent and Vehicle: Purified water

### Unit –IV

#### Definition, Preparation, Properties, Assay methods, Limit tests and Uses

**i. Expectorants:** of Ammonium chloride, Potassium Iodide.

**ii. Emetics:** Potassium antimony tartarate, copper Sulphate, Zinc Sulphate.

**iii. Antidotes:** Sodium thiosulphate, sodium thiosulphate injection, sodium nitrite.

**iv. Inhalants:** Oxygen, Nitrous oxide, dilute solution of ammonia (BP), Ammonium carbonate (BP).

### Unit –V

#### Definition, Preparation, Properties, Assay methods, Limit tests and Uses

**(a) Topical agents:** i.Astringents: ZnSO<sub>4</sub>, Zinc Oxide, Calcium Hydroxide, CuSO<sub>4</sub> and Bismuth subcarbonate.

ii.Topical protectants: Zinc oxide, Calamine, Zinc stearate, Talc, Titanium-dioxide, Heavy kaolin and Light kaolin

iii.Silicone polymers: Activated Dimethicone.

Anti infectives: Hydrogen peroxide, Potassium permanganate, Silver Nitrate (Silver protein), Iodine, (solutions, povidone iodine), boric acid, zinc undecylenate, Mercury compounds (Yellow mercuric oxide, Ammoniated Mercury). Sulphur, Selenium sulphide.

**(b) Dental products:** i.Fluorides: Sodium fluoride, Sodium Monofluorophosphate and stannous fluoride.

ii.Oral antiseptics and Astringents: Hydrogen peroxide, Sodium peroxide (BP), Magnesium peroxide, Zinc peroxide and Mouth washes

iii.Dentifrices: Calcium carbonate, dibasic calcium phosphate, calcium phosphate, sodium metaphosphate and strontium chloride.

iv.Cements and Fillers: Zinc oxide.

**(c) Other Medicinal agents:** i.Internal parasiticides: Sodium Antimony Gluconate

ii.Anti-neoplastic agents: Cisplatin.

iii.Sedative-hypnotics: Potassium bromide

iv.Anti-depressants: Lithium carbonate

v.Anti-rheumatic agents: Sodium aurothiomalate

vi.Anti-thyroid agents: Potassium perchlorate

vii.Diagnostic agent: Barium Sulphate

viii.Surgical aid: Plaster of Paris

**Examination :** One question from each unit with internal choice.

### **Text Books**

1. Bentley & Driver's Text book of Pharmaceutical chemistry Ed: L. M. Atherden, 1983, Oxford University press, Delhi.

2. Inorganic Medicinal & Pharmaceutical chemistry; J. H. Block, F. B. Roche, T.O. Soine, C.V. Wilson, 1986, Varghese publishing house.

3. Inorganic Pharmaceutical chemistry; P. Gundu Rao, Vallabh Prakashan 1995,

Delhi

### **Reference Books**

1. Pharmacopoeia; (Indian, British, US and European)
2. Martindale: The Extra Pharmacopoeia; 31st Edn, 1996, The Royal Pharmaceutical Society.
3. Remington Pharmaceutical sciences; 20th Edition Lippincott Williams and Wilkins.
4. Hand Book of Pharmacy & Health care Ed: Robin. J. Haiwan 1990, The Pharm Press, UK



SUBJECT CODE	SUBJECT
PYT.1.103	PHARMACEUTICS –I (GENERAL & DISPENSING PHARMACY)

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Impart the knowledge of history of profession of pharmacy and also understand the basics of different dosage forms, Pharmaceutical calculations.

CO2. Understand the professional way of handling the prescription and dispensing the prescriptions and the principals involved and procedures adopted in preparation, labelling and dispensing of typical products and also uses of official and other products in common use.

CO3. Impact the knowledge during manufacturing of liquid pharmaceutical preparations

CO4. Document, maintain the various records in experimental stage and during manufacturing of semisolids and pharmaceutical incompatibilities and methods to overcome and handling of incompatible prescriptions.

CO5. Understand the methods of preparation and uses of Tinctures and extracts in official and also uses of medicinal gases. Handling & storage along with radiopharmaceuticals. Meet the challenges occur in practicing Pharmacy profession.

**Unit –I**

**Pharmacy profession:** Pharmacy as a career, Pharmaceutical Education, Registration as a Pharmacist, Brief introduction to Evolution of Pharmacy, European and American Pharmacy. Pharmacopoeia (IP, BP, USP and International) and other sources, SI and imperial systems, inter conversions. Weighing -selection and care of weights and balances. Sensitivity and minimum weighable quantities.

**Pharmaceutical calculations:** Calculations of doses, enlarging and reducing recipes; Percentage solutions, alligation, alcohol dilutes and proof spirit.

**Unit –II**

**Prescription:** Definition, Parts, sources of errors and care required in dispensing prescriptions, General Dispensing procedures, types of dispensing products. Dispensing of proprietary medicine. Prescription containers, closures and labelling of dispensed products, colours, flavours and sweeteners used in prescription.

**Dosage form:** Definition, Advantages and limitations of dosage form. Principals involved and procedures adopted in preparation, labelling and dispensing of typical products. (Unit III-IV). Uses of official and other products in common use.

### **Unit III**

**Liquid preparation:** Aromatic waters, spirits, solutions, mixtures, syrups, elixirs, suspension, emulsion, lotions, liniments, eye, ear and nasal drops, inhalations, throat paints, gargles, glycerin and collodions.

### **Unit –IV**

**Semisolids:** Ointments and their bases, creams, jellies, suppositories and their bases, effervescent granules, tablet triturates, pastilles, lozenges and pills.

**Incompatibilities:** Physical, Chemical and Therapeutic incompatibilities. Methods of overcoming and handling of incompatible prescriptions.

### **Unit –V**

**Tinctures and Extracts:** Methods of preparation and uses of Tinctures & Extracts official in IP.

**Medicinal Gases:** Official medical gases and uses, containers and fitting, handling and storage.

**Radio Pharmaceuticals:** Preparation, Therapeutic and Diagnostic uses.

**Examination :** One question from each unit with internal choice.

### **Text Books:**

1. Bentley's text book of pharmaceuticals, Rawlkins, 8th edn. ELBS Publishers.
2. Cooper & Gunn's dispensing for Pharmaceutical students, Carter CBS Publishers, Delhi.

### **Reference Books:**

1. Introduction to pharmaceutical dosage forms, HC. Ansel 5th ed. 1990.
2. Dispensing of Medication, Ed. E.W. Martin, Mach Publishing Co., Eastern PA.



SUBJECT CODE	SUBJECT
PYT.1.104	BIOLOGY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe plant kingdom, plant cells, Tissues & their functions, Morphology & Histology.

CO2. Sketch the Taxonomical features of different medicinal & Economical important plants.

CO3. Summarize plant physiology, DNA replication, Genetic code & Heredity.

CO4. Demonstrate Animal tissues & study of different systems of frog.

CO5. Describe the principles of morphology & life History of Human parasites.

**Unit –I**

**Plant Kingdom:** Definition and Classification

**Plant cells:** Its structure, living and non-living inclusions. Different types of plant tissues and their functions, Mitosis and Meiosis.

**Morphology and Histology:** Roots, Stems, Barks, Woods, Leaf, Flower, Fruit and Seed.

**Modification:** Root, Stem, Leaf and Inflorescence.

**Unit –II**

**Plant Taxonomy:** Classification, study of the following families with special references to medicinal and economical important plants a) Apocynaceae b) Solanaceae c) Umbelliferae d) Leguminosae e) Scrophulariaceae f) Rubiaceae

**Unit –III**

**Plant Physiology:** Absorption, transpiration, respiration photosynthesis, basis in DNA replication.

**Genetic code and Heredity:** Polyploidy, hybridization and mutation.

**Unit –IV**

**The study of animal cell:** Animal tissue and cell division, difference between plant cell and animal cell, study of different systems of frog. Histology of liver, kidney, skeletal muscles, smooth muscles, pancreas, intestine and endocrine glands of rabbit.

## Unit –V

**Morphology and Life History of Human Parasites:** Plasmodium, Entamoeba, tapeworm, ascaris, leishmania, anchylostoma and trypanosoma. Life history of Mosquitoes and housefly as agents for spreading diseases.

**Examination :** One question from each unit with internal choice.

### **Text Books:**

1. A text book of botany, by A.C. Dutta
2. A text book of biology by Vikram series



SUBJECT CODE	SUBJECT
PYT.1.104	MATHEMATICS

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Learn the definitions of logarithm to understand & apply to solve the problems. Different formulae to memorize & apply to different examples.

CO2. Provides knowledge on differential calculus. It requires to apply the methods to solve the problems and also to memorize & recite them to effectively use for solution of problems.

CO3. This course comprises of Integral calculus. It has to interpreted properly to apply to solve the problems. This involves solving problems using the formulae which have to memorized.

CO4. This course comprises of matrices definitions their types. It imparts knowledge on matrices. It requires concentration & knowledge to solve them.

CO5. Concentrate on bio-mathematical principles also includes 2D-Geometry, equation of line & circle. This requires to use and draw diagrams to understand and solve the problem by using creativity. By constructing & inferring results effectively problems can be so head.

**Unit –I**

**Logarithms:** Logarithm of a real number to an arbitrary base, Napierion Base -Theorems on Logarithms -Use of Tables.

**Trigonometry:** Measurement of angles, Trigonometrical ratios and simple relations connecting the complimentary and supplementary angles, Negative angles sum and difference of two angles, sine and cosine formulae for multiple angles and half angles.

**Unit –II**

**Differential Calculus:** Functions, Limits, Differential coefficient rules, Differentiation of a sum, product and quotient of functions, Differentiation from first principles, Differentiation of implicit, Geometrical, composite and inverse functions, Partial Differentiation, Maxima and Minima.

**Unit–III**

**Integral Calculus:** Integration considered as converse of differentiation, simple integrations, standard forms like  $x dx$ ,  $\sin(ax) dx$ ,  $\cos(ax) dx$ ,  $\sec(ax) dx$  etc. Methods of substitution,

simple example integration by parts. Integration of rational, irrational, trigonometrical functions. Calculations of areas of standard bodies using integration.

#### **Unit–IV**

**Matrices:** Matrices, basic definitions, matrix operations, transpose, adjoint, rank, inverse of a matrix, solution of linear systems of equations, matrix inversion, Gaussian elimination.

#### **Unit–V**

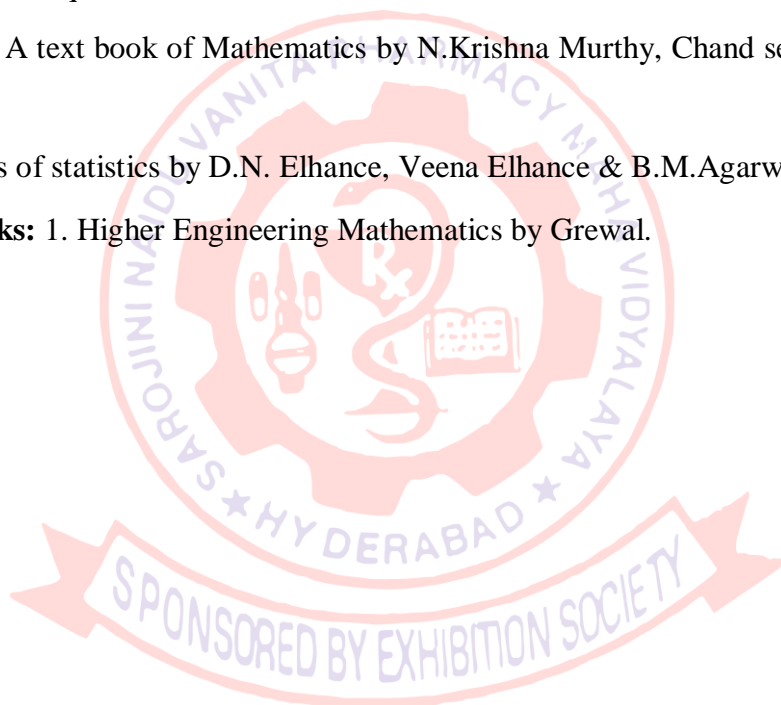
**Biomathematics:** Basic Mathematical Principles that are commonly used in Biological testing, integers, linear and non-linear graphs, 2d Coordinate geometry, Equation of line, circle.

**Examination :** One question from each unit with internal choice.

**Text Books:** 1. A text book of Mathematics by N.Krishna Murthy, Chand series, Volume- I and II

2. Fundamentals of statistics by D.N. Elhance, Veena Elhance & B.M.Agarwal.

**Reference Books:** 1. Higher Engineering Mathematics by Grewal.



SUBJECT CODE	SUBJECT
PYT.1.105	BASIC COMPUTER APPLICATIONS

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. This course comprises of evolution, History, structure of computer. It helps to acquire knowledge about computer & explains the architecture of it. Also gives insight about types of printer's principles of flow charting & operating systems like MS Dos, UNIX& windows.

CO2. This course helps to learn the programming language 'C' Also emphasis on how to apply knowledge to solve real life situation problems. Ensures knowledge of operators, expressions, data input-output control statements etc.

CO3. Helps to learn & practice the MS Office which includes MS word & MS Excel. This helps to organize data through different commands & MS Excel functions. Helps to make good documentation & formatting text.

CO4. Focuses on learning Ms-Office which includes Ms-power point & Ms-Access. This teaches to how effectively data can be presented through MS Power point & also how data can be solved & accessed through MS Access. It helps to understand & write effective reports.

CO5. To understand the concepts of internet, Browsers, Search engines, www.email which helps to communicate with people around the world. Also teaches how to write & design web page through HTML. It emphasizes to use SQL commands & Design database.

**Unit –I**

**Computer Concepts:** Evolution, Basic structure and Characteristics of computers; Types of memory chips; Study of various input -out put devices like magnetic tapes, magnetic discs, MICR, OCR, CDROMS etc., Types of printers; Principles of flow charting; Importance of operating systems, detailed study of the operating systems MSDOS , UNIX and WINDOWS; Computer Viruses

**Unit –II**

**Programming In 'C' Language** Operators, Expressions, Data input, Output, Control statements like - (IF-ELSE, WHILE DO, FOR, BREAK AND CONTINUE and GOTO) Functions, Library functions, Arrays.

## **Unit –III**

### **Introduction to Ms-Office (Word & Excel)**

**MS-Word:** Basics, working with files, working with text, formatting paragraphs, styles, lists, tables, Graphics, spellings and grammar and page formatting macros, table of contents.

**MS-Excel:** Basics, Spreadsheets, data types, formulas, formatting, charts, graphs.

## **Unit –IV**

### **Introduction to Ms-Office (Power Point & Access)**

**MS-Power Point:** Power point basics, Views, Slide control, Apply design, Page setup, Templates, Background, Control, Colour Screens, Transitions and animations, working with texts and working with graphics.

**MS-Access:** Data base concepts, Screen layouts, Creating tables, Data sheet records, table relationships, Sorting and filtering, Queries, forms, form controls, Sub forms, reports, importing, exporting, linking.

## **Unit –V**

**Information Infrastructure Internet and World Wide Web (WWW):** Structure and Organization of the WWW, Browsers, Information search in WWW, search engines, Pharmaceutical resources in WWW Types of indexing tools & search strategies; Hyper Text Manuscript Language (HTML) and E-Mail.

**Introduction to Structured Query Language (SQL):** Overview of SQL Reserved Words; SQL Commands, Comparison for Access and SQL Server; Chemical Database Design & their Tools

**Examination :** One question from each unit with internal choice.

### **Text Books:**

1. Fundamentals of Computers by P.K. Sinha
2. Let Us C by Yashvanth Kanetkar
3. Working in Microsoft Office By Ron Mansfield
4. SQL, PL/SQL The Programming Language of Oracle by Ivan Bayross

### **Reference Books:**

1. Programming with 'C' by Byron Goltfield- Schum series
2. Computer programming in 'C' by Y. Raja Raman

SUBJECT CODE	SUBJECT
PYT.1.106	ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Identify different bones, tissues, organs of human body.

CO2. Analyze the hematological tests like blood cell count hemoglobine estimation, bleeding/clotting time, ESR etc.

CO3. Analyze blood pressure & vital capacity.

01. Study of histological slides of different tissues / organs

02. Study of various models, specimens of bones / organs

03. Hematology – blood grouping

04. Hemoglobin content estimation

05. Estimation of bleeding time

06. Estimation of clotting time

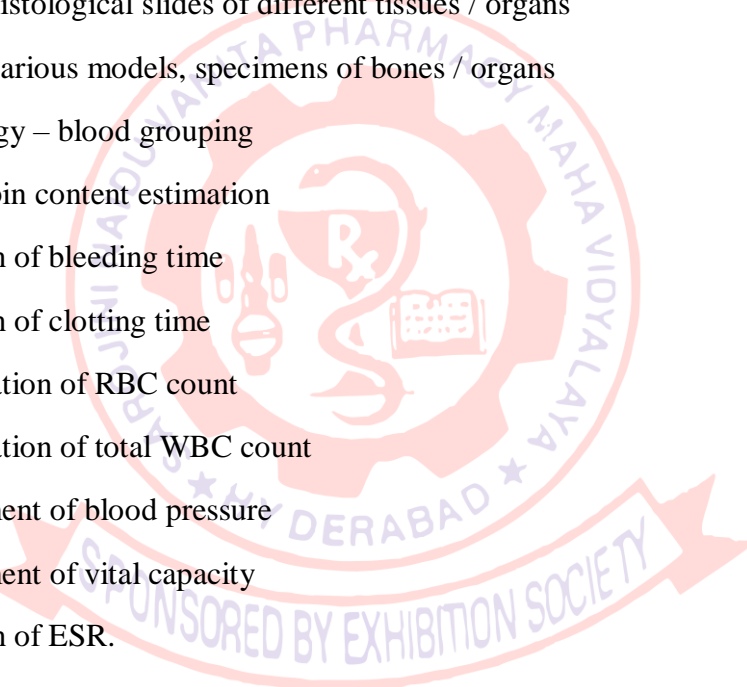
07. Determination of RBC count

08. Determination of total WBC count

09. Measurement of blood pressure

10. Measurement of vital capacity

11. Estimation of ESR.



SUBJECT CODE	SUBJECT
PYT.1.107	PHARMACEUTICAL INORGANIC CHEMISTRY LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Able to analyse cations & anions through systematic qualitative analysis.
- CO2. Evaluate the impurities present in inorganic pharmaceuticals & drugs and find their pharmacopoeia limits.
- CO3. Create the method of preparation of inorganic pharmaceuticals & memorize their uses.

**Systematic quantitative analysis for inorganic mixtures up to 4 radicals preferably by semi-micro methods.**

01. Pharmacopoeial limit test for Chlorides
02. Pharmacopoeial limit test for Sulphates.
03. Pharmacopoeial limit test for lead.
04. Pharmacopoeial limit test for iron.
05. Preparation and purification of Boric acid
06. Preparation and purification of sodium citrate
07. Preparation and purification of potash alum.
08. Preparation and purification of yellow mercuric oxide.
09. Preparation and purification of Ammoniated Mercury.



SUBJECT CODE	SUBJECT
PYT.1.108	PHARMACEUTICS – I LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Impart the knowledge about the principle, Procedure involving pharmaceutical calculations, dosage calculations for pediatric and geriatric patients.</p> <p>CO2 Understand the incompatibility studies in few simple dosage forms</p> <p>CO3. Impart the knowledge about the principle and procedure regarding the liquid dosage forms including labeling &amp; packing procedure as well as containers.</p> <p>CO4: Impart the knowledge about the principle and procedure regarding the semi-solids including labeling &amp; packaging procedure as well as containers.</p> <p>CO5: Impart the knowledge about the principle and procedure regarding the solids (effervescent granules) including labeling &amp; packaging procedure as well as containers.</p>	

**Dispensing Procedures involving pharmaceutical calculation, dosage calculations for pediatric and geriatric patients**

01. Incompatibility studies in few simple dosage forms.
02. Preparation of Aromatic waters
03. Preparation of spirits
04. Preparation of different types of iodine solution
05. Preparation of cresol soap solution
06. Preparation of compound Sulphur & Calamine lotion
07. Preparation of turpentine liniment
08. Preparation of gargles and throat paint
09. Preparation of sulphur ointment
10. Preparation simple ointment
11. Preparation of whitfield ointment
12. Preparation of non staining iodine ointment
13. Preparation of creams & pastes

14. Preparation of any glycerogelatine based suppository
15. Preparation of Tragacanth jelly
16. Preparation of effervescent granules
17. Preparation of simple syrup
18. Preparation of ear / eye drops



SUBJECT CODE	SUBJECT
PYT.1.109	BIOLOGY LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Explain the study of plant parts &amp; their modifications.</p> <p>CO2. Perform Histology of crude drugs, different organs &amp; tissues through permanent slides.</p> <p>CO3. Identify different systems of frog.</p>	

01. Study of plant parts and their modification
02. Study of representative of families – Apocynaceae, Solanaceae, Umbelliferae, Rubiaceae
03. Histology of following crude drugs – Cinchona, Clove, Coriander, Linseed
04. Histological study of different organs through permanent slides
05. Study of various tissues through permanent slides
06. Study of digestive system of frog
07. Study of arterial and venous system of frog
08. Study of male urinogenital system of frog
09. Study of female urinogenital system of frog
10. Study of renal portal system of frog
11. Study of skeletal system of frog
12. Study of spinal nerves system of frog

SUBJECT CODE	SUBJECT
PYT.1.110	BASIC COMPUTER APPLICATIONS

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Learn M S Dos commands. This enables to understand how to interact with computer also emphasizes on memorizing the commands.

CO2. This course gives hands on experience to work with Ms-Office. Exercises are well designed to improve computer skills in Ms-word, Ms-Excel, Ms-PowerPoint and Ms-Access. Ability to design and develop documents, Excel sheets, reports presentations is imparted.

CO3. This course focuses on to understand the logic, syntax for problem solving through flowcharts and programming language 'C'. Through learning SQL (Structured query language) ensures data storage and retrieval.

01. Exercised Based on Dos commands
02. Programming in "C" Language.
03. Exercises on MS-Office.
04. Exercises based MS word
05. Exercises based on MS Excel
06. Exercises based on MS Access and Power Point.
07. Programming in SQL.

SUBJECT CODE	SUBJECT
PYT.2.101	PHARMACEUTICAL ORGANIC CHEMISTRY-I

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Define and explain the concepts of structure and reactivity of organic molecules.
- CO2. Describe the nomenclature give examples, properties, general methods of preparations & characteristic reactions and reactivity of aliphatic hydrocarbons.
- CO3. Describe the Nomenclature give examples, general methods of preparations, relative reactivity, reactions of Halogens & Hydroxy compounds.
- CO4. Describe the nomenclature give examples, general methods of preparations, relative reactivities of carbonyl compounds, carboxylic and acid derivatives.
- CO5. Describe the nomenclature; give examples general method of preparation, relative reactivities & reactions of Nitro compounds and amines.

**Unit –I Structure and Reactivity of Organic Molecules** Hybrid orbital's, Molecular orbital's and Covalent bond, Bond angles, Heterolysis, Polarity of covalent bond, Polarity of Molecules, Dipole moments, Intermolecular forces, Boiling Point, Melting Point, Solubility, Electronic effects: Inductive effect, Electromeric or Mesomeric effect and Resonance. Isomerism (structural and spatial). Reaction Progress -Activation Energy, Energy diagrams of Reactants and Products.

**Unit –II Aliphatic Hydrocarbons** Nomenclature, Physical properties, General Methods of Preparation and Characteristic reactions of Alkanes, Alkenes and Alkynes; Heats of combustion or Heats of Hydrogenation, Homologous series, Free radical reactions of Alkanes (Halogenation), Catalytic reduction and Electrophilic addition reactions of Alkenes and Alkadienes, Markonikov's Addition, Anti Markonikov's Addition, Peroxide effect or Kharasch effect, Cis-Trans reduction of alkynes, Acidity of 1-Alkynes. Electrophilic addition reactions of alkynes, stability of conjugated alkadienes and their addition reactions. General methods of preparation of Cycloalkanes: Nomenclature, ring size, stability, Bayer's strain theory, Sachse -Mohr theory, Puckered rings, Configuration and Conformations of Cycloalkanes, axial and equatorial bonds, Cis-trans Isomers.

**Unit–III Halogen and Hydroxy Compounds** Nomenclature, General Methods of preparation, Relative reactivity of Halides and Hydroxy Compounds, primary, secondary and

tertiary classes, Nucleophilic substitution reactions (SN1 and SN2) -Walden inversion, Elimination reactions (E1 and E2) -Saytzeff's rule. Nucleophilic substitution VS Elimination. Oxidation of alcohols

Ethers: Nomenclature, Properties and Synthesis (Williamson's synthesis and Ziesels Method).

**Unit-IV A) Carbonyl Compounds (Aldehydes and Ketones)** Nomenclature, General Methods of Preparation, relative reactivities of Carbonyl Compounds, Nucleophilic addition reactions, Addition-Elimination reactions -Schiff's bases, oxidative reactions.

**B) Carboxylic Acids and Acid Derivatives (Acid Halides, Anhydrides, Esters and Amides)** Nomenclature, General Methods of Preparation of Carboxylic acids, Relative acidity of Carboxylic acids, Action of alkalis, salt formation, Alpha -Halogenation and functional (Nucleophilic substitution) reactions of Carboxylic acids and methods of preparation of acid derivatives, Hydrolysis of acid derivatives, Reactivity and synthetic applications of malonic ester and aceto-acetic ester.

#### **Unit-V Nitrogen Compounds**

**A) Nitro Compounds:** Nomenclature, methods of preparation

**B) Amines:** Nomenclature, primary, secondary and tertiary types, Relative Basicity of amines, Reactions of amines, Action of Nitrous acid, alkylation and acylation, Nucleophilicity of amines, Hinsberg's method of separation of amines. Aryldiazonium salts -Reactions (synthetic applications) of aryldiazonium salts.

**Examination :** One question from each unit with internal choice.

#### **TEXT BOOKS:**

1. 'Organic Chemistry' by T.T.Morrison & R.Boyd. Prentice Hall of India Private Limited, New Delhi.
2. Organic Chemistry by FERGUSON

#### **REFERENCE BOOKS:**

1. The Fundamental Principles of organic chemistry, by I.L.Finar, ELBS, London.
2. Organic chemistry by Cram & Hammond.
3. Text Books of Pharmaceutical Chemistry, by T.M.Atherden, Bentley and Drivers, Oxford University Press, London.

SUBJECT CODE	SUBJECT
PYT.2.102	PHARMACEUTICAL ENGINEERING – I

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe the materials for the construction of Pharmaceutical Equipment's and methods to prevent corrosion and definitions of unit operations.

CO2. Explain the principles, theories measurements of fluid flow and heat transfer proceeds and its applications.

CO3. Classify the transportation of materials based on their nature and its principles of construction & uses.

CO4. Determination of humidity charts, their definitions of various terms. Write a note on air conditioning refrigerants and its applications.

CO5. Acquire knowledge and understand the principles of filtration and centrifugation methodologies.

**Unit – I**

**Materials of Construction:** Factors affecting the material selection for Pharmaceutical plants.

**Ferrous Metals:** Cast iron steels and Stainless steels,

**Non-Ferrous Metals:** Copper, Aluminum, Lead, Tin, Silver, Nickel, Zinc, Platinum, Chromium and their important alloys.

**Nonmetals:** Glass, Stoneware, Stone slate, Brick, Concrete, Asbestos, Rubber, Timber, Plastics.

**Corrosion and its Prevention:** Types of corrosion, factors influencing corrosion, theories of corrosion, methods of prevention of corrosion.

Definition of unit operations, unit processes. Steady and unsteady states, dimensionless equations, dimensional formulas, dimensional analysis, and dimensionless groups.

**Unit – II**

**Fluid Flow:** Fluid statics, manometers, types of flow, Bernoulli's theorem, losses in Mechanical energy of flowing fluids, measurement of fluids flow rate - orifice, venturi, pitot and rotameter, flow meters.

**Heat Transfer:** Nature of heat flow,

**Conduction:** - Fourier's law, thermal conductivity, compound resistance in series, heat flow through a cylinder - mean radius and mean area.

**Convection:** - Natural and forced convection, temperature gradients in forced convection, surface and overall coefficients. Parallel current and counter current flow.

**Radiation:** - black body, Stefan Boltzmann law, and gray body. Heaters, heat exchangers, Scraped surface exchangers, extended surface equipment.

**Steam as heating medium:** - properties and uses of steam traps, vacuum pumps, condensers, entrainment separators, foam and its prevention.

### Unit – III

#### Transportation of Materials

**Solids:** - Classification, principles of construction & uses of different types of conveyers, detailed study of belt, screw and pneumatic conveyers.

**Fluids:** - Pipes, tubes, joints, fittings, valves, Different types of reciprocating & rotary pumps, airlift pumps, screw pumps, monopumps, peristaltic pumps.

**Gases:** - Fans, Blowers, types of compressors, ejectors, vacuum pumps, jet pumps.

### Unit – IV

**Humidification dehumidification and air conditioning:** Definition of various terms, wet bulb and adiabatic saturation temperatures, humidity chart, determination of humidity, methods of increasing and decreasing humidity. Air conditioning - applications in pharmacy.

**Refrigeration:** Definition; compression and absorption; types of refrigeration cycles; coefficient of performance, refrigerants and their choice; Brine systems, load and applications in pharmacy.

### Unit – V

**Filtration:** Laboratory filtration equipment, classification of industrial filters, sand filters, chamber press, plate & frame filter press, brief description of leaf filters, rotary continuous



Filters, top feed filters, streamline & meta filters, choice of filtration unit. Membrane filters, Air filtration. Filter operation - effect of pressure, filter aids, Filter media, factors affecting rate of filtration, pretreatment of materials. Filtration theory - Mechanism of filtration, Kozeny equation and its limitations.

**Centrifugation:** Theoretical considerations, large scale centrifuges classification, perforated & non perforated basket centrifuges, disc centrifuge bowls, tubular bowl centrifuges, horizontal centrifuges, continuous centrifuges, vertical solid bowl centrifuge, laboratory equipment.

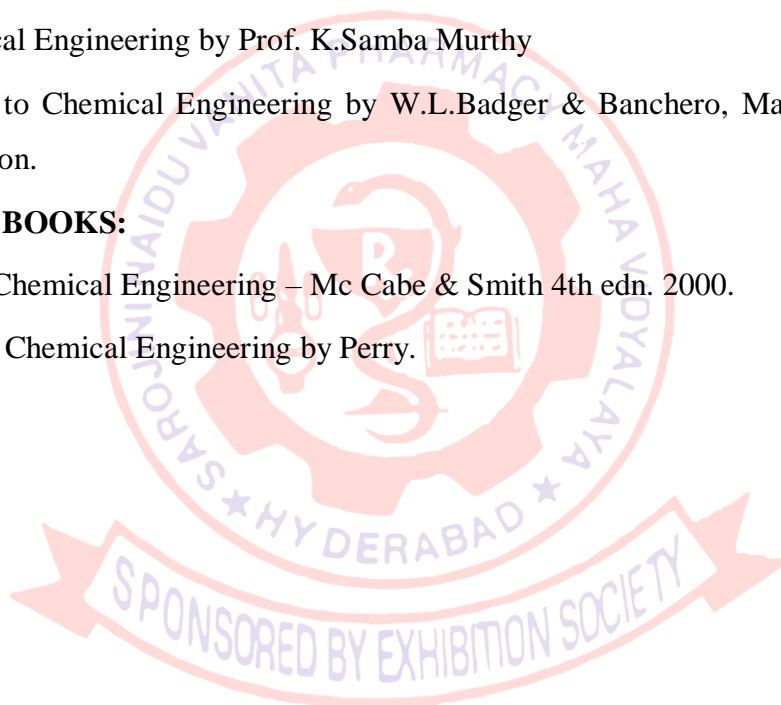
**Examination :** One question from each unit with internal choice.

**TEXT BOOKS:**

1. Pharmaceutical Engineering by Prof. K.Samba Murthy
2. Introduction to Chemical Engineering by W.L.Badger & Banchemo, Macrohll Int. book company, London.

**REFERENCE BOOKS:**

1. Elements of Chemical Engineering – Mc Cabe & Smith 4th edn. 2000.
2. Handbook of Chemical Engineering by Perry.



SUBJECT CODE	SUBJECT
PYT.2.103	PHARMACEUTICAL ANALYSIS – I (CHEMICAL ANALYSIS)

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Explain the fundamental concepts of volumetric analysis.
- CO2. Explain and apply the principles of Neutralization titrations.
- CO3. Explain and apply the principles of redox titrations and gravimetric analysis.
- CO4. Explain and apply complexometric precipitation, nonaqueous titrations and gas analysis.
- CO5. To recall and acquire knowledge on computation of analytical results.

**Unit – I**

Computation of analytical results - Significant figures, Concept of error, precision, accuracy, Specificity, sensitivity, detection limit, linearity and range, ruggedness, standard deviation  
Rejection of doubtful values with special reference to volumetric and gravimetric analysis.  
Calibration of analytical equipment. Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.

**Unit – II**

Physico-chemical concepts required for analysis such as electrolytic dissociation, Modern theory of acids, bases and salts - Bronstead - Lowry theory, Lewis electronic theory; chemical equilibrium, pH and buffer action, solubility product, common ion effect, hydrolysis of salts and amphoteric substances.

Principles of Neutralization reactions; Theory of indicators and Neutralization indicators.

**Unit – III**

Principles of oxidation -reduction titrations, redox, self-indicators and their use, reactions in Pharmaceutical analysis precipitation. Principles of gravimetric analysis - typical methods involving precipitation, coagulation, digestion, drying procedures, co-precipitation.

#### **Unit – IV**

Theory and applications of complexometric titrations, argentometry, iodometry, potassiumiodate, potassium bromate, EDT A, non-aqueous titrations redox titration's, ammonium sulphate,titanous chloride. Principles of gas analysis.

#### **Unit – V**

Stoichiometry of Ionic equations and Solutions: The Mole concept, Measuring of Moles of Elements and Compounds; Percentage Composition; Empirical and Molecular Formula; Balancing of Chemical Equations; Some analytical problems and calculations based on mass balance, limiting reagent theoretical yield and percentage yield; The theory, principles and applications of gravimetric and gas analysis are analyzed.

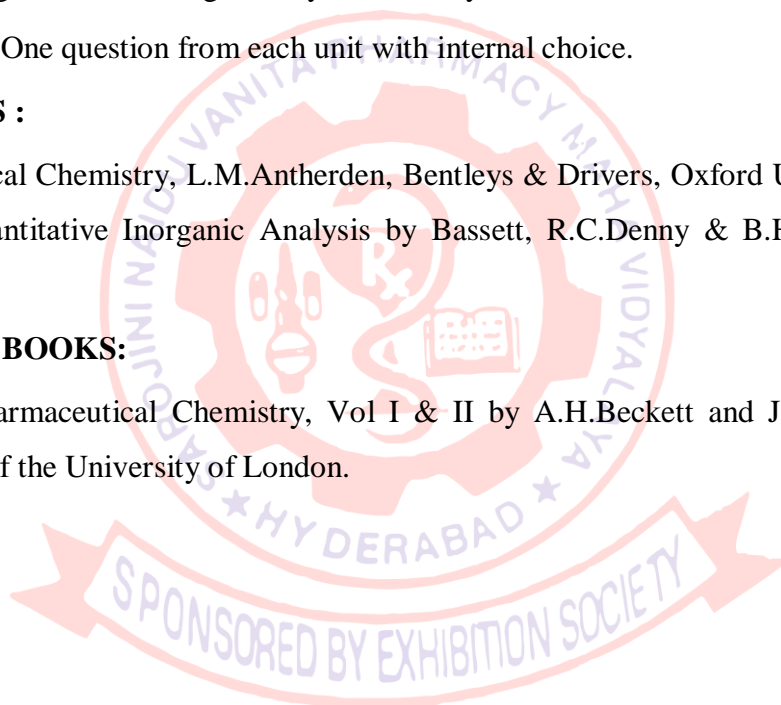
**Examination :** One question from each unit with internal choice.

#### **TEXT BOOKS :**

1. Pharmaceutical Chemistry, L.M.Antherden, Bentleys & Drivers, Oxford Univ. Press, U.K.
2. Vogel's Quantitative Inorganic Analysis by Bassett, R.C.Denny & B.H.Jeffery, ELBS, U.K.,

#### **REFERENCE BOOKS:**

1. Practical Pharmaceutical Chemistry, Vol I & II by A.H.Beckett and J.B.Stanlake, The Athlone Press of the University of London.



SUBJECT CODE	SUBJECT
PYT.2.104	PHARMACEUTICAL. MICROBIOLOGY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Explain microbiology and Microscopy. Write the taxonomical classification of different Micro-organisms and their significance in pharmacy. Explain the Nutrition, cultivation Isolation, Identification and preservation techniques used for Bacteria.

CO2. Enumerate the different Bio-Chemical reactions employed to identify the Micro-organisms. Explain the physiology and Reproduction of bacteria, actinomycetes, fungi, yeasts and viruses. Write about mutations and mutants various factors influencing mutations and their repair mechanism.

CO3. Explain sterilization and different methods involved in sterilization. Enumerate the factors involved in disinfection.

CO4. Describe the general principles of Immunology and serology with their applications.

CO5. Explain the term infection and write about communicable diseases and their prevention like tuberculosis, typhoid, Diphtheria, Whooping cough plague, Malaria, filariasis, Influenza. Explain the systemic studies of E.Coli, Pencillium species, streptomyces, Explain the microbiology of milk and water.

**Unit – I**

**Introduction to the Science of Microbiology and Microscopy.** Groups of microbes(bacteria, fungi, virus and actinomycetes) classification, macro and micro morphology and taxonomy. Different methods of bacterial count. Nutrition, Cultivation, Isolation, Identification and Preservation of pure cultures. Organisms important in Pharmacy.

**Unit – II**

Different biochemical reactions employed in identification of organisms, stains and staining, tolerance, Physiology and reproduction of bacteria, actinomycetes, fungi, yeasts and viruses.

**Microbial genetics and Variation:** Introduction, genetic organization, mutation, mutagens, different types of mutants, physical and chemical mutagenesis repair mechanism and their isolation.

### **Unit – III**

**Disinfections:** Factors influencing disinfections, dynamics of disinfections, different groups of disinfectants and antiseptics and their evaluation and applications.

**Sterilization:** Premises and Equipment, detailed evaluation and application of different sterilization methods. Sterilization indicators and their importance.

### **Unit – IV**

Microbial attack and host defense, virulence and pathogenicity, primary and specific defensive mechanisms of body. General Principles of immunology and their applications.

**Immunogenetics:** Classification and principles of different types of immunity, Immune systems - humoral immunity, cellular immunity and tolerance. Phagocytosis, Hypersensitivity and other reactions.

General Principles of Serology and Chemical nature of antigens, antibodies. Different antigen-antibody reactions and their applications. Precipitation, agglutination and their significance in diagnosis and diagnostic tests. Different antigens of bacterial cells, monophasic and biphasic variation. Bacterial exotoxins and endotoxins, Toxoids.

### **Unit – V**

**General principles of infection and communicable diseases.** Significant symptoms, General modes of transmission of the following epidemic and endemic diseases.

a) Tuberculosis, cholera, typhoid. b) Diphtheria, whooping cough. c) Plague, malaria, filariasis, influenza. d) Infective hepatitis, poliomyelitis.

**Systematic studies of a few selected organisms** - E.Coli, Penicillium sps, Streptomyces sps, and Saccharomyces sps. Microbiology of water and milk.

**Examination :** One question from each unit with internal choice.

### **TEXT BOOKS :**

1. Text book of Microbiology by Pelezzair & Reid
2. Text book of Microbiology – Probisher

SUBJECT CODE	SUBJECT
PYT.2.105	COMMUNICATIVE ENGLISH

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Describe the role & importance of different types of communication.
- CO2. Apply communication through letters, memos, circulars & notices
- CO3. Categorize the importance of English Grammar. Summarize the concepts of learning & listening.
- CO4. Write essays on different topics

**Unit –I**

Role and Importance of Communication; Verbal and Non-Verbal Communication; Group Communication, Effective Communication; Barriers to communication; Communication Mediums; Participating in discussions, Conduct of Seminars, Conferences etc., Making Presentations through collection, evaluation, organizing the information; Interacting with learners and teachers; Role of Wit and Humor in Communication

**Unit –II**

Spoken English Vs Written English; Formal / Informal English (one way/two way); British/ American/Indian English; How to introduce one self and others; How to tender apology; How to thank in different ways; Greetings; Some Polite Expressions; Agreements and Disagreements; How to use a dictionary; How to use a Thesaurus; Vocabulary Development; Synonyms and antonyms; Single word substitutes; comprehensions

**Unit –III**

Communication through Letters; Official and Personal Letters; Letters of complaint; Letters of Enquiries; and Responses; Writing Memos, Circulars and Notices; What to avoid while writing; Writing Paragraph, Document and Scientific/Technical Report; Drafting & Delivering a Speech

**Unit –IV**

Grammar in English: Tenses; Voice; Articles; Direct and Indirect speech; Degrees of Comparison; Common errors in English made by Indian Learners of English Concepts of

Learning and Listening: Types and Methods of Learning and Listening; Learning and Listening of Knowledge, Attitudes, Skills and Practices

### **Unit –V**

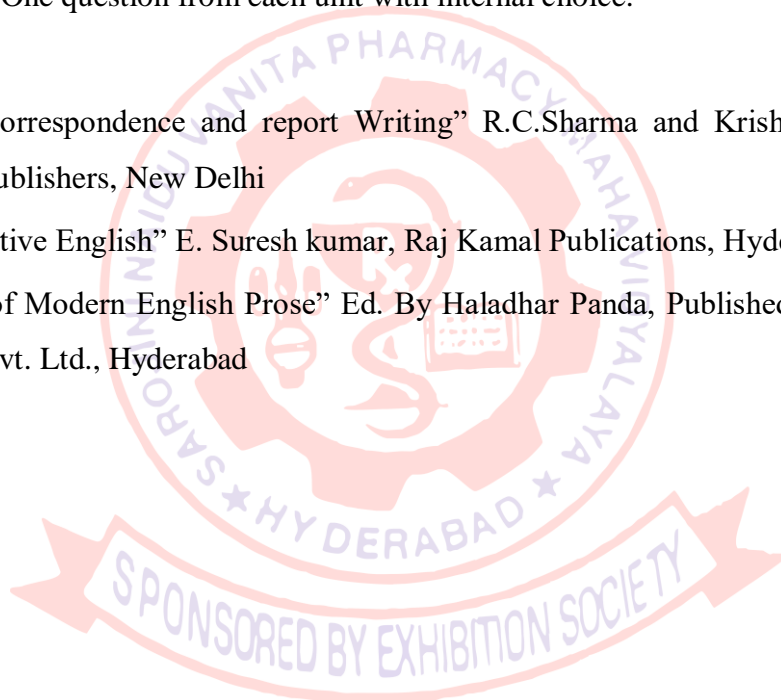
The following Four Essays from “Selections from ModernEnglish” prose Edited by Haladhar Panda are prescribed.

1. “Our Own Civilization” -C.EM. Joad
2. “Andrew Carnegie” -E.H Carter
3. “The Secret of work” -Swami Vivekananda
4. “The Generation Gap” -Benjamin Spock

**Examination :** One question from each unit with internal choice.

### **BOOKS:**

1. “Business Correspondence and report Writing” R.C.Sharma and Krishna Mohan, Tata McGraw Hill Publishers, New Delhi
2. “Communicative English” E. Suresh kumar, Raj Kamal Publications, Hyderabad
3. “Selections of Modern English Prose” Ed. By Haladhar Panda, Published by Universities Press 9 India) Pvt. Ltd., Hyderabad



SUBJECT CODE	SUBJECT
PYP 2.106.	PHARMACEUTICAL ORGANIC CHEMISTRY – I LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. To understand & acknowledge various laboratory techniques of organic chemistry lab.

CO2. To perform systemic qualitative analysis of unknown organic compounds.

CO3. To understand reaction mechanisms involved in synthesis of various organic compounds.

1. Organic Chemistry laboratory techniques.
2. Experiments in simple qualitative analysis including preparation of derivatives.
  1. Nitration : Preparation of Nitrobenzene from Benzene.
  2. Halogenation : Preparation of p-Bromo acetanilide from Acetanilide.
  3. Oxidation : Preparation of Benzoic acid from toluene or Benzylchloride
  4. Reduction : Preparation of m-Nitroaniline from m-Dinitro Benzene.
  5. Esterification : Preparation of n-Butyl acetate from n-Butyl alcohol.
  6. Acetylation : Preparation of Acetanilide from Aniline.
  7. Etherification : Preparation of  $\beta$ -Naphthyl methyl ether from  $\beta$ -Naphthol.
  8. Hydrolysis (Saponification ) : Preparation of Benzoic Acid from Methyl Benzoate  
OR Preparation of Benzoic acid from Benzamide.



SUBJECT CODE	SUBJECT
PYP 2.107.	PHARMACEUTICAL ANALYSIS – I

**COURSE OUTCOMES:**

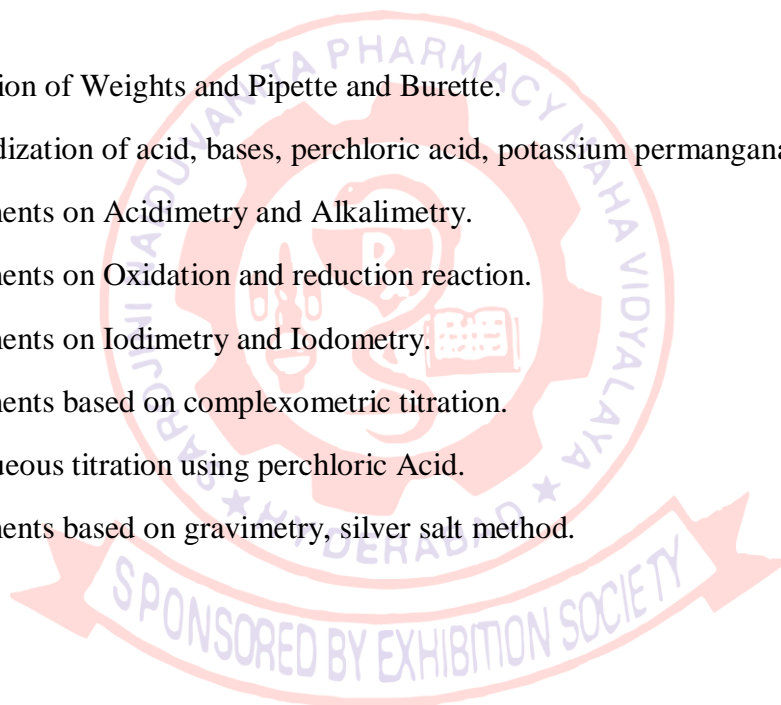
**Upon completion of the syllabus students should be able to**

CO1. To apply the concept of calibration of various glassware used in analytical techniques.

CO2. To apply the concept of Standardization & Estimation of various compounds using different volumetric titrations.

CO3. To apply the concept of Estimation of compounds by gravimetric methods.

1. Calibration of Weights and Pipette and Burette.
2. Standardization of acid, bases, perchloric acid, potassium permanganate EDTA.
3. Experiments on Acidimetry and Alkalimetry.
4. Experiments on Oxidation and reduction reaction.
5. Experiments on Iodimetry and Iodometry.
6. Experiments based on complexometric titration.
7. Non-aqueous titration using perchloric Acid.
8. Experiments based on gravimetry, silver salt method.



SUBJECT CODE	SUBJECT
PYP 2.108.	PHARMACEUTICAL MICROBIOLOGY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Explain the sterilization procedures using dry heat and moist heat sterilization.

CO2. Describe the various medias, methods of Aseptic transfer Isolation of pure cultures and preservation technique.

CO3. Enumerate the different staining techniques and biochemical reactions for identification of bacteria. Describe the Bacteriology of milk and water.

1. Basic equipments used in Microbiology Laboratory
2. Sterilization by dry heat and moist heat technique
3. Preparation of various media.
4. Aseptic transfer technique
5. Staining techniques
6. Study of bacterial motility by hanging drop technique
7. Biochemical reactions for identification of bacteria
8. Isolation of pure cultures
9. Enumeration & isolation of bacteria from air.
10. Bacteriology of milk and water and
11. Preservation of cultures

SUBJECT CODE	SUBJECT
PYT.2.201	PHARMACEUTICAL ORGANIC CHEMISTRY –II

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1.Explain Reactions, Reactivity, Nomenclature, Orientation of Benzene, Benzene derivations and Polynuclear hydrocarbons.

CO2. Define, classify, organize the atoms and produce stereoisomers.

CO3. To describe nomenclature, explain methods of preparation, examples and uses of Heterocyclic compounds containing on heteroatom

CO4. Describe nomenclature explain methods of preparation, examples and uses of heterocyclic compounds containing one heteroatom.

CO5. Describe methods of preparations and applications of different synthetic reagents and named reactions.

**Unit –I Aromatic Hydrocarbons (Benzene and Derivatives)**

Structure of Benzene, stability of Benzene (Heats of hydrogenation), Aromatic character – Huckel’s (4n + 2 electron) rule. Nomenclature of Benzene derivatives. Electrophilic substitution reactions (Halogenation, Nitration, Sulphonation, Friedel-Crafts alkylation and acylation), Effect of substituent on Reactivity and orientation of monosubstituted Benzenes. Nucleophilic substitution in Halobenzenes. Acidity and Reactions of Phenols. Polynuclear Hydrocarbons: Napthalene and Anthracene: Structure, relative stability and aromaticity, Electrophilic substitution reactions -orientation, reduction and oxidation.

**Unit –II Stereo Chemistry**

Stereoisomerism, conformational isomerism, Cis-trans (E & Z) isomerism, sequence rules for E & Z configurations. Enantiomerism and optical activity: Plane of symmetry, asymmetry or chirality, plane polarized light, Relative (D & L) configurations, Absolute (R & S) configurations, sequence rules, Diastereomers, Meso structures, racemic modifications, concept of stereospecificity.

**Unit –III Heterocyclic Compounds Containing One Hetero Atom**

Introduction, classification and nomenclature of Heterocyclic compounds, Ring structure, methods of preparation and characteristic reactions of pyrrole, furan, thiophene, Pyridine,

Indole, Quinoline, Isoquinoline and Acridine. Structure and specific uses of two medicinally important compounds representing each of the heterocyclic systems.

#### **Unit –IV Heterocyclic Compounds Containing Two Hetero Atoms**

Structure and preparation of Pyrazole, Imidazole, Benzimidazole, Oxazole, Isoxazole, thiazole, diazine, pyrimidius, pyrazine and phenothiazine. Nomenclature and Ring Structure and specific uses of two medicinally important compounds representing each of the above heterocyclic systems; Benzofuran, Benzopyran, dioxane, cinnoline, phenazine, oxazine, triazine, triazole, tetrazole, phenam and cepham.

#### **Unit –V Synthetic Reagents and Reactions**

Specific synthetic Applications (at least two) of the following reagents: Lithium Aluminium Hydride (LAH), Lead Tetra Acetate (LTA), N-Bromosuccinimide (NBS), Selenium oxide, sodium periodate, perchloric acid, Mechanism of the following reactions: Fries migration, Beckmann Re-arrangement, Birch reduction, Hoffman's hypobromite reaction, oppenauer oxidation. MPV reduction, Arndt Eistert synthesis

**Examination :** One question from each unit with internal choice.

#### **TEXT BOOKS:**

1. 'Organic Chemistry' by T.T.Morrison & R.Boyd. Prentice Hall of India Private Limited, New Delhi and
2. Organic Chemistry by FERGUSON

#### **REFERENCE BOOKS:**

1. The Fundamental Principles of Organic Chemistry, by I.L.Finar, ELBS, London.
2. Pharmaceutical Chemistry, by T.M.Atherden, Bentley and Drivers, Oxford Univ. Press, U.K.,

SUBJECT CODE	SUBJECT
PYT 2.202	PHARMACEUTICAL BIOCHEMISTRY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Recall the biochemical organization of cell, transport processes and explain the concept of free energy & energy rich compounds.

CO2. Understand the catalytic activity of enzymes, metabolic processes of carbohydrates in physiological & pathological condition.

CO3. Explain the metabolism of lipids in physiological & pathological condition.

CO4. Understand the metabolism of protein, amino acid and the genetic organisation of mammalian genome, functions of DNA in synthesis of RNA & proteins.

CO5. To apply the knowledge of biochemical processes for qualitative & quantitative determination of various bio molecules in body fluids for various diagnostic purposes.

**Unit-I**

Biochemical organization of the cell and transport processes across cell membrane. The concept of free energy, determination of free energy change from equilibrium constant and reduction potential, energy rich compounds, production of ATP and its biological significance.

**Unit -II**

**Enzymes** -Nomenclature & classification, Kinetics, mechanism of action and inhibition, clinical applications of enzymes, isozymes and coenzymes. Carbohydrate metabolism: - Glycolysis, gluconeogenesis, glycogenolysis, glycogen synthesis, metabolism of galactose, role of sugar nucleotides in biosynthesis; pentose phosphate pathway. TCA cycle, its significance, Anapleurotic reactions, Effects of inhibitor and regulation of TCA cycle, Glyoxalate cycle.

**Unit-III**

**Lipid metabolism** -fate of dietary lipids; beta oxidation, oxidation of unsaturated fatty acids; synthesis of ketone bodies, biosynthesis, of saturated and unsaturated fatty acids, cholesterol metabolism, phospholipids and sphingolipids.

**Unit-IV**

**Electron transport and biological oxidation.** Nitrogen balance, metabolism of amino acids; biosynthesis of purins, pyrimidines and their nucleotides, formation of uric acid. Integration of carbohydrate, lipid and protein metabolism. Biosynthesis of RNA and DNA, Physical and chemical mutagenesis, DNA repair mechanism, recombinant DNA, mechanism of protein synthesis and its regulation, inborn errors in metabolism.

#### **Unit –V**

Principles involved and methods used in qualitative & quantitative analysis of blood for - SGPT, SGOT, Bilirubin, glucose, urea, creatinine, albumin, albumin globulin ratio and their clinical significance. Principles involved and methods used in qualitative and quantitative analysis of urine for -glucose, ketone bodies, bile salts, bile pigments and albumin. Product inhibition, feedback inhibition, role of cyclic AMP in enzyme activation, repression and induction and control of enzyme synthesis by regulation of transcription.

**Examination :** One question from each unit with internal choice.

#### **TEXT BOOKS :**

1. Text Book of Biochemistry, by B.Harrow & A.Mazur, W.B.Saundons Co., Philadelphia.
2. Principles of Biochemistry, A.L.Lehninger, CBS publishers, New Delhi.
3. Text Book of Biochemistry, by Rama Rao.

#### **REFERENCE BOOKS:**

1. Outlines of Biochemistry by E.E.Conn and P.K.Stumpf. John Wiley & Sons, New York.
2. Harper's Review of Biochemistry, D.W.Martin, P.A.Mayes & V.M.Redwell, Language Medical Publications

SUBJECT CODE	SUBJECT
PYT 2.203	PHARMACEUTICAL ENGINEERING –II

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Define & choose various unit operations in pharmaceutical industries for size reduction & size separation. To understand the material handling techniques. To perform the various process involved in pharmaceutical manufacturing process.

CO2. Define & classify evaporation & Distillation. To understand the Principle construction working & applications of various equipment's used in evaporation & distillation.

CO3. Define & classify drying & crystallization. To understand the principles, construction working & applications of equipment's used in Drying & Evaporation. Describe about the importance of gas absorption in Pharmacy & their properties & type of equipment's.

CO4. Define about mixing & the types of mixing process. Describe about the Principle, construction working advantage, disadvantage of various mixers and ion exchange operations.

CO5. Explain about various process involved in manufacturing process of tablets. Explain about the various automatic process variables.

**Unit-I**

**Size reduction** –Objectives, properties of solids, Classification of equipment. Important intermediate crushers & fine grinders, Cutting rolls, disk crushers, edge and end Runner mills, disintegrators, hammer mills, ball mills and their different modifications, colloid mill, impact mills, pin mills, fluid energy mills, particle size classifiers used with grinding mills.**Size separation** –I.P.Grades of Powders, Sieves –Standards, materials of construction, sieving of powders –Particle size distribution and its measurement using sieves. Representation on data. Screening equipment for coarse and fine powders. Shifting by gyratory turbulence.

**Fluid classification methods** –Cyclone separators, air separators, bag filters, scrubbers, air filters, size separation by settling, double cone classifier. Laws of settling, sedimentation, Elutriation.



**Leaching and Extraction** –Solid liquid Extraction, theory, problems of crude drug Extraction, solvents, properties choice and recovery. Factors affecting choice of Extraction process and efficiency of Extraction. Maceration, percolation and continuous Extraction process. Diffusion batteries Extraction towers.

**Liquid extraction** –Principles, Small and large scale equipment, podbielniak extractor.Expression equipment for small and large scale operation.

## **Unit –II**

**Evaporation** –General principles, heat supply and vapour removal. Heat transfer, film coefficients, scale formation. Evaporators –Classification, pan, stills, short tube, long tube, vertical forced circulation with internal heating element, film and vapour compression evaporators. Evaporation under reduced pressure.

**Distillation and condensation** –Different mass transfer operations, theory applied to binary mixtures; Distillation methods –Equilibrium and differential distillations, azeotropic distillation, rectification, sieve plate and packed columns, HEPT. Steam distillation –theory, equipment and applications, Molecular distillation –theory, equipment and applications. Automatic water stills, steam jacketed kettle, distillation under reduced pressure.

## **Unit –III**

**Drying** –Theory of drying, Drying of damp solids, tray, vacuum tunnel, rotary and infrared dryer. Drying of slurries of solution –Drum, spray, freeze drying and fluidized bed drying.

**Crystallisation** –Importance of crystal purity, size, shape, geometry, habit, forms and types. Solubility curves and calculation of yields. Material and heat balances around Swenson Walker crystalliser. Miers super saturation theory and its limitations. Nucleation mechanisms, crystal growth. Classification of crystallisers, Tank, agitated batch, Swenson Walker, single vacuum, circulating magma and Krystal crystallizer. Caking of crystals and its prevention.Gas absorption –Importance in pharmacy. Properties and type of tower packing, Tower construction and other commercial absorbers and their operations, two phase flow through packed tower. Pressure and Mass Transfer Coefficients; Desorption.

## **Unit –IV**

**Mixing** –Definition and objectives; Types of mixers; Solid –solid mixing: Selection of mixer, Mixing of viscous masses; Kneading and ban burry mixtures; Ointment mills, triple roller mill.



**Liquid –liquid and gas liquid mixing equipment:** Different types of mixing impellers, their characteristics, operation and application

**Absorption and Ion exchange** –Ion exchange operations, Ion exchange principles different types of Ion exchangers behaviours of ion exchange resins, applications.

#### **Unit–V**

**Compaction** –Scope, measurement of Punch forces, transmission of force through powders, distribution of forces in powder mass, effect of pressure on relative volume, lubrication of diewall, adhesion and cohesion of particles, factors effecting strength of granules and strength of tablets.

**Automatic process control systems** –Process variables (temperature, pressure flow, level and vacuum) and their measurement; Elements of automatic process control and introduction automatic process control systems and automatic process control system.

**Examination :** One question from each unit with internal choice.

#### **TEXT BOOKS :**

1. Pharmaceutical Engineering by Prof.K.Samba murthy
2. Introduction to Chemical engineering by W.L.Badger and Banchero, Macrohill Int. book Co, London.

#### **REFERENCE BOOKS:**

1. Unit operations to chemical engineering by W.I.Macebe and J.C.Smith, Macrohill Int. book Co, London
2. The theory and practice of Industrial Pharmacy by L.Lachman, H.Lieberman and J.L.Kanig, Lea and Febiger Philadelphia.

SUBJECT CODE	SUBJECT
PYT 2.204	PHARMACOGNOSY –I

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe the different methods of classification of crude drugs & plant hormones. Describe techniques involved in the cultivation & collection of crude drugs.

CO2. Illustrate the different techniques employed in Biosynthetic pathways. To appreciate the applications of primary & secondary metabolites of the plant.

CO3. Analyse & identify the various methods to detect the adulteration of crude drugs. To carry out the microscopic & morphological evaluation of crude drug. To analyze the evaluation techniques of crude drugs.

CO4. Memorize the source, active constituents, chemical tests & uses of crude drugs such as carbohydrates & Tannins

CO5. Memorize systematic study of fibres, minerals proteins & enzyme crude drugs.

**Unit-I**

**Introduction to pharmacognosy**, methods of classification of crude drugs. Systematic description and storage of crude drugs. Plant hormones and their applications.

**Cultivation** -Advantages and disadvantages of obtaining drugs from cultivated and wild Plants. Variability of drug constituents due to exogenous and endogenous factors like altitude, light, temperature, rainfall, propagation by seeds, vegetative means, selection, mutation, hybridization and polyploidy.

**Collection of Medicinal Plants** -effect of season, time of collection and age of the plant on the quality of active principles. Treatment subsequent to collection -desirable and undesirable changes after collection / drying.

**Unit-II**

**Plant Biosynthesis** -Techniques employed in Biosynthetic pathways, precursor – product sequence, competitive feeding, sequential analysis. Study of basic metabolic pathways, Carbohydrate synthesis, Shikimic acid pathway, Isoprenoid biosynthesis.

### **Unit –III**

**Hazards** -like infestation with spores of micro organism's eggs and steps to prevent the same. Drugs deterioration by non living factors like moisture etc., and steps to prevent deterioration. Adulterations of crude drugs and their detection. Quality control of crude drugs and Phytochemicals. Study of the following methods for evaluation, identity, purity, quality by organoleptic, microscopic, physical, chemical and biological characters; Moisture content determination, determination of foreign organic matters and analysis of volatile oils, quantitative microscopic exercises including lycopodium spore method, leaf constant, crude fibre content.

### **Unit–IV**

#### **Systematic Pharmacognostic study of following drugs**

Carbohydrates -Agar, Tragacanth, acacia, starch, isabgol linseed, regenerated carbohydrate fibres, cellulose, alginates and tamarind; Fixed Oils, Fats and Waxes -Chaulmoogroil, neem oil, castor oil, olive oil, bees wax, spermaceti, carnaubawa, theorbroma oil, and lard.

Tannins -Myrobalan, Black catechu, Pale catechu, gal amla and arjuna.

### **Unit–V**

**Systemic Pharmacognostic study of the following Fibers:** Cotton, Jute, Hemp, Rayon, Wool, silk and Nylon.

**Drugs from mineral and animal origin** -Kaolin, talc Bentonite, Cod liver oil, Shark liver oil, cantharides, Musk, Honey, and cochineal.

**Proteins & Enzymes** -Papain, Pepsin Gelatin, Pancreatin.

**Examination :** One question from each unit with internal choice.

#### **TEXT BOOKS:**

1. Pharmacognosy by Trease G.T and Evans W.C 12 ed, Bailliers Tindall Easbourne, UK.
2. Pharmacognosy by C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali Prakashan, Pune.

SUBJECT CODE	SUBJECT
PYT 2.205	ENVIRONMENTAL STUDIES

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Acquire the knowledge about environment, Natural resources of its allied problems and its conservation.

CO2. Explain the impact of biodiversity and its conservation.

CO3. Give a note on environmental pollution and explain its problems.

CO4. Explain about social issues related to the environment.

CO5. Create the awareness about environmental acts and its regulations.

**Unit –I**

**The Multidisciplinary Nature of Environmental Studies:** Definition, Scope and Importance; Indicators for Sustainable Development; Natural Resources: Forest, Land, Mineral, Food, Water and Energy Resources; Uses, Benefits, Safety, Security and over-exploitation; Role of an individual in conservation of natural resources. Sustainability Theory and Practice; equitable use of resources for sustainable lifestyles; Ecosystem: Concepts, Types, Characteristic Features, Structure and Functions

**Unit –II**

**Biodiversity and Its Conservation.** Introduction, Definition, Types and Levels of Biodiversity; Genetic, Species and Ecosystem diversity; Species Richness; Indigenous Knowledge, Magnitude and Distribution of Biodiversity; Medicinal and Economic Value of biodiversity; Consumptive and Productive use; Biodiversity at Global, National and Local levels. Biogeographical Classification of India -India as a mega-diversity nation and Hot spots; Threats to biodiversity; Endangered and endemic species of India; Conservation of biodiversity: In-situ conservation of biodiversity. Relevance of Biotechnology and Nanotechnology in Sustainable Development, Production and Environment Protection

**Unit –III**

**Environmental Pollution and Its Problems Local and Global Issues** -Definition, causes, effects and control measures of: a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution and g) Nuclear hazards. Role of an

individual in pollution prevention and case studies of pollution. Solid and Hazardous Waste Management: Causes, effects and control measures of urban and industrial wastes; Development of Value added products from Solid Wastes; Waste Minimization in Manufacturing Industry: Alternative Methods and Routes for Process Development; Reduce, Recycle and Reuse; Cost Benefit analysis of a Process or Method and Importance of Mass Balance; Case studies with reference to Pharma Industry; Green House Gas Effects: Climate change, global warming, acid rain and forest, ozone layer and ground water depletion. Environmental Problems in India: Drinking Water, Sanitation and Public Health.

#### **Unit –IV**

**Social Issues and the Environment Human Population and Environment:** Population Growth and Population Explosion; Social Problems related to poverty, energy, water, shelter, infrastructure, food, health, sanitation, hygiene, landscape, livelihood, information, environment and value education. Effects of Human Activities on the quality of Environment: Urbanization; Communication, Transportation, Industrialization and Green revolution; Water conservation, Rain Water harvesting, Watershed Management; Resettlement and Rehabilitation of People, its problems and concerns. Case Studies. Environmental ethics; Civic Sense, Issues and Possible Solutions. Disaster management plan: Natural and Man Made disasters, floods, earthquake, cyclone, tsunami, landslides, nuclear accidents, fire and bioterrorism; Case studies related to social issues: Waste land reclamation. Consumerism and waste products.

#### **Unit –V**

**Institutional Setup and Legislation:** Government Regulatory Bodies in Monitoring and Enforcement of Environmental Regulations; Environment Protection Acts: Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Coastal Regulation Zone (CRZ) Act, EIA Notification, Hazardous Waste Rules and Municipal Solid Waste Rules; Right to Information Act, Wildlife Protection Act and Forest Conservation Act, International Conventions on Environment: Stockholm, Rio, Basel, Aarhus, Ramsar and Kyoto. Environment Impact Assessment (EIA) Studies: Definition, Classification, Direct, Indirect and Cumulative Assessment of Impacts; Reversible, Irreversible, Negative and Positive Impacts; Eco Audit and Eco Labelling (ISO: 14000); Environmental Management Plan (EMP); Design for Environment; Relevance of Command Control Paradigm in Environmental Governance; Issues involved in enforcement of environmental legislation. Public awareness. Case Studies.

**Note:** Atleast one field visit is must for studying of Environment in a Local Area / Ecosystem / Industry and also an Assignment on Environment.

**Examination :** One question from each unit with internal choice.

**TEXT BOOKS:**

1. Anjaneyulu . Y., Introduction to Environmental Sciences. B.S.Publications, 2003.
2. Murali Krishna K.V.S., Glimpses of Environment, Environment Protection Society, 2003

**REFERENCES:**

1. Agarwal, K.C.2001 Environmental Biology, Nidi Publ. Ltd Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: mapin@icenet.net ( R )
3. Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ.House, Mumbai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment ( R )
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press. 473p
9. Hawkins R.E, Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay ( R )
10. Heywood, V.H. & Watson, R.T 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M.19965. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & Schoch, R.M.1996. Environmental Science systems & Solutions, Web enhanced edition.639p.
13. Mhaskar A.K, Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P 1971. Fundamentals of Ecology. W.B.Saunders Co.USA, 574p
16. Rao M.N.& Datta, A.K.1987. Waste Water treatment. Oxford & IBH Publ. Co.Pvt.Ltd.345p.

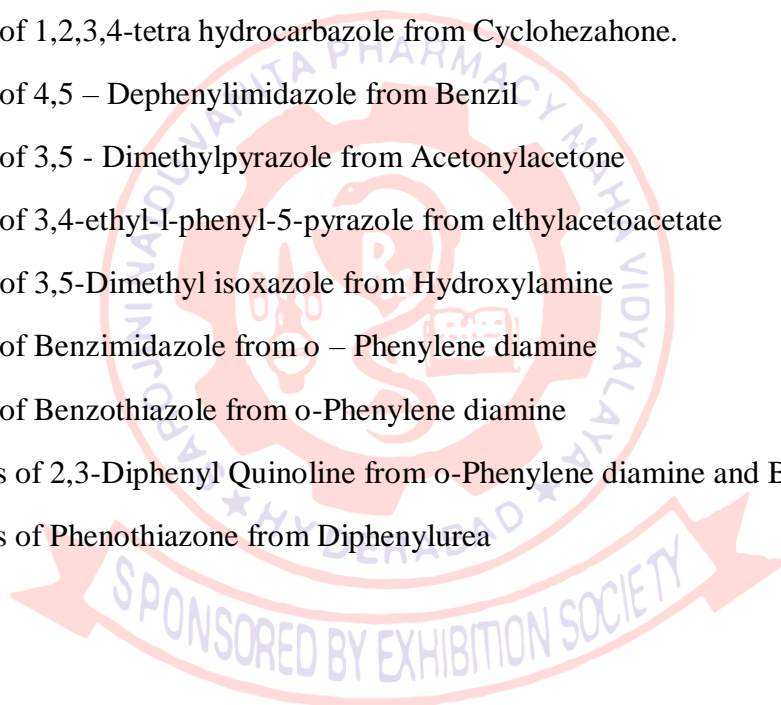
17. Sharma B.K., 2001. Environmental Chemistry. Goel Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II, Enviro Media ( R )
21. Trivedi R.K. and P.K.Goel, Introduction to air pollution, Techno-Science Publications (TB)
22. Wagner K.D.,1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA (M) Magazine,( R ) Reference,(TB) Textbook





SUBJECT CODE	SUBJECT
PYP.2.206.	PHARMACEUTICAL ORGANIC CHEMISTRY – II LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Outline &amp; Illustrate the synthesis of various Organic compounds</p>	

- 1.Synthesis of 2,5 – Dimethyl pyrrole from Acetyl acetone
- 2.Synthesis of 2,5 – Dimethyl thiophene from Acetyl acetone
- 3.Synthesis of 1,2,3,4-tetra hydrocarbazole from Cyclohexanone.
- 4.Synthesis of 4,5 – Diphenylimidazole from Benzil
- 5.Synthesis of 3,5 - Dimethylpyrazole from Acetylacetone
- 6.Synthesis of 3,4-ethyl-1-phenyl-5-pyrazole from ethylacetoacetate
- 7.Synthesis of 3,5-Dimethyl isoxazole from Hydroxylamine
- 8.Synthesis of Benzimidazole from o – Phenylene diamine
- 9.Synthesis of Benzothiazole from o-Phenylene diamine
- 10.Synthesis of 2,3-Diphenyl Quinoline from o-Phenylene diamine and Benzil
- 11.Synthesis of Phenothiazone from Diphenylurea





SUBJECT CODE	SUBJECT
PYP.2.207	PHARMACEUTICAL BIOCHEMISTRY LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. To identify & analyze various Carbohydrates, Proteins & Amino acids qualitatively.

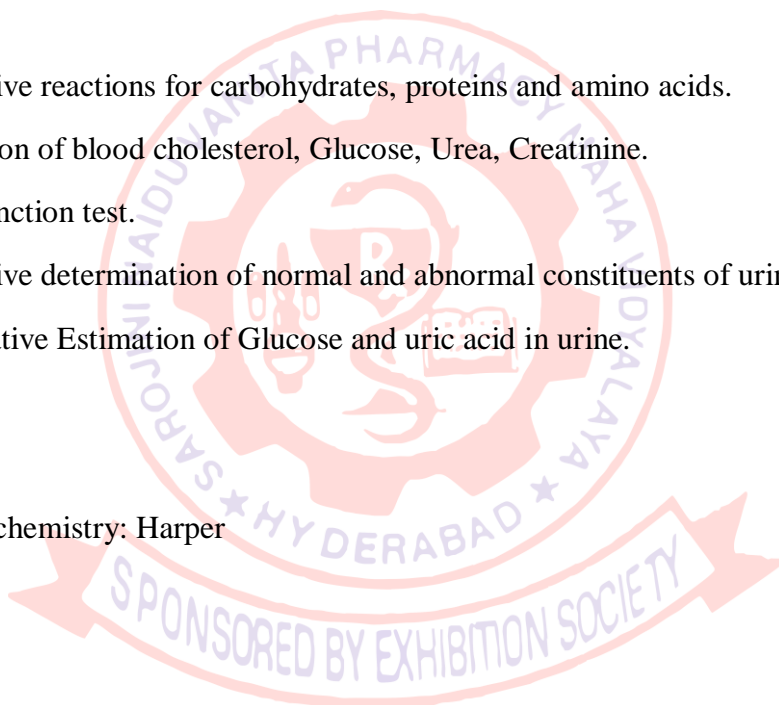
CO2. To analyze and estimate Cholesterol, Glucose, Urea & Creatinine in Serum quantitatively.

CO3. Qualitative & Quantitative estimation of normal and abnormal constituents of Urine.

1. Qualitative reactions for carbohydrates, proteins and amino acids.
2. Estimation of blood cholesterol, Glucose, Urea, Creatinine.
3. Liver function test.
4. Qualitative determination of normal and abnormal constituents of urine
5. Quantitative Estimation of Glucose and uric acid in urine.

**TEXT BOOK:**

1. Practical Biochemistry: Harper



SUBJECT CODE	SUBJECT
PYP.2.208	PHARMACEUTICAL ENGINEERING – II LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Identify the Reynold’s number, Analyse the heat transfer co-efficient. To differentiate &amp; identify the humidity by dew point &amp; Psychrometry method. To analyze the stokes law.</p> <p>CO2. Analyse the efficiency of size reduction using the ball mill. To represent the size distribution by sieve analysis.</p> <p>CO3. Comprehend the symbols for unit operation. Appreciate the plant layout design used in various unit operations.</p>	

1. Determination of Reynolds number
2. Determination of heat transfer coefficient by mechanisms.
3. Determination of humidity of air by psychrometry & dew point method
4. Verification of Stokes Law
5. Efficiency of size reduction using different size reducing equipment.
6. Determination particle size distribution by sieve analysis
7. Rate of Drying of solids
8. Purification by simple distillation.
9. Drawing of symbols for unit operations
10. Drawing of equipment used in unit operations (for scale up/scale down)
11. Flow sheet Industries for manufacturing procedures of drugs.

SUBJECT CODE	SUBJECT
PYT 3.101	MEDICINAL CHEMISTRY – I

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Explain the influence of physico chemical properties of drug molecules in relation to biological activity.

CO2. Knowledge on classification, mechanism of action, structural activity relationship, synthesis and metabolites of some pharmacodynamic agents.

CO3. Classify and explain mechanism of action, structural activity relationship, synthetic route and metabolites of selected cardio vascular system.

CO4. Define, classify and describe mechanism of action, SAR, synthesis and metabolites of selected category of drugs which interfere the Hormonal balance in our body.

CO5. Classification, design and development of drugs which treat allergies. Descriptions of Proton pump inhibitors classification and description of coagulants and anticoagulants.

**Unit – I Basic Considerations of Drug Activity**

Physico chemical properties of drug molecules in relation to biological activity -Solubility, lipophilicity, partition-coefficient, Ionization, hydrogen bonding, Chelation, Redox potential and Surface activity. Bioisosterism and Steric features of drugs, drug distribution and protein binding; Introduction to Pro and Soft drug approach in drug design; Drug metabolism and factors affecting on drug metabolism.

NOTE: Introduction, definition, nomenclature, chemical classification (other types of classification wherever relevant), structure, synthesis, general mechanism, mode of action (wherever known), SAR including physicochemical and stereo chemical aspects, metabolism and therapeutic uses of the drugs from each category shall be studied for the following units. An outline of synthetic procedure and metabolism of only the drugs, which are official as per Indian pharmacopoeia and British pharmacopoeia and mentioned in brackets against each category.

**Unit – II** Adrenergic agents - (Isoproterenol and Salbutamol) . Adrenergic blocking agents - (Prazocin and Atenalol). Cholinergic drugs and Acetyl Choline esterase inhibitors - (Carbachol, Physostigmine). Cholinergic blocking agents - (Pyridinium bromide and

Dicyclomine HCl). Ganglionic blocking agents and neuromuscular blocking agents - (Mecamylamine HCl and Pentolinium Tartarate). Skeletal muscle relaxants - neuromuscular - (meprobamate)

**Unit – III** Cardio Vascular Drugs - Anti-hypertensive drugs - (Captopril and Clonidine) Antiarrhythmic drugs - (Verapamil, Nifedipine and Diltiazem), Vasodilators - (Isosorbidedinitrate and Dipyridamole) Anti- hyper lipidemic agents - (Clofibrate and Aterostatin) Anti-platelet drugs - (Aspirin and Ticlopidine) Cardio tonic Agents – Synthetic analogs of cardiac glycosides

**Unit – IV** Diuretics - (Acetazolamide and Furosemide, Hydrochlorothiazide and Amiloride). Positive Inotropic Agents (Amrinone) .Hypoglycemic agents - (Tolbutamide and Glyclazide). Thyroid agents, Anti-thyroid gents -. (Prophylthiouracil) .Immunosuppressants - (Azathioprine) and Immunostimulants -(Levamisole)

**Unit – V** Anti-histaminics (H<sub>1</sub> & H<sub>2</sub>)-(Diphenhydramine, Chlorpheniramine, Cetirizine, Ranitidine). Proton Pump Initiators (Omeprazole) .Coagulants and Anti-coagulants -(Warfarin)

**Examination :** One question from each unit with internal choice.

**TEXT BOOKS :**

1. J.H. Block & J.M. Beale (Eds) Wilson and Giswold's Text Book of Organic Medicinal & Pharmaceutical Chemistry, 11th Edn, Lippincott, Raven, Philadelphia, 2004.
2. W.O. Foye, Text Book of Medicinal Chemistry, 5th edn, Lea & Febiger, Philadelphia, 2002.
3. S.N. Pandeya, Text Book of Medicinal Chemistry, 2nd edn, S. G. Pubn, Varanasi, 2003.

**REFERENCE BOOKS :**

1. D. Abraham (Ed) , Burger Medicinal Chemistry and Drug Discovery, Vol.I , 6th edition, John Wiley & Sons, New York, 2003.
2. B.N. Lads, M.G. Mandel and F.I.Way, Fundamentals of drug metabolism & disposition, William & Welking Co, Baltimere.
3. C. Hansch, Comprehensive Medicinal Chemistry, Vol I-VI Elsevier Pergamon Press, Oxford, 1991. 4. Daniel Lednicer, Strategies for Organic Drug Synthesis & Design, John Wiley N.Y., 1998. 5. D. Lednicer , Organic Drug Synthesis, Vol. I-VI, John Wiley N.Y.

SUBJECT CODE	SUBJECT
PYT 3.102	PHARMACOGNOSY-II

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe classification, Isolation tests, chemical nature and uses of various alkaloidal containing crude drugs.

CO2. Describe classification, Isolation, tests, chemical nature and uses of various glycoside containing crude drugs.

CO3. Demonstrate Isolation, characterization & estimation of Phyto constituents. Describe classification, Isolation, tests, chemical nature and uses of various volatile oil containing crude drugs.

CO4. Understands various techniques involved in tissue culture.

CO5. Understand the preparation & development of herbal formulation. To analyse various quality control and standardization methods of raw materials used in herbal formulation.

**Unit – I Alkaloids** Introduction, definition, classification, isolation, tests, chemical nature and uses of Rauwolfia, Vinca, Nuxvomica, opium, ipecac, belladonna, datura, lobelia vasaka, kurchi, ephedra, cinchona, colchicum, aconite, punemava, shankhpushpi, tobacco.

**Unit – II Glycosides** Introduction, Definition, Classification, Isolation, tests, chemical nature and uses of Senna, aloes, rhubarb, digitalis, squill, dioscoreia, liquorice, momordica, black mustard, ammi, psoralea, gentian, picrorrhiza, ashwagandha, gokhru, kalmegh, stropanthus, shatavari, brahmi, quassia, gymnema.

**Unit – III Phytopharmaceuticals Chemistry, Tests, Isolation, Characterization and Estimation of Following Constituents**

1. Sennosides from Senna
2. Caffeine from tea
3. Cineole from eucalyptus oil
4. Quinine from cinchona
5. Carvone from dill
6. Tannic acid from myrobalan
7. Rutin, hesperidin from citrus fruits.

Introduction, definition, classification, isolation, tests, chemical nature and uses of Volatile Oils and Resins from following Plant Sources: Fennel, Clove, Cinnamon, Gaultheria oil, Artemisia, Taxus, Capsicum, Turmeric, Podophyllum, Guggul Asafoetida and Pyrethrum.

**Unit – IV Tissue Culture** History, introduction, callus culture, suspension culture, Immobilization of culture, single cell culture, organogenesis and embryo culture. Production of secondary metabolites, biotransformation and clonal propagation, Significance and application of plant tissue culture.

**Unit – V Herbal Medicines** Herbal medicines in India, practice, regulations, Quality Control and Standardization of Raw Materials. Types of herbal formulations and products. Some Traditional Plant Medicines as a source of New Drugs Introduction to dosage form of Ayurveda - Aristavas, Asawas, Chumas, Bhasma, Leyhas, Ghritams, Rasayanam and Kashayams.

**Examination:** One question from each unit with internal choice.

**TEXT BOOKS:**

1. Trease and Evans, Pharmacognosy by W.C. Evans, Elsevier Ltd., London, UK/ Vailliers Tindal Easbourn UK.
2. Pharmacognosy by C.K. Kokate, Nirali Publication, Pune.
3. Pharmacognosy by T.E. Wallis CBS publishers and Distributors, Delhi.

**REFERENCE BOOKS:**

1. The Ayurvedic pharmacopoeia of India I-III Govt. of India, Ministry of Health and Family Welfare Dept. of Indian system of medicine and Homeopathy, New Delhi.
2. Herbal Drug Industry, Eastern publishers, New Delhi.
3. Natural Products by O.P. Agarwal Vol.I & II Goel publications, Meerut.
4. Text Book of Pharmacognosy by Brady & Taylor.
5. Tissue culture and plant science by street
6. An Introduction to plant Tissue culture by M.K. Razdan, Oxford & IBH publishing Co. Pvt. Ltd. – New Delhi & Calcutta.

SUBJECT CODE	SUBJECT
PYT 3.103	PHYSICAL PHARMACY – I

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Explain the basic concepts, interactions and formation of Physical states of matter and its various physicochemical properties of drug molecules in designing the dosage forms and different techniques to identify them.

CO2. Explain the basic concepts of thermodynamic including definition of thermodynamic terms and different laws of thermodynamics and statements along with applications.

CO3. Explain the behaviour of ideal and real solutions, colligative properties and their molecular weight determination and solutions of solids in liquids. Apply the principles of ionisation of acids and bases etc.

**Unit – I**

States of Matter and Phase Equilibria .Gaseous state: Ideal Gas law, Molecular Weight determination, Kinetic Molecular Theory and Vander-waals Equation for Real Gases; Liquid state: Liquefaction of Gas, Methods of Achieving Liquefaction, Vapor pressure of Liquids, Boiling Point and Heat of Vaporization including Clausius –Claypeyron equation; Solids and Crystalline state: Crystalline Solids --- X-ray diffraction, melting point and heat of fusion, Intermolecular forces, Polymorphism. Amorphous solids and Liquid crystalline state. Phase equilibria: The phase rule; Systems containing one, two and three components, Rules relating to Triangular Diagrams; Solid dispersions; Thermal Analysis: Differential scanning Calorimetry; Differential thermal analysis and Thermo gravimetric and Thermo chemical Analysis; Physical properties of drug molecules: Refractive index & Molar refraction.

**Unit – II**

Thermodynamics .Definition of Thermodynamic Terms: Specific Heat, Sensible Heat, Latent Heat and Heats of Transition; Laws of Conservation of Energy; Meaning of Energy Balance and its importance and Inputs of Energy balance; Concept of Heat and Work; First Law of Thermodynamics: Statement, Definition of Internal Energy, Enthalpy and Heat Capacity; Heat Capacities at constant Volume and Pressure and their relationship; Thermo chemistry: Standard State Heats of Formation and Combustion; Standard Enthalpy of Formation – Hess’s Law of Heat summation and its application; Heat of reaction at constant pressure and



at constant volume; Enthalpy of neutralization; Bond dissociation energy and its calculations from thermo chemical data; The second and third laws of thermodynamics: Statements, Definition of Entropy, Free energy and Gibbs Free Energy; Free Energy functions and applications.

### **Unit – III**

Solutions of non-electrolytes: Properties, types of solutions and concentration expressions; Ideal and real solutions; Colligative properties and Mol. Wt.determinations. Solutions of electrolytes: Arrhenius theory of electrolytic dissociation; Modern theory of strong electrolytes; Debye- Huckel theory; Coefficients for expressing colligative properties –  $L$  value, Osmotic Coefficient and Osmolality. Ionic equilibria: Acid-base equilibria – Ionisation of weak acids, weak bases, water and ampholytes, Sorensen's pH scale. Acidity constants – effect of ionic strength upon acidity constants, effect of temperature on ionic equilibria. Determination of Acidity constants.

### **Unit – IV**

Buffered and Isotonic solutions: The Buffer equation – Common ion effect and the buffer equation for weak acid and its salt and a weak base and its salt; pH indicators; Factors influencing pH of buffer solutions; Measurement and calculating tonicity and methods of adjusting tonicity and pH; Buffer capacity and its calculations; Van Slyke equation; Influence of concentration on buffer capacity and maximum buffer capacity; Buffers in Pharmaceutical and biological systems – in vivo biologic buffer systems. Drugs as buffers: Pharmaceutical buffers and their preparation, influence of buffer capacity and pH on tissue irritation, stability vs optimum therapeutic response, pH and solubility.

### **Unit – V**

Electro Motive Force and Oxidation-Reduction: Electrochemical cells, Types of Electrodes, measuring the EMF of cells, reference electrodes and standard potentials, electrometric determination of pH and specific ions; Hydrogen and glass electrodes, operation of pH meter, ion elective electrodes, Applications of Oxidation – Reduction Potentials(Redox potentials) in pharmacy. Catalysis: Definition of Catalysis and Catalyst; Types of Catalyst; Promoters and Inhibitors; Mechanism of Simple Catalytic Reactions; Factors affecting the catalyst and Catalysis.

**Examination:** One question from each unit with internal choice.

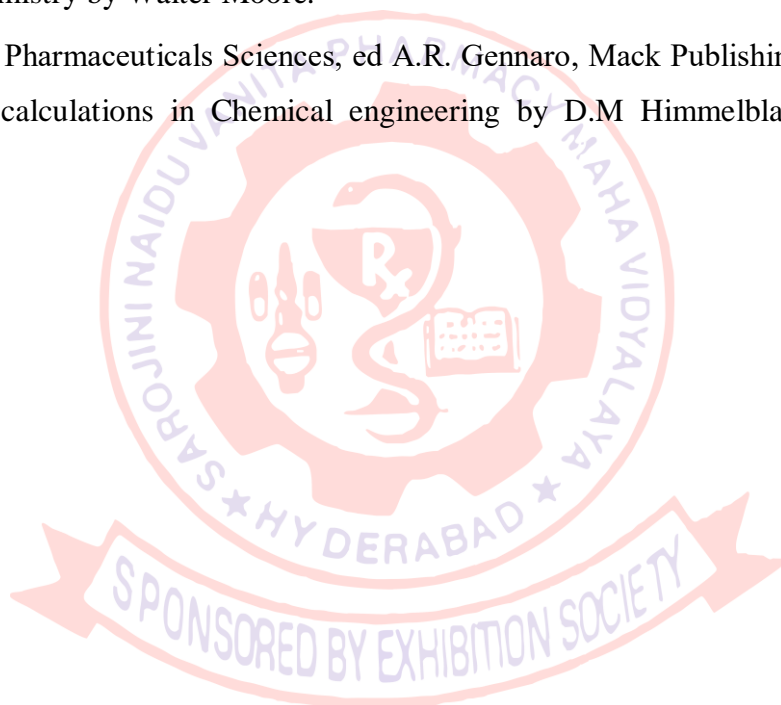


**TEXT BOOKS:**

1. A. Martin, J. Swarbrick & A. Cammarata, "Physical Pharmacy" Lea and Febiger, Philadelphia, III Edition, 1983.
2. C.V.S. Subrahmanyam, Essentials of Physical Pharmacy, Vallabh Prakashan, Delhi, 2005
3. Hougen and Watson k.M & ragatz r.A, Chemical Process principles, Part-I (Material and Energy Balances), 2nd Edition , New Age International

**REFERENCE BOOKS:**

1. Physical Pharmaceutics, by Shoton & Ridgway, Oxford press, London.
2. A Text Book of Physical Chemistry, by S. Glasstone, Van Nostrand, New Delhi.
3. Physical Chemistry by Walter Moore.
4. Remington's Pharmaceuticals Sciences, ed A.R. Gennaro, Mack Publishing co., PA. Basic principles and calculations in Chemical engineering by D.M Himmelblau, Prentice Hall Publications



SUBJECT CODE	SUBJECT
PYT 3.104	PHARMACEUTICAL TECHNOLOGY(Pharmaceutics - III)

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Give a note on the properties, selection of various recipients used in different forms and formulation, preparation, evaluation of capsules.

CO2. Explain the formulation, manufacturing and evaluation of suspensions, emulsions.

CO3. Give a note on the formulation, manufacturing and evaluation of tablets, tablet coating.

CO4. Explain the formulation manufacturing and evaluation of parenteral, ophthalmic preparations.

CO5. Explain the formulation, manufacturing, evaluation of Aerosols and acquire knowledge about packaging materials of their properties, uses evaluation.

**Unit – I Formulations** Excipients Properties and selection, Antioxidants, Preservatives, Coloring agents, Flavouring agents, Sweetening agents, Diluting agents, Vehicles, Surfactants, Hydrocolloids, Adjuvants should be studied with reference to FDA approvals and Drugs & Cosmetics Rules wherever applicable. Capsules Hard Gelatin Capsules: Advantages, Sizes, Storage, Printing, Formulation, Selection of sizes, Filling, Sealing, Cleaning and Polishing, Evaluation. Soft Gelatin Capsules: Advantages, Applications, Formulation, Manufacture & Evaluation.

**Unit – II Suspensions and Emulsions.** Suspensions: Formulation Types; Deflocculated and Flocculated suspensions, Formulation parameters; Methods of Manufacture and Evaluation.

Emulsions: Formulation Types, Formulation-parameters, Manufacturing Methods and Selection of equipment, Evaluation methods including the shelf life, Concepts of Multiple emulsions.

**Unit – III Tablets and Tablet Coating.**

Tablets: Types & Classes, Advantages and Disadvantages, Challenges in formulation and manufacture, Excipients in the formulation, Ideal requirements of Excipients, Granulation methods, Compression Machines, Processing problems in compression - Capping & Lamination, Picking & Sticking, Mottling, Weight variation, Hardness variation etc.

Evaluation of Tablets. Tablet Coating: Coating principles, General equipment, Sugar coating-steps, Compression coating, Film coating-steps, materials used in film coating, enteric coating, Film defects, Specialized coating techniques and Quality Control of Tablets

#### **Unit – IV Parenterals and Ophthalmic Preparations**

Parenterals: Definition, Classification and Types of Parenterals, Advantages and limitations, Preparation, Formulation, Containers, Production procedures & facilities, Environmental and other controls, filling procedures, Products requiring Sterile Packing, Evaluation tests, Sterile Powders, Emulsions, Suspensions.

Ophthalmic Preparations: Requirements of Eyeointments, Eye drops, Formulation, Methods of preparation, containers, Evaluation and quality control.

#### **Unit – V Aerosols and Packaging Materials**

Aerosols: Definition, Types, Advantages and Disadvantages; Propellants, General Formulation, Manufacturing and packing methods - Pharmaceutical Applications

Packaging Materials: Glass, Plastics, Metal and Rubber, their influence on dosage form stability.

**Examination:** One question from each unit with internal choice.

#### **TEXT BOOKS:**

- 1) L. Lachman, H.A. Lieberman and J.L. Kanig, Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Mumbai, 3rd Edn, 1991.
- 2) Ansel's Pharmaceutical dosage forms and Drug delivery systems, 8th edn, 2004, Lippincott Williams & Wilkins, USA.
- 3) Micheal E Aulton, Pharmaceutics – The science of dosage form design, 1st edition, 1998, Churchill living stone.

#### **REFERENCE BOOKS:**

- 1) A.R. Gennaro, Remington: The Science and Practice of Pharmacy, 20th Edition, Vol. 1, Lippincott Williams & Wilins, Philadelphia, 2004.
- 2) E.A. Rawlins, Bentley's Textbook of Pharmaceutics, 8th Edition, Baillere Tindill, London, 2002.
- 3) The Prevention of Food Adulteration Act 1954 with Rules.
- 4) Vijay Malik Drugs & Cosmetic Act 1940, 10th edition.

SUBJECT CODE	SUBJECT
PYT 3.105	PHARMACOLOGY-I

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Explain the basis of Pharmacology, Pathophysiology and experimental Pharmacology.

CO2. Describe the Pharmacology of drugs acting on Autonomic nervous system.

CO3. Describe the Pharmacology of drugs acting on central nervous system.

CO4. Predict drug targets based on etiopathogenesis of cardio vascular & respirations diseases and describe the Pharmacology of drugs acting on cardio vascular system and Respiratory system.

CO5. Predict the drug targets based on etiopathogenesis of Renal and gastro intestinal disease and describe the Pharmacology of Drugs acting on Renal and gastro intestinal system.

**Unit – I**

**General Principles of Pharmacology** Introduction, Nature and sources of drugs, Routes of administration of drugs. Concept of absorption, bioavailability, Drug distribution, Biotransformation and excretion drugs, Biological half-life and its significance Mechanism of action including drug receptor Interactions and factors influencing them. Dose response relationship.

**Unit – II**

**Pharmacology of Drugs Acting On ANS** Introduction, Transmission, Distribution and Functions of Drugs acting on Autonomic Nervous System: Cholinoceptor – Activating and cholinesterase inhibitory drugs, Cholinoceptor blocking drugs, Adrenoceptor -Activating and other sympathomimetic drugs, Adrenoceptor - Antagonist drugs.

**Unit - III**

**Pharmacology of Drugs Acting On CNS** Introduction, Transmission, Distribution and Functions of Drugs acting on Central Nervous System: CNS Neuro transmitters; CNS Stimulants: Hypnotics and Anxiolytics; Antipsychotic Agents; Anti-epileptic Agents; Anti-depressants and Mood Stabilizers; Local Anesthetics; Analgesics and Nonsteroidal anti-inflammatory agents; Pharmacological management of Parkinsonism and other movement disorders

## **Unit – IV**

**Drugs Acting on Cardio Vascular & Respiratory System** General Considerations, Pharmacology of drugs used in the treatment of congestive heart failure, Antiarrhythmics, Anti-hypertensives & Anti-hyperlipidemic drugs, Anti-anginals and Vasodilators. Drugs used in the therapy of shock. Pharmacology of Drugs affecting Respiratory System: Drugs used in the treatment of disorders of Respiratory Function and Bronchial Asthma. Bronchodilators, Antitussives and expectorants

## **Unit – V**

**Drugs Acting on Renal and Gastro Intestinal System** Diuretics and anti-diuretics, Water and Electrolytic Balances and pH modifying agents. Pharmacology of purgatives/laxatives, Anti-diarrhoeals, Emetics and Antiemetics. Drugs used in peptic ulcers.

**Examination:** One question from each unit with internal choice.

### **TEXT BOOKS:**

1. Pharmacology and Pharmacotherapeutics, R.S. Satoskar and S.D. Bhandarker, Popular Prakashan, Mumbai.
2. Pharmacology, H.P. Rang, M.M. Dale & J. M. Ritter : Churchill Livingstone, 4th edition.
3. Basic and Clinical Pharmacology, 9th edition – Bertram. G. Katzung.

### **REFERENCE BOOKS:**

1. Essentials of Medical Pharmacology, K.D. Tripathi, J. P. Brothers Medical Publishers.
2. Lewis's Pharmacology, by J. Crossland, Churchill Livingstone.
3. Pharmacological Principles of Medical Practice, by Krantz and Care, Williams and Wilkins co.
4. Goodman and Gilman's, The Pharmacological Basis of Therapeutics. J. G. Hardman and Lee E. Limbard, Mc. Graw Hill, Health professions Division.

SUBJECT CODE	SUBJECT
PYP.3.106.	PHARMACEUTICAL TECHNOLOGY (Pharmaceutics - II) LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Acquire about formulation of parenteral and sealing of ampoules.</p> <p>CO2 Prepare gels, suspensions, emulsions &amp; evaluate the suspensions, emulsions.</p> <p>CO3 Prepare tablets, hard gelatin capsules by different methods and evaluate them.</p>	

1. Determination of optimum concentration of suspending agent (tragacanth) required for maximum physical stability of calcium carbonate suspension.
2. Preparation, identification and physical stability evaluation of an emulsion.
3. Manufacture of Tablets sodium bicarbonate tablets IP (500 mg).
4. Manufacture of paracetamol tablets IP (500 mg)
5. Manufacture of ascorbic acid tablets IP (50 mg).
6. Manufacture of aspirin tablets IP (300 mg).
7. Manufacture of calcium lactate tablets IP (300 mg).
8. Evaluation of uncoated marketed tablets (in-process and quality assurance).
9. Evaluation of coated marketed tablets (in process and quality assurance).
10. Manufacture of aspirin hard gelatin capsules USP (300 mg).
11. Evaluation of marketed hard gelatin capsules.
12. Manufacture of ascorbic acid injection IP.
13. Manufacture of calcium gluconate injection IP.
14. Manufacture of nandrolone deconate injection IP.
15. Manufacture of dextrose intravenous infusion IP.
16. Manufacture of strong ammonium acetate solution IP.
17. Manufacture of magnesium hydroxide mixture BPC. (preparation of emulsion with combination of emulsifying agents using HLB values concept).
18. Manufacture of non-staining iodine ointment BPC.( Preparation of suspension using suitable suspending agent).
19. Manufacture of diclofenac gel.
20. Manufacture of cold cream. (Preparation of Multiple emulsions).

SUBJECT CODE	SUBJECT
PYP 3.107.	PHARMACOGNOSY-I LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Identify the morphological &amp; microscopical evaluation of crude drugs</p> <p>CO2. Analyse physical &amp; microscopical methods of evaluation of crude drugs</p> <p>CO3. Describe about isolation &amp; estimation of various crude drugs.</p>	

1. Detailed Microscopical study (Transverse section ) of following drugs (Any four)
  - (a) Rauwalfia (b) Cinchona (c) Senna (d) Liquolice (c) Fennel (f) Clove (g) Nux-Vomica.
2. Microscopical powder characters of (Any eight)
  - (a) Vasaka (b) Clove (c) Ephedra (d) Cinnamon (e) Liquorice (f) Digitalis (g) Quassia (h) Nuxvomica (i) Cinchona (j) Coriander (k) Senna (l) Kruchi (m) Rauwolfia.
3. Morphological Identification of drugs listed in theory.
4. Determination of swelling factor.
5. Determination of refractive index and optical rotation.
6. Isolation and Identification of starch from potatoes.
7. Isolation and Identification of Caffeine from tea
8. Isolation of Tannic acid from Galls.
9. Estimation of cincole in encalyptus oil.
10. Distillation of volatile oils (Demo).
11. Qualitative Microscopical powder Analysis (Binary Mixture).
12. Determination of stomatal index, palaside ratio and number.
13. Measurement of fibers and grains



SUBJECT CODE	SUBJECT
PYP.3.108	MULTIMEDIA AIDED LANGUAGE LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Write effective headings, passages, grammatically sound sentences with Active & passive voices, punctuations.

CO2. Write specific documents like letter, memos, covering letters, Job applications, resume, report writing etc.

CO3. Webpage design, HTML language & Electronic publishing.

CO4. Understand Phonetics & spoken English, Group discussions, Pharmacy related discussions, Elocutions, debating, collaboration of Health care providers using Network technologies.

Exercise – 1: Writing Effective Headings; Writing Effective Passages - To describe; To compare and contrast; To define; To show cause and effect and To show sequence

Exercise – 2: Writing Grammatically Sound Sentence; Using the Right Tense and Voice - Using the active voice; Paring the passive; Writing in the third person and Using the imperative voice

Exercise – 3: Punctuating Effectively - Common punctuation marks and how to use them; Using punctuation to clarify messages and improve readability; Bullets, numbers, white space and Using symbols and abbreviations

Exercise – 4: Writing Summaries; Description – Event and Product

Exercise – 5: Writing Specific Documents - Letters and Memos; Job Applications, Cover letters and Resume.

Exercise – 6: Writing - Procedures; Proposals and Analytical Reports;

Exercise – 7: Using of Graphs, Tables and Figures for representing a data

Exercise – 8: Writing out a talk; Extra verbal Cues; Handouts, Visuals and demonstration Models;

Exercise – 9: Basics of Web Page Design; Writing and Designing for World Wide Web;



Exercise – 10: Document Authoring and Maintenance; HTML Language and Electronic Publishing;

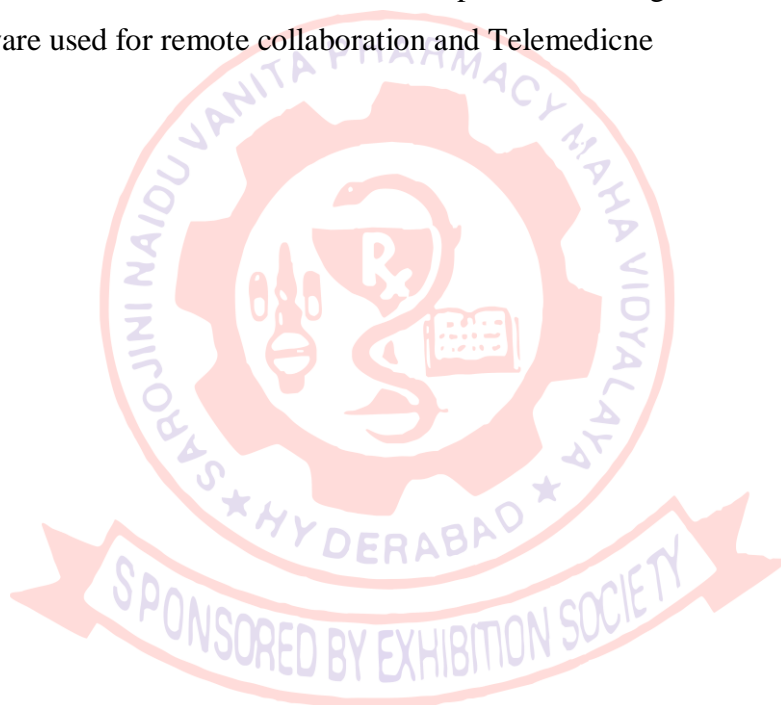
Exercise – 11: Designing and Writing for Multimedia

Exercise – 12: Personal and Group Communication: E-mail; Mailing Lists, News Groups and Pharmacy –Related Discussion Forums;

Exercise – 13: Phonetics and Spoken English – Rhythm, Intonation, Reading aloud, Accent difference between American, British and Indian English; International Varieties of English

Exercise – 14: Formal and Informal types of Speech; Elocution; Debating; Group Discussion; Brain Storming;

Exercise – 15: Collaborations of Health care providers using Network Technologies; Intranets, Software used for remote collaboration and Telemedicine



SUBJECT CODE	SUBJECT
PYT 3.201	<b>PHARMACEUTICAL CHEMISTRY</b> <b>(CHEMISTRY OF NATURAL PRODUCTS)</b>

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Identify the various chemical techniques to confirm the structures of Natural carbohydrates. Analyse the fats and oils by different analytical techniques.

CO2. Describe the Relationship of Amino acids to proteins and polypeptides. Explain the chemistry of Protein drugs with their significances.

CO3. Explain the general methods of structural determination of flavonoids. Recognise the significance of flavonoids. List out the methods of Isolation of terpenoids. Choose the different chemical techniques to confirm the structures of terpenoids.

CO4. Classify the alkaloids with examples. Describe the general methods of extraction and uses. Explain the structure Elucidation and chemistry of Alkaloidal drugs. Acquire knowledge in purine drugs understands the significance of Naturally occurring drug resources.

CO5. Identify the steroidal drugs. Categories the hormonal drugs with their significance. Explain the mechanism of Action and uses of cardiac drugs.

**Unit – I**

Poly Functional Natural Products Carbohydrates: Introduction, Definition, Classification, Isolation, General Properties (including isomerism) and Pharmaceutical importance of Carbohydrates, Chemistry (Structure, Nomenclature and Reactions) of glucose, fructose, sucrose, maltose, cellulose and starch. Oils & Fats: Introduction, Definition, Classification, Isolation, General properties and Pharmaceutical importance of oils and fats. Chemistry (Structure, Nomenclature and Reactions) of Oils and Fats and analyse according to Pharmacopoeial methods .

**Unit - II**

Amino Acids and Proteins Introduction, Definition, Classification, Isolation, General properties and Pharmaceutical importance of amino acids and their relationship to proteins

and polypeptides. Chemistry of Protein Hormones: Insulin, Oxytocins, Thyroxin and anti-thyroid drugs.

### **Unit - III**

Flavanoids and Terpenoids  
Flavonoids: Sources, Uses, chemistry and General methods of structural determination (chemical & spectral analysis) of Amygdalin, arbutin and quercetin  
Terpenoids: Isoprene rule, Special Isoprene Rule for terpenes, General methods of isolation and. Chemistry of citral, menthol and camphor.

### **Unit - IV**

Alkaloids - Purine and Xanthine Derivatives Introduction, Definition, Occurrence, Classification, Isolation, General properties and Pharmaceutical importance of Alkaloids. General methods of extraction, Structure elucidation and Chemistry (Structure, Nomenclature and Reactions) of ephedrine, atropine, papaverine and quinine and also Caffeine and Uric acid.

### **Unit - V**

Steroids Introduction, Definition, Occurrence, Classification, Isolation, General properties and Pharmaceutical importance of Sterols: colour reactions of cholesterol, stigmasterol, ergosterol. Importance & general concepts of bile acids. Steroidal saponins: Diosgenin and hecogenin. Androgens, Estrogens, Progestational agents, Steroidal contraceptives. Adrenocorticoids, Deoxycorticosterone, Cortisone, Prednisone, Aldosterone. Cardiac Glycosides of Digitalis other Cardiac drugs, Strophanthus and Squill.

**Examination:** One question from each unit with internal choice.

### **TEXT BOOKS:**

01. Organic Chemistry, Vol.II by I.L. Finar, The English Language Book Society, London.
02. Natural Products Vol.I & II by O.P. Agarwal Goel publications – Meerut.

### **REFERENCES :**

01. R.T. Morrison and R.N. Boyd, Organic Chemistry, Allyn and Bacon, Inc., Boston
02. Burger's Medicinal Chemistry, M.E. – Wolff, Ed., John Wiley & Sons, New York.
03. F.G.Mann & B. Saunders, Practical Organic Chemistry Longmans Green & Co. Ltd., U.K
04. R. M. Acheson, An Introduction to the Chemistry of Heterocyclic Compounds, Interscience NY.

SUBJECT CODE	SUBJECT
PYT 3.202	PHARMACOLOGY – II

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Explain the basic principles of chemotherapy and Analyze the problem associated with the drugs used for the treatment of various microbial infections and cancer.

CO2. Describe physiological role of autacoids and pharmacology of related drugs and predict the drug targets based on etiopathogenesis of haemopoietic disease and explain the pharmacology of drugs acting on haemopoietic systems.

CO3. Explain the Pharmacology and rationale use of drugs used for the treatment of various endocrine disorders.

CO4. Explain the principles of Bioethics and Bioassays and describe the biological assays of some selective drugs.

CO5. Explain the principles of Toxicology and their adverse reactions and Describe the treatment of poisoning for drugs and phases of clinical trials.

**Unit – I**

Chemotherapy of Infections and Cancer. Basic Principles of Chemotherapy; Systemic Pharmacological study of Anti-bacterial, Antiviral, Anti-fungal, Anti-protozoal and Anti-helmenthic drugs; Cancer Chemotherapy

**Unit – II**

Pharmacology of Autocoids: Local Hormones Anti-histamines: Histamine, Serotonin and ergot alkaloids; Vasoactive principles; Eicosanoids; Prostagladins, Thromboxanes,Leukotrines and related compounds. Nitric oxide, Donors and inhibitors. Para Drugs acting on blood and blood forming agents -Coagulants, Anti-coagulants, Haematinics (iron, vitamin-B12, Folic acid) and Thrombolytic Agents.

**Unit – III**

Pharmacology of Endocrine System Systemic Pharmacological study of PituitaryHormones, Sex Hormones, Oral Contraceptives, Oxytocics and Uterine relaxants; Pharmacology of

thyroid and Anti-thyroid drugs, Insulin, Oral hypoglycemics, Glucagon and Adrenocorticosteroids;

#### **Unit – IV**

Bioethics and Bioassay Of Some Selective Drugs Principles of Bioethics, Bioethics of Animals used in Bioassay studies; Principles of Bioassays; Official Bioassays; Biological assay of anti-haemophilic fraction, Heparin sodium, Chorionic gonadotropin, Corticotropin, Insulin, Oxytocin, Vasopressin and Adrenaline; Biological assay of diphtheria anti-toxin, anti-rabies vaccine, tetanus anti-toxin and old tuberculin vaccine;

#### **Unit – V**

Toxicology of Drugs and Clinical Pharmacology Principles of Toxicology; Definition of Poison; General principles of treatment of poisoning with special reference to barbiturates, Opium and Organophosphorus toxicity; Treatment of Poisoning for the following toxins: Methyl Alcohol, Heavy metals, Paracetamol and Digitalis. Introduction to Clinical pharmacology and Phases of clinical trials

**Examination:** One question from each unit with internal choice.

#### **TEXT BOOKS:**

1. Essentials of Medical Pharmacology, K.D. Tripathi., Jaypee Brothers Medical Publishers
2. Pharmacology and Pharmacotherapeutics., R.S.Saathoskar and S.D. Bandarkar., Popular Prakashan, Mumbai.,
3. Text Book of Pharmacology by Rang and Dale

#### **REFERENCE BOOKS:**

1. Goodman and Gilman's: "The Pharmacological basis of Therapeutics" by Joel G. Hardman and Lee E. Limbard., Pergamon Press
2. Lewis's Pharmacology by J. Crossland., Churchill Livingstone Publications
3. Basic and Clinical Pharmacology by Katzung B.G., Prentice-Hall
4. Clinical pharmacology by Lanzence

SUBJECT CODE	SUBJECT
PYT 3.203	PHYSICAL PHARMACY – II

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Understand & describe the solubility of solute in liquids focus on solids distribution phenomena for application in the design of drugs.

CO2. Describe the chemical kinetic principles, order, rate of reaction, factors affecting the rate of reaction, prevent degradation & use of these principles for stability testing and determination of expiry date of formulations.

CO3. Understand & Explain principles and applications of interfacial phenomena, Adsorption at solid interfaces, Electrical properties of interfaces.

CO4. Understand & Explain principles and applications of colloids, micromeritics, properties of colloids, methods to determine particle size distribution, derived properties of powders.

CO5. Describe type of flow (Rheology) & their measurement. Applications of Rheology, Thixotropy and its measurement, psychology, classify polymers and their pharmaceutical applications.

**Unit – I**

Solubility and Distribution Phenomena Definitions, Expressions, Phase rule, Solvent -Solute interactions - polar solvents and semi polar solvents, Solubility of gases in liquids - effect of pressure and temperature, Salting out, Effect of chemical reactions, Solubility calculations. Solubility of liquids in liquids ideal and real solutions, Complete and partial miscibility, Influence of foreign substances, Three component systems, Dielectric constant and solubility. Solubility of solids in liquids Ideal and nonideal solutions solvation and association in solutions. Solubility of salts in water, Solubility of slightly soluble and week electrolytes, Calculating solubility of weak electrolytes as influenced by pH, Influence of solvents on the solubility of drugs, Combined effect of solvents. Distribution of solutes between immiscible solvents -Effect of ionic dissociation and molecular association on partition & extraction, Solubility and partition coefficients, Preservative action of weak acids in emulsions, Drug action and partition coefficients.

## **Unit – II**

Chemical Kinetics Rates and orders of reactions - Rate, order of reaction, Molecularly, Specific rate constant, Units of basic rate constants, Mathematical treatment of rates. Apparent zero order kinetics. First order reactions. Second order reactions. Determination of order of a reaction. Elementary and complex reactions. Specific and general acid base catalysis. Influence of temperature and other factors on reaction rates - Effect of solvents, Ionic strength, Dielectric constant, Catalysts and light. Decomposition and destabilization of medicinal agents against hydrolysis, Oxidation. Kinetics in the solid state. Accelerated stability analysis.

## **Unit – III**

Interfacial Phenomena Introduction, liquid interphases - Surface and interfacial tensions, Surface free energy, measurement of surface and interfacial tensions, spreading coefficient. Adsorption at liquid interfaces - Surface active agents, Systems of hydrophilic - Lipophilic classification, Solubilization and detergency. Types of mono layer at liquid surfaces, applications of amphiphiles. Absorption at solid interfaces - Solid/Gas interface - Solid/Liquid interface. Electric properties of interfaces - Electric double layer, Nerst and zeta potentials.

## **Unit – IV**

Colloids and Micromeritics Dispersed systems, Size and shape of colloidal particles - pharmaceutical application, Types - Lipophilic, Lipophobic and Association colloids, Comparison of properties of colloidal sols; Optical, Kinetic and Electric properties of colloids, Solubilization gels - Structure, Properties and Applications. Particle size and size distribution - average particle size, particle size distribution, number and weight distributions, Particle number; Methods for determining particle size – optical microscopy, sieving, Sedimentation, Particle volume measurement, Particle shape and surface area, Methods for determining surface area - Absorption methods, Air permeability methods; Derived properties of powders - Porosity, Packing arrangements, Densities, bulkiness, Flow properties.

## **Unit – V**

Rheology and Polymers Rheology of Pharmaceutical Fluids: Newtonian and Non-Newtonian Systems; Newtonian systems - Laws of flow, Kinematic viscosity, Effect of temperature. Non newtonian systems - Plastic and Pseudoplastic dilatant flow. Thixotropy - Measurement of thixotropy, Thixotropy in formulation. Determination of rheologic properties - choice of viscometer, Capillary, falling sphere, Cup and bob, and cone and plate viscometers. Psycho

rheology. Applications to pharmacy. Polymers: Definition, Types of Polymers, Water Soluble and Water Insoluble Polymers; Polymers as Thickening Agents; Pharmaceutical Application of Polymers.

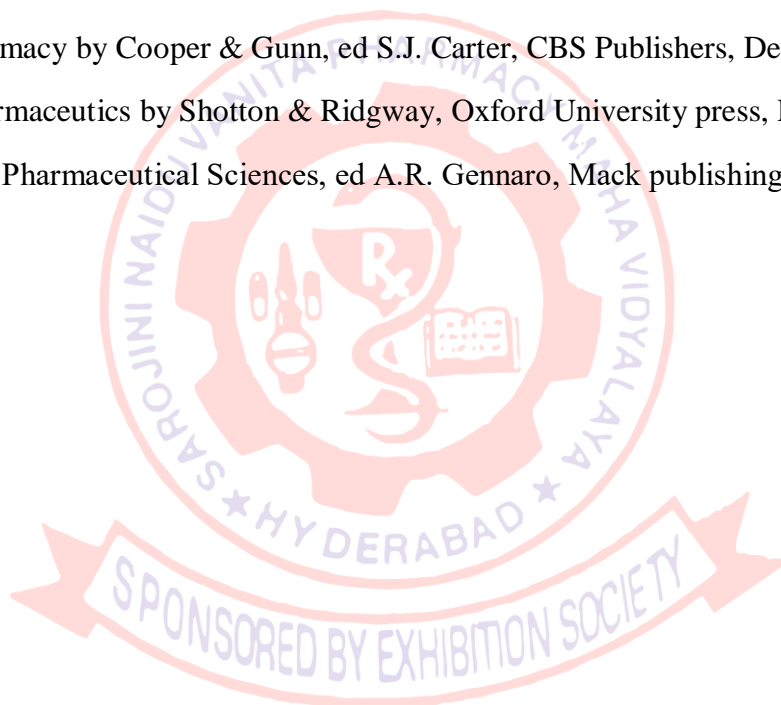
**Examination:** One question from each unit with internal choice.

**TEXT BOOKS:**

1. A.N. Martin, Arthur Cammarata and J. Swarbrick, Physical Pharmacy by 3rd ed, K.M. Varghese & Co, Bombay.
2. C.V.S. Subrahmanyam, Textbook of Physical Pharmaceutics, 2nd Edition, Vallabh Prakashan, Delhi, 2004.

**REFERENCE BOOKS:**

1. Tutorial Pharmacy by Cooper & Gunn, ed S.J. Carter, CBS Publishers, Delhi.
2. Physical Pharmaceutics by Shotton & Ridgway, Oxford University press, London.
3. Remington's Pharmaceutical Sciences, ed A.R. Gennaro, Mack publishing Co, PA.





SUBJECT CODE	SUBJECT
PYT 3.204	FORENSIC PHARMACY (PHARMACEUTICAL JURISPRUDENCE)

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe about pharmaceutical and Drug legislation in India, Explain evolution and growth of Pharmaceutical industry and code of Pharmaceutical Ethics.

CO2. Gain knowledge on Administration, control and manufacture and regulation of Drugs & cosmetics Act 1940,

CO3. Explain schedules, amendments & rules related to Drugs & cosmetic Act

CO4. Explain the amendments, salient features & rules related to magic remedies food adulteration and factories act 1948.

CO5. Describe about IPR, drug price control order, pharmaceutical policy & Indian patent act with its amendments, objectives & inventions.

**Unit – I**

1. Evolution of Pharmaceutical and Drug Legislation in India.
2. The Pharmacy Act 1948.
3. Code of Pharmaceutical Ethics.
4. Consumer protection Act 1986.
5. Narcotic and Psychotropic substances Act 1985.

**Unit – II** Drugs and Cosmetics Act 1940 and Drugs & Cosmetic Rules 1945 (also amendments).Administration of the Act – The controlling and licensing regulation at state level and central level(the organisation, function and duties of state and central drug control authorities).

Drugs & Cosmetic Act Rules – the provisions related to a. The manufacture of drugs (other than homeopathic) including schedule C, C(1), F, F(1) and X drugs and cosmetics. b. The sale and distribution of drugs (other than homeopathic) includingschedule C, C(1), F, F(1) and X drugs and cosmetics.

**Unit – III**

Drugs & Cosmetics Act Rules

1. (i.) The import and export of drugs & cosmetics.  
(ii) Labelling and packing requirements for all categories of drugs & cosmetics.
2. (i.) List of schedules to the Drugs & Cosmetics Rules.  
(ii.) Detailed study of schedule M (new), U and Y.
3. Medicinal & Toilet preparations (Excise Duties) Act 1955.

#### **Unit – IV**

1. Drugs and magic Remedies (Objectionable Advertisements) Act 1954.
2. Prevention of Food Adulteration Act 1954 (salient features)
3. The Factories Act 1948 and the Amendment (salient features.).

#### **Unit – V**

##### IPR's and Patent Laws

1. Intellectual Property Rights – a brief introduction to various IPR's.
2. Indian Patent Act 1970 and the Amendments to the Act (upto date with reference to WTO Agreement)
  - a. Introduction & Objectives
  - b. Inventions and Not inventions according to the Act.
  - c. Procedure of obtaining patent for drugs and pharmaceuticals.
3. Drug Price Control Order (Latest).
4. Pharmaceutical Policy 2002.

**Examination:** One question from each unit with internal choice.

#### **TEXT BOOKS:**

1. Forensic Pharmacy by B.M. Mithal, Vallabh Prakashan.
2. Forensic Pharmacy by Dr. B.S. Kuchekar, A.M. Khadatare and Sachin C. Itkar, Nirali Prakashan, Pune.
3. Drugs and Cosmetics Act 1940 by Vijay Malik, Eastern Book Company, Lucknow.

#### **REFERENCE BOOKS:**

1. Bare Acts, published by Govt. of India.
2. Patent Act 1970 with patent Rules , published by Taxman Allied services (P) Ltd., 59132, New Rohtak Road, New Delhi – 110005.
3. ISO, International Organisation for Standardisation, Switzerland, 1994.

SUBJECT CODE	SUBJECT
PYT 3.205	BIOSTATISTICS (PHARMACOSTATISTICS)

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. This course underlines the basics of statistics. Define mean, median & mode. It helps to understand concepts of standard deviation correlation, regression. Also focuses on describing the probability theory and application of theorems to day to day problems.

CO2. This course comprises of nature scope, statistical methods & limitations. It focuses on methods of graphical representation to represent data. It discusses the Discrete & continuous distribution to evaluate the probability problems.

CO3. This course defines sampling & describes the methods of sampling & representation of data through diagrams. It helps to understand & compare the sampling of Non-Sampling errors.

CO4. This course deals with various bio-statistical techniques & its applications. It helps to apply common parametric/Non-Parametric test in biological/pharmaceutical experiments.

CO5. This course discusses various parametric tests like t-Test, Chi-square test, ANOVA. It evaluates the data & explains the various tests of significance & their application. Also discusses the various principles of experimental design.

**Unit – I**

Definition and determination of terms Mean, Median, Mode, relation between mean, median, and mode. Standard deviation, histogram, Coefficient of correlation, regression analysis, curve fitting, theory of probability.

**Unit – II**

Nature and Scope of Statistical methods and their limitations, compilation, classification, tabulation and applications in pharma and life sciences; Graphical representation; Measures of Average Stem and Leaf Plots; Box and Whisker Plots, Co plots; Introduction to Probability Theory and Distributions (Concepts without Derivations), Binomial, Poisson & Normal Distributions (Only definition and Problems)

**Unit – III**

Sampling Methods: Simple, Random, stratified, Systematic and Cluster Sampling Procedures; Data Collection, Data Organization and Data Representation; Bar, Pie, 2-D and 3-D Diagrams; Sampling and Non-Sampling Errors; Sampling Distributions; measure of dispersion.

#### **Unit – IV**

Interference Concerning Means: Point Estimation - Interval estimation – Bayesian estimation - Tests of Hypothesis; Common Parametric and Non parametric tests employed in testing of significance in biological/pharmaceutical experiments.

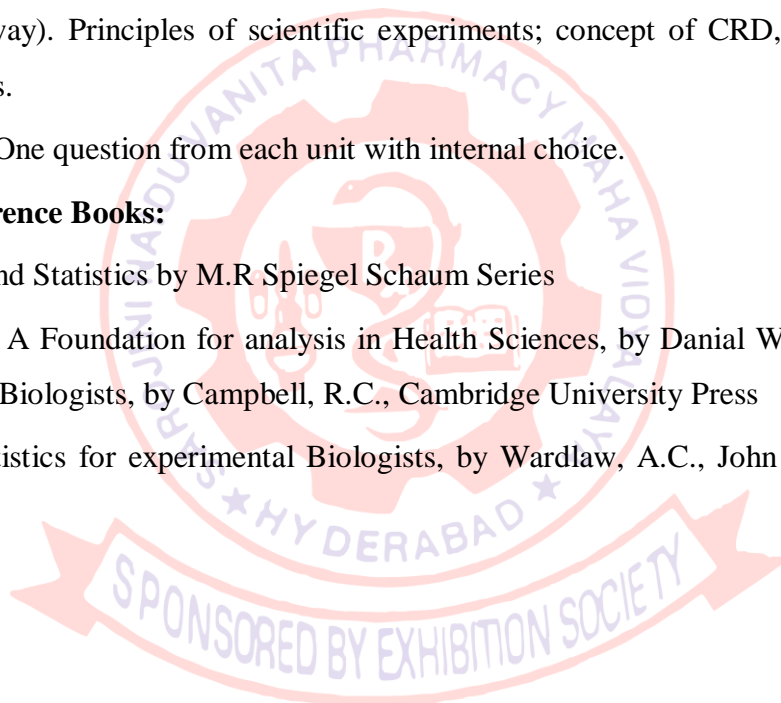
#### **Unit – V**

Tests of significance - T -test, chi-square test, analysis of variance, elements of Anova (one way and two way). Principles of scientific experiments; concept of CRD, RBD and Latin square diagrams.

**Examination:** One question from each unit with internal choice.

#### **Text and Reference Books:**

1. Probability and Statistics by M.R Spiegel Schaum Series
2. Biostatistics: A Foundation for analysis in Health Sciences, by Danial W.W., John Wiley
3. Statistics for Biologists, by Campbell, R.C., Cambridge University Press
4. Practical statistics for experimental Biologists, by Wardlaw, A.C., John Wiley and Sons Inc.,



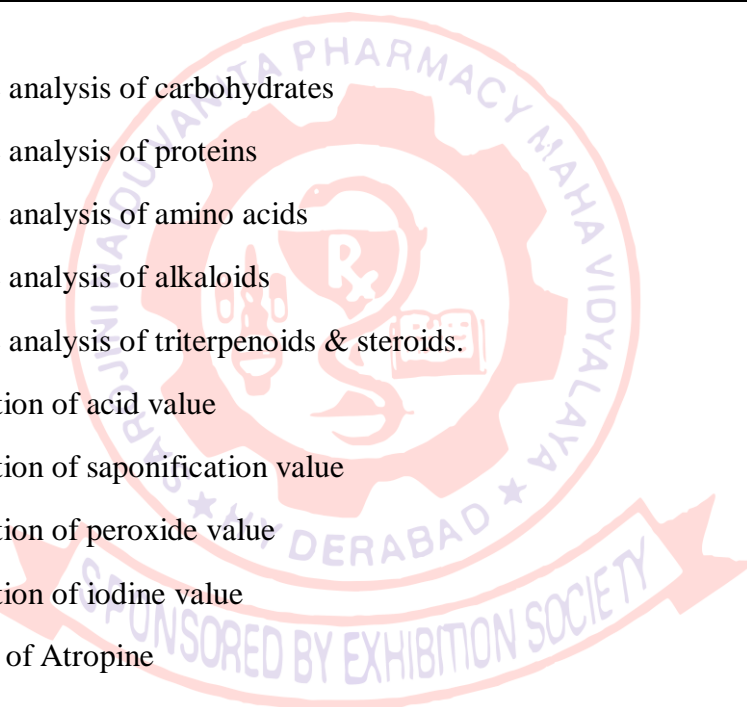
SUBJECT CODE	SUBJECT
PYP 3.206	PHARMACEUTICAL CHEMISTRY (CHEMISTRY OF NATURAL PRODUCTS) LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Identify the different classes of Natural drugs with qualitative analysis
- CO2. Analyse the fats and oils by Analytical techniques judge the purity of the substance.
- CO3. Select the techniques for estimation of natural drugs.

1. Qualitative analysis of carbohydrates
2. Qualitative analysis of proteins
3. Qualitative analysis of amino acids
4. Qualitative analysis of alkaloids
5. Qualitative analysis of triterpenoids & steroids.
6. Determination of acid value
7. Determination of saponification value
8. Determination of peroxide value
9. Determination of iodine value
10. Estimation of Atropine
11. Estimation of Ephedrine.



SUBJECT CODE	SUBJECT
PYP.3.207	PHARMACOLOGY –II LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1: Understand the concepts and fundamentals of experimental pharmacology, it's history and various equipment and appliances used in introduction part of experimental pharmacology.

CO2: Analyse the receptor location, action and the effect of various drugs on isolated tissue or whole using simulation experiments.

CO3: Learn and comprehend the effect of various drugs response on different activity studies such as anti-pyretic, hypoglycaemic, anti-psychotic, analgesic, types of antagonism on whole animal/isolated tissue preparation.

CO4: Understand the various routes of administration by using different drugs available, and acquire data regarding dose response curve relationships.

CO5: Understand the concepts of bioassay and its significance.

1. An introduction to different equipments used in Pharmacology laboratory
2. Effect of routes of administration on the action of drugs.
3. Dose response curves of Acetyl cholins.
4. Demonstration of different types of antagonism on isolated tissue preparations.
5. Effect of different electrolytes or drugs on isolated frog's heart.
6. Effect of drugs on isolated frog rectus abdominus (any four drugs).
7. Bioassay of drugs by matching method
8. Bioassay of drugs by graphical (interpolation) method
9. Bioassay of drugs by three point and four point methods.
10. Effect of various drugs on isolated rabbit intestine / guinea pig ileum
11. Hypoglycemic activity of insulin in rabbit.
12. Effect of drugs on ciliary movement of frog's esophagus
13. Local anesthetic activity on Rabbit eye / Guinea pig/ Frog's hind limb withdrawal (Demo).

14. Anti-psychotic effect by pole climbing apparatus (Demo)
15. To study the analgesic effect of narcotic analgesic by using hot-plate/acetic acid induced writing method. (demo)
16. Effect of drug on blood vessels
17. Antipyretic effect in rabbits.



SUBJECT CODE	SUBJECT
PYP.3.208	PHYSICAL PHARMACY – II LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Demonstrate the physico chemical properties of drugs and solvency.

CO2. Evaluate the Acidity, Instant.

CO3. Demonstrate the behaviour of surface phenomena.

CO4. Study the solid-state properties of drugs and Excipients.

1. Determination of bulk density and flow properties of powders / granules.
2. Determination of viscosity liquid using Ostwald viscometer/ Redwood viscometer.
3. Determination of surface tension by stalagmometer method.
4. Determination of HLB of surfactant – Saponification method.
5. Determination of CMC of a surfactant –Drop count method using stalagmometer.
6. Ternary phase diagram for a three component system comprising of alcohol, water and benzene.
7. Determination of adsorption behavior of acetic acid on charcoal.
8. Determination of CST of Phenol- water system.
9. Effect of sodium chloride on CST of phenol water system.
10. Determination of solubility- Heat of solution method.
11. Determination of first order reaction rate constant- Acid hydrolysis of ester.
12. Preparation of pharmaceutical buffer and determination of its buffer capacity.
13. Determination of second order reaction rate constant- Alkali hydrolysis of ester
14. Determination of ionization constant. conductivity method /distribution method.
15. Determination of distribution coefficient of benzoic acid in benzene and water.
16. Determination of particle size distribution – Microscopy.



SUBJECT CODE	SUBJECT
PYT4.101	BIOPHARMACEUTICS AND PHARMACOKINETICS

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Understand the basic concepts in biopharmaceutics and pharmacokinetics their significance, describe the factors affecting drug Absorption.

CO2. Determine factors affecting drug distribution, explain protein and tissue binding of drugs and their significance.

CO3. Understand determine the factors affecting the metabolism Explain phase-I and phase-II metabolic reactions. Understand Excretion of drugs factors affective Excretion of drugs rate processes in biological system.

CO4. Understood and Describe rate processes in biological system, derive various pharmacokinetic parameters, their significance and applications, explain the clinical pharmacokinetics, dose adjustment with & without renal & hepatic diseases.

CO5. Use of plasma concentration time profile. Analyze the PK parameters to interpolate Absorption, distribution, metabolism, Excretion and elimination under the conditions of IV bolus infection, Intravenous infusion, oral single dose graphically.

**UNIT-I:**

**BIOPHARMACEUTICS**

Introduction and their role in formulation development and clinical setting; Fate of drug after administration, Passage of drugs across biological barrier – Passive diffusion, Active transport and other transport mechanisms, Drug Absorption Mechanisms: Factors governing in drug absorption (Physico – Chemical, Biological, Metabolic, Formulation and Dosage Form considerations).

**UNIT – II:**

**DRUG DISPOSITION AND EXCRETION OF DRUGS**

Distribution of Drugs through Organ/Tissue; Factors affecting distribution (Physico-Chemical Properties of the Drug, Organ/Tissue Size, Blood Flow to the Organ, Biological barriers to the diffusion of drug, Drug binding blood/Tissues/Macromolecules and Apparent volume of distribution); Localisation of drugs – Protein binding of drugs, Factors affecting

protein binding, Significance and Kinetics. Tissue binding of drugs, Biotransformation of Drugs – Phase I & Phase II reactions; Factors affecting Biotransformation Elimination of drugs through Renal and Non Renal routes – Factors affecting renal and Non-renal excretions.

### **UNIT – III:**

#### **PHARMACODYNAMICS**

Induction and Inhibition of Drug Metabolizing Enzymes; Elementary treatment of enzyme stimulation, enzyme inhibition, membrane active drugs, drug metabolism and its significance; Metabolites: Hepatic Clearance of Metabolites, Pharmacological activity of metabolites, Deposition of metabolites, First Pass Effect, Biliary Excretion, Enterohepatic Circulation, Extra hepatic Metabolism and Minor Pathways of Drug Excretion;

### **UNIT – IV:**

#### **PHARMACOKINETICS**

Introduction, Basic concepts – Rate processes in biological systems – Pharmacokinetic parameters; AUC, C<sub>max</sub> and T<sub>max</sub>; Biological half-life, Apparent volume of distribution, Clearance, Absorption rate constant – Methods of determination, Significance and applications. Pharmacokinetic drug interactions and their significance in combination therapy. Clinical Pharmacokinetics: Dosage adjustments in patients with and without renal and hepatic failure.

### **UNIT – V:**

#### **COMPARTMENT MODELS**

Basic concepts, One and two compartment models – Kinetics of blood levels – Pharmacokinetics of absorption, Distribution, Metabolism and Elimination under the following conditions; i) Intravenous bolus injection ii) Intravenous infusion iii) Oral –single dose iv) Oral – multiple dose Application of Pharmacokinetic Principles and computation of parameters by graphical approach

**Examination:** One question from each unit with internal choice.

#### **Text Books:**

1. Biopharmaceutics and Pharmacokinetics – An Introduction by Robert E. Notary, 2nd edn. 1975, Marcel Dekkar Inc., New York.
2. D.M. Brahmanekar and S.B.Jaiswal, Biopharmaceutics and Pharmacokinetics - A Treatise, Vallabh Prakasham, Delhi, 1995.

3. L. Shargel and A.B.C. Yu, Textbook of Applied Biopharmaceutics & Pharmacokinetics, 4th Edn, Appleton-Century-Crofts, Connecticut, 2004.

4. Venkateswarlu, Fundamentals of Biopharmaceutics & Pharmacokinetics, Paras Pubs, Hyd.

#### **Reference Books**

1. Remingtons Pharmaceutical sciences 17th edn. 1985 Mac Pub. Co., Easton, Pennsylvania.

2. Modern Pharmaceutics by Banker, 1979, Marcel Dekker Inc., New York.

3. L. Lachman, H.A. Lieberman, J.L. Kanig, The Theory and Practice of Industrial Pharmacy, 3rd Edition, Varghese Publishing House, Mumbai, 1991.

4. A.R. Gennario, Remington: The Science and Practice of Pharmacy, 20th Edition, Volume II, Lippincott Williams & Wilkins, Philadelphia, 2004.



SUBJECT CODE	SUBJECT
PYT4.102	<b>PHARMACEUTICAL ANALYSIS–II</b> <b>(INSTRUMENTAL METHODS OF ANALYSIS)</b>
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>The students should be able to:</p> <p>CO1. Understand the principle of absorption in UV-Visible spectroscopy and its applications</p> <p>CO2. Understand &amp; apply the concepts of IR spectroscopy in interpreting of functional groups</p> <p>CO3. Explain the principle involved in Fluorescence spectroscopy, NMR spectroscopy &amp; mass spectrometry &amp; its application.</p> <p>CO4. Explain the principle &amp; theoretical aspects DTA, Home photometry &amp; Electrochemical analysis – like conductometry, potentiometry, Amperometry.</p> <p>CO5. Describe and apply the principles of separation in chromatography &amp; Electrophoresis to analyse various drugs.</p>	

Note: The subject is to be discussed with special reference to quality assurance of pharmaceuticals, its scope and importance in pharmaceutical industry. The following analytical techniques will be discussed with suitable examples.

**UNIT–I: ABSORPTION SPECTROSCOPY:** Regions of Electro Magnetic Spectrum, properties of EMR, Atomic and Molecular Spectra, Beer-Lambert's Law and deviation from Beer's Law; Molecular Vibrations and Hooke's Law. UV–Visible Spectroscopy: Principles and theoretical aspects – Electronic Transitions; Effect of Conjugation; Concept of Chromophore and Auxochrome; Bathochromic, Hypsochromic, Hyperchromic and Hypochromic shifts. Instrumentation – Components of Spectrophotometer, types of spectrophotometers, solvents and sample handling. Applications - Qualitative and Quantitative measurements – single component and multi component analysis; UV spectra of conjugated dienes and enones. IR-Spectroscopy: Principles and theoretical aspects – Selection rules, Intensity and Position of IR bands, Measurement of IR spectrum, Finger Print region

and Characteristic absorptions of various functional groups. Instrumentation – Spectrophotometer Components, Sample preparation and handling. Applications - Interpretation of IR spectra of simple organic compounds and structure elucidation in brief, Quantitative applications.

**UNIT – II: SPECTROMETRY (NMR, ESR, Mass and X-Ray diffraction)** A brief introduction to the principles of NMR, ESR, Mass and X-Ray diffraction analysis. General Introduction to the Instrumentation of NMR and Mass spectrometry; Definition of following terms of NMR and Mass spectrometry: NMR: Chemical Shift, Spin-Spin interaction, Shielding effect, Double resonance, contact shift reagents, solvent effects, Fourier Transform Technique and Nuclear Overhauser Effect (NOE). Mass: Ion Production, Ion analysis, Ion abundance, Mass fragmentation, Molecular ion peak, meta stable peak, Nitrogen rule and Maclafferty rearrangement. Application - Interpretation of NMR (Proton) and Mass spectrometry of the following Organic Compounds (Ethanol, Acetaldehyde, Ethyl acetate, Toluene and Acetophenone) for Structure determination.

**UNIT - III :** Fluorescence spectroscopy: Fundamentals, Radiative and non-radiative processes, Mirror image relationship, Fluorescence and molecular structure, Fluorescence properties. Instrumentation – Components of spectrofluorimeter. Applications. Electrogravimetry and Polarography: Principles and theoretical aspects; current – voltage curve, different currents, half wave potential, Ilkovic equation. Instrumentation – Polarographic setup, polarographic run Applications – Qualitative and Quantitative analysis. Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD): Principles and Theoretical aspects: Instrumentation and Sample handling; Application using deduction of absolute configuration for optical isomers.

**UNIT – IV:** Potentiometry and PH Metry: Principles and theoretical aspects -electrodes, representation of electrodes and cells, Measurement of cell potential, Measurement of PH, End point evaluation methods, Potentiometric titrations, Null point Potentiometry and applications. Specific-Ion Electrode: Principle and Theoretical Aspects – Instrumentation and Pharmaceutical Applications

Conductometry : Principles and theoretical aspects –conductance, Equivalent and Molar conductance, effect of dilution on conductance, conductivity of water, cell constant, conductivity cell, Measurement of conductivity, Wheat stone bridge principle, conductimetric titrations and applications. Other Analytical Instruments: Principles, Instrumentation and

Pharmaceuticals applications of following instrumental methods of analysis: Amperometry, Turbidimetry, Nephelometry, Flame photometry and Differential Thermal Analysis.

**UNIT – V:** Chromatography: Principles, instrumentation, experimental details and the applications of Paper Chromatography, TLC, Column Chromatography, Gel permeation Chromatography, Ion Exchange Chromatography, Gas Chromatography, HPLC and HPTLC  
Electrophoresis: Principles, Instrumentation, Experimental details and the Applications in Qualitative Analysis of Protein based Drugs.

**Examination:** One question from each unit with internal choice.

**TEXT BOOKS:**

1. Practical Pharmaceutical Chemistry Vol. I & II by A.G.Beckett and J.B. Stresnlake, The Athlone press of the University of London.

2. Instrumental methods of Chemical Analysis by B.K. Sharma, 23rd edn, GOEL Pub. House,

**REFERENCES BOOKS:**

1. Indian Pharmacopoeia Published by Controller of Publications.

2. B.P. / U.S.P./Extra Pharmacopoeia.

3. A Text Book of Pharmaceutical Analysis by K.A. Connors, Wiley Interscience, New York.

4. Jenkin's Quantitative Pharmaceuticals Chemistry by A.M.Knevel & F.E. Digengl, McGraw Hill Book Co., New York.

5. Pharm.Analysis by Higuchi.T and Hansen E.B.

6. Vogels textbook of Quantitative chemical analysis,sixth Edition J. Mendham, R.C. Denny, J.D. Bannes M J K Thomas, Pearson education ,Delhi, India.

7. Principles of Instrumental Analysis, fifth edition D.A. Skoog, F. James Holler, Timothy A. Nieman, Harcourt Brace college publishers, Florida, US.

8. J.A. Howell, Hand Book of Instrumental techniques for Analytical Chemistry, prentice hall, upper saddle river (1197).

SUBJECT CODE	SUBJECT
PYT4.103	MEDICINAL CHEMISTRY-II

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe the structural features, synthetic route and their influence on metabolic pathway for selected Anti-inflammatory agents.

CO2. Explain and gain knowledge on classification and structure activity relationship influencing metabolism for antibiotics and chemotherapeutic agents.

CO3. Knowledge on various parasitic and protozoal infections and to describe the role of medicinal agents used for prophylaxis.

CO4. Classify and describe structural features mechanism of action of some drugs influencing central nervous system.

CO5. Knowledge on preparation and biochemical role of vitamins, essential amino acids and protein drugs in health promotion.

Note: Introduction, definition, classification, structures, synthesis, general mechanisms, mode of action (wherever known), SAR including physicochemical, steric aspects, metabolism and uses of various categories of drugs mentioned in brackets against each category of the following units.

**UNIT I:** Local Anesthetics -(Lidocaine and Bupivacaine). Narcotic analgesics -(Pethidine and Fentanyl), Narcotic antagonists -(Naloxone), Peripheral analgesics, Antipyretics & Anti-inflammatory agents -(Aspirin, Paracetamol, Piroxicam, Ibuprofen and Diclofenac Sodium).

**UNIT II:** Anti-neoplastic agents -(Chlorambucil, Busulfan, Fluorouracil, Methotrexate and Tamoxifen), Chemotherapeutic agents, Sulfonamides -(Sulphamethoxazole and Sulphadiazine) Antibiotics –General Classification of Antibiotics; Beta-lactam antibiotics - Penicillin, Ampicillin, Cloxacillin); Cephalosporins -(Cephalexin); Tetracyclines - Chlortetracycline, Oxytetracycline), Quinolones -(Norfloxacin and Ciprofloxacin); Aminoglycosides, Macrolides, Polypeptides; Miscellaneous - (Chloramphenicol and Novobiocin).



**UNIT III:** Antitubercular drugs -(INH, PAS, Ethambutol); Antileprotic drugs -(Dapsone); Antifungal drugs -(Ketoconazole and Fluconazole); Antiviral drugs -(Zidovodine ); Antimalarial drugs -(Chloroquine, Pyrimethamine, Primaquine); Anthelmintic drugs -(Diethyl carbamazine citrate, Albendazole, Niclosamide, Pyrantel formate and Piperazine citrate); Antiprotozoal drugs -(Metronidazole, Tinidazole).

**UNIT IV:** Drugs acting on CNS: CNS stimulants and psychotropic agents -(Imipramine and Amirpytiline), General Anesthetics -(Halothane, Ketamine, Enflurane), Sedative & Hypnotics -(Phenobarbitone, Glutethimide, Zolpiclone), Anxiolytics -(Diazepam, Medazolam, Buspirone). Antipsychotic (Tranquilizing) agents: (Chlorpromazine, Thiothixene, Haloperidol and Pimozide) Anticonvulsants -(Phenytoin, Carbamazepine, Ethosuximide), Anti parkinsonism drugs -(Benztropine and Carbidopa).

**UNIT V:** Vitamins: Structure, Preparation, Storage, Uses and their biochemical role in health promotion (Fat Soluble –A, D, E & K and Water Soluble –B1, B2, B3, B5, B6, B12 & C) Structure and Functional Role of Essential Amino Acids; Development of Protein Drugs.

**Examination:** One question from each unit with internal choice.

**TEXT BOOKS:**

1. J.H. Block & J.M. Beale (Eds) Wilson and Giswold's Text Book of Organic Medicinal & Pharmaceutical Chemistry, 11th edition, Lippincott, Raven, Philadelphia, 2004.
2. W.O. Foye, Text Book of Medicinal Chemistry, 5th edn, Lea & Febiger, Philadelphia, 2002.
3. S.N. Pandeya, Text Book of Medicinal Chemistry, 2nd edn, S. G. Pubs, Varanasi, 2003.

**REFERENCE BOOKS:**

1. D. Abraham (Ed), Burger Medicinal Chemistry and Drug Discovery, Vol.I , 6th edition, John Wiley & Sons, New York, 2003.
2. B.N. Lads, M.G. Mandel and F.I.Way, Fundamentals of drug Metabolism & Disposition, William & Welking Co, Baltimore U.S.A.,
3. C. Hansch, Comprehensive Medicinal Chemistry, Vol I-VI Elsevier Pergamon Press, Oxford, 1991.
4. Daniel Lednicer, Strategies for organic Drug Synthesis and Design, John Wiley N.Y., 1998.
5. D. Lednicer , Organic Drug Synthesis, Vol. I-VI, John Wiley N.Y



SUBJECT CODE	SUBJECT
PYT4.104.	DOSAGE FORMULATION DESIGN (PHARMACEUTICS –III)

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Explain and describe physic chemical parameters in preformulation studies.
- CO2. Explain, describe & prepare dosage form by using techniques of sustained action and microencapsulation.
- CO3. Design & prepare new drug delivery systems like transdermal, Liposomes, ocular, nanoparticles.
- CO4. Describe, indicate, apply and judge Bioavailability & Bioequivalence
- CO5. Explain and indicate the procedures of quality control, quality Assurance and manufacturing process.

**UNIT-I: PREFORMULATION STUDIES** Study of Physical Properties of Drug: Particle size, Shape, pKa, Solubility, Partition Coefficient, Crystallinity, Polymorphism and Hygroscopicity, Powder Characteristics: Bulk density, Flow Properties, Solid State stability, Solution stability, and Stability Protocol, Dissolution and Organoleptic property and their effect on formulation. Study of Chemical Properties of Drug: Hydrolysis, Oxidation, Reduction, Recemization, Polymerization etc., and their influence on formulation and stability of the Products

**UNIT-II: SUSTAINED ACTION PHARMACEUTICALS** Concept, Benefits, Limitations, Advantages & Disadvantages, Definition of various types of prolonged action pharmaceuticals. Sustained Action Oral Products: Theory-Zero order release approximation, First order release approximation, Approaches based on drug modification and dosage form modification, in vitro & in vivo evaluation of the sustained release products. Formulation – Drug complexes, Encapsulated slow release granules, Tabletted slow release granulations and matrix tablets. Microencapsulation: Applications, Core and Coat materials, Techniques-Air suspension, Coacervation-Phase separation, Pan Coating, Spray Drying & Spray congealing, Solvent Evaporation, Polymerisation.

**UNIT-III: NEW DRUG DELIVERY SYSTEMS** Importance, Formulation and Applications. Transdermal Drug Delivery Systems: Concept, Advantages and disadvantages, Approaches used in developing Transdermal drug delivery systems(4 types), in vitro

evaluation of Transdermal drug delivery systems. Liposomes: Formulation, Preparation of liposomes-physical dispersion and solvent dispersion, Characterisation of Liposomes, Applications in Pharmacy. Ocular Drug Delivery Systems: Concept, Advantages and disadvantages, Mucoadhesives, design of Occuserts (Pilo 40 and Pilo 20), Erodable inserts. Nanoparticles: A brief introduction to Nanoparticle technology and Nanoparticles as drug carriers in controlled & targeted drug delivery systems.

**UNIT-IV: PERFORMANCE EVALUATION METHODS** Bioavailability: Definitions, Objectives, Considerations, Assessments, Enhancement Methods, Dissolution Studies for solid dosage forms and methods of interpretation of dissolution data. In vitro and In vivo methods of evaluation Bioequivalence: Definition, Objectives, Testing Protocols and Procedures, Experimental Design of single dose bioequivalence study and Statistical Interpretation of data.

Concepts of Process Validation: Definition, Importance, types of validation in Pharmaceutical Operations and Introduction to different process validation methods.

Concepts of Good Manufacturing Practices in Production of Pharmaceutical Products

**UNIT -V: QUALITY CONTROL AND ASSURANCE:** Introduction, Quality Assurance, Sources of Quality variation, Control of Quality variation: Raw Materials Control –Raw Material Quality Assurance Monograph, Active or Therapeutic Materials Control, Quality Assurance at start up –Raw Materials Processing, Compounding, Packing materials. Quality Assurance during packing operation –Auditing, Concept of statistical Quality Control and Quality Control Charts. Control & Assurance of Manufacturing practices: Personal, Equipment & Buildings. Control of records –Master formula record, Batch production record. Control of production procedures –Manufacturing control, Packing Control and Labels control. Stabilization and Stability testing protocol for various pharmaceutical products.

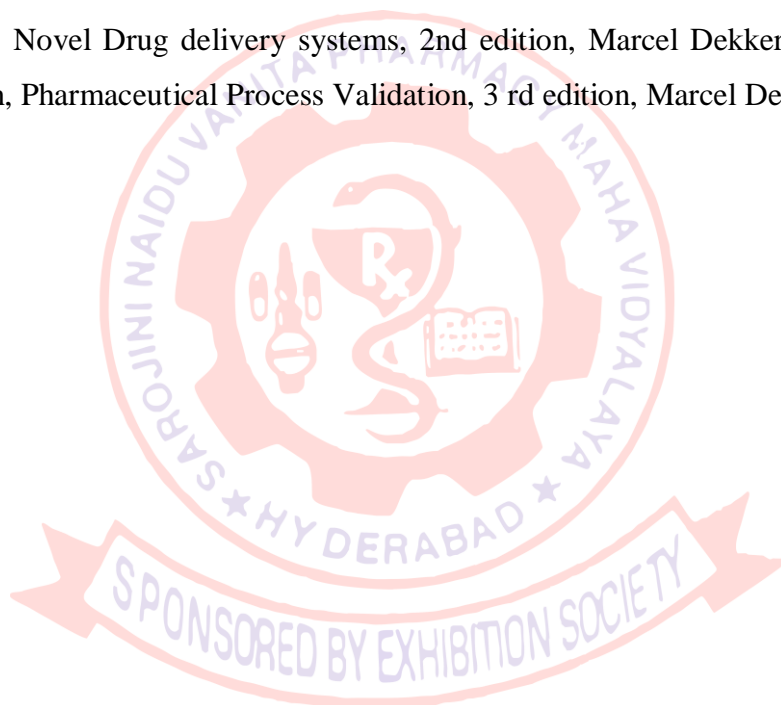
**Examination:** One question from each unit with internal choice.

**TEXT BOOKS:**

- 1) L. Lachman, H.A. Lieberman and J.L. Kanig, Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, 3rd Edition, 1997.
- 2) S.P. Vyas and Roop K. Khar, Targetted and Controlled Drug delivery Novel carrier systems, 1 st edition, 2002, C.B.S. New Delhi.
- 3) C.V.S. Subrahmanyam, Pharmaceutical Production and Management, Vallabh Prakashan, New Delhi, 2005

## REFERENCE BOOKS:

- 1) A.R. Gennaro, Remington: The Science and Practice of Pharmacy, 20th Edition, Vol. 1, Lippincott Williams & Wilins, Philadelphia, 2004.
- 2) E.A. Rawlins, Bentely's Textbook of Pharmaceutics, 8th Edition, Baillere Tindill, London, 1992.
- 3) S.H. Willing, M.M. Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, 2nd Edition, Marcel Dekker, Inc., New York, 1988.
- 4) Gilbert S. Banker and Christopher T Rhodes , Modern Pharmaceutics, IV Edition, Marcel – Dekker, USA, 2005.
- 5) Yiew Chien, Novel Drug delivery systems, 2nd edition, Marcel Dekker, USA, 1992. 6) Robert .A. Nash, Pharmaceutical Process Validation, 3 rd edition, Marcel Dekker, 2003.



SUBJECT CODE	SUBJECT
PYT4.105	PHARMACEUTICAL BUSINESS MANAGEMENT

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Explain Management concepts for production planning & quality control. Summarise principles of Management information system & principles of TQM for Pharmaceutical products.

CO2. Describe about the Evolution of Pharmaceutical industry, plant layouts, Building facilities, Utilities & services. Explain Good manufacturing practices procedure involved in maintenance of documentation of equipment & records.

CO3. Generalize the procedures of material purchasing, maintenance of store & Inventory control, Explain how to control store stocks, stock accounting & records.

CO4. Demonstrate the principles of personnel Management & Industrial Psychology.

CO5. Explain effectiveness & qualities of Marketing Management. Describe the role of Pharmacist in marketing field.

**UNIT –I: GENERAL MANAGEMENT (PRODUCTION AND CONTROL)-**

Management concepts: Policies, goals and objectives, principles of management, functions of management, levels of management, management information systems (MIS); Production Planning and Quality Control –Production Forecasting, Process production, Batch Production, Process planning, Economic Batch quantity. Problems of Productivity; Integration of modern management practices and principles of Total Quality Management (TQM) with requirements specified in GMP, GSP, ISO 19000, GB/T 19000 and ES 29000.

**UNIT II: INDUSTRIAL MANAGEMENT (PHARMACEUTICAL INDUSTRY)-**

Pharmaceutical manufacture, Development, Location–Factors influencing, Special provisions. Plant Layout: Types of plant layout, Factors influencing plant layout, Methods of factory layout, Special provisions, Storage space requirements, Layouts–Sterile or aseptic area, tablets production area. Building: Compartmentalized facilities–Rooms, floors, walls and ceilings. Pharmaceutical Process Flow and Work Study: General Flow Patterns, Work Station Design, Process Flow Diagrams –Production of Tablets, Work Study and Work Measurement. Utilities and Services: Power, Water, Air conditioning systems, Dust

collection systems, Compressed air systems, Vacuum and special gases. Good Manufacturing Practices: Equipment and documentation (Records).

**UNIT III: MATERIALS AND STORES MANAGEMENT** -Materials Purchasing Procedure, Stores Organization –location and layout of stores, receiving, inspection of materials, Issue, Control of store and store stocks, Stock accounting and records. Selection of site for drug store, Layout design for drug store and compliance with control measures; Inventory control –Objectives, Economic order Quantity, ABC analysis.

**UNIT IV: PERSONNEL MANAGEMENT**–Selection, Appointment, Training, Transfer, Promotion and demotion policies, Remuneration, Job Evaluation and merit rating. Industrial Psychology –Concept, Individual and group behaviour, X and Y theory, Hawthorne experiments, morale, motivation and fatigue.

**UNIT -V: MARKETING MANAGEMENT**- Meaning and Scope, Types of Target Market, size, composition, demographic description and socio-psychological characteristics of the consumer, Marketing mix. Market consideration in product development –product classification, product planning, product differentiation, Branded Vs Generic, new Product Development. Distribution Channels –Selection of Channels, Wholesaler and retailers, role and distribution. Pricing policies –factors affecting price, selective and exclusive pricing, discount policies, Credit policies, Patent policies, Sales Promotion policies –Objectives, detailing to physician, professional personnels sampling, window and interior display, media planning and publicity.

**Examination:** One question from each unit with internal choice.

**TEXT BOOK:**

1. Industrial Engineering and Management – O.P. Khanna.

**REFERENCE BOOKS:**

1. Pharmaceutical Marketing in India by S.V. Subba Rao, Asian Institute of Pharmaceutical Marketing, Hyderabad
2. “Principles of Marketing” by Philip Kotler, Eastern Edn.,

SUBJECT CODE	SUBJECT
PYP. 4.106.	PHARMACEUTICAL ANALYSIS–II PRACTICALS (INSTRUMENTAL METHODS OF ANALYSIS) LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. To apply the concepts of separation in Chromatography & Electrophoresis.

CO2. To apply the concepts of absorption in determination of lambda max, isobestic point, molar absorptivity.

CO3. To apply the concepts of absorption, emission, scattering in analysing drugs using UV-Visible spectroscopy, Fluorimetry, Nepheloturbidometry & Flame Photometry.

CO4. To apply the concepts of various Electrochemical methods in determination of ions & equivalence point.

1. Experiments based on paper chromatography / TLC / Column chromatography.
2. Determination of Lambda max.
3. Determination of Isosbestic point.
4. Determination of Molar absorptivity.
5. Estimation of drugs by using colorimeter / UV-Spectrophotometer / Fluorimeter.
6. Determination of sulphate or chloride ions by turbidimetry and Nephelometry.
7. Potentiometric determination of equivalence point.
8. Conductimetric titration.
9. Determination of concentration of Ions by Polarography.
10. Determination of concentration of Ions by Specific – Ion Electrode.
11. Experiments based on Electrophoresis.
12. Determination of Na and K Ions using Flame photometer.
13. Determination of moisture content of a drug by using Karl Fischer titrator.

SUBJECT CODE	SUBJECT
PYP. 4.107	MEDICINAL CHEMISTRY – II LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Outline &amp; Illustrate the synthesis for selected compounds.</p> <p>CO2. Recognize and interpret the IR spectral data for selected medicinal agents</p> <p>CO3. Estimate and evaluate the percentage purities of selected drugs in formulations.</p>	

1. Synthesis of Phenytoin
2. Synthesis of Phenacetin
3. Synthesis of antipyrine
4. Synthesis of 6-methyl uracil
5. Synthesis of Sulphanilamide
6. Synthesis of 7-Hydroxy - 4-Methyl Coumarin.
7. IR spectral study of drugs (Acetazolamide, Clonidine HCl, Ibuprofen, INH, Metronidazole).
8. Estimation of drugs in formulations (Phenytoin, Phenacetin, Sulphanilamide and Codeine Phosphate).

**REFERENCES :**

1. Vogels Text Book of Practical Organic Chemistry, 5th edition, ELBS, 1996.
2. Indian Pharmacopoeia (I.P) Vol.-I & II, Controller of Publications, The Ministry of Health and Family Welfare, Government of India, New Delhi, 1996.
3. B.P. 1993, Vol-I Department of Health & Social Services for Northern Ireland, U.K.



<b>SUBJECT CODE</b>	<b>SUBJECT</b>
<b>PYP. 4.108</b>	<b>DOSAGE      FORMULATION      DESIGN      PRACTICALS</b> <b>(PHARMACEUTICS – III) LAB</b>

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Prepare and Evaluate different Novel drug delivery systems.
- CO2. Prepare and evaluate sustain release and matrix tablets.
- CO3. Evaluation of Liposomes, transdermal matrix preparations.

1. Preparation and evaluation of albumin microspheres by heat stabilization technique and their particle size characteristics.
2. Preparation of matrix tablets using various polymers like PVP etc and studying their release pattern.
3. Preparation and evaluation of drug (ibuprofen, salicylic acid) loaded alginate microspheres.
4. Evaluation of marketed sustained release tablets for in vitro dissolution behaviour.
5. Preparation and evaluation of matrix tablets containing drugs.
6. Preparation and evaluation of solid dispersion of drugs using PEG polymers.
7. Preparation and evaluation of reservoir type devices using PEG-ethyl cellulose in chloroform-dichloromethane).
8. *In vitro* transport of marketed transdermal preparation using suitable diffusion cell.
9. Preparation of drug loaded liposomes using solvent evaporation method and evaluation of extent of entrapment (demonstration).



SUBJECT CODE	SUBJECT
PYT4.201	PHARMACEUTICAL BIO TECHNOLOGY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe the Genetic code and explain the different products that are obtained by the r-DNA technology

CO2. Explain the process of Fermentation in detail and different byproducts that are obtained by this process.

CO3. Describe the Immunization products (Active & Passive). Explain their preparation, standardization, storage, labelling and their applications.

CO4. Explain the blood products and glandular products, plasma substitutes and write about their collection, processing and storage.

CO5. Explain the production of monoclonal antibodies along with techniques that are involved in the process of Animal culture.

**Unit –I** Genetic Engineering: Introduction, History, Development, Application and Scope Genetics, DNA/RNA replication, Restriction Endonucleases, DNA Ligases, Vectors, Hosts, Cloning strategies, Gene Expression in Recombinant DNA. Application of recombinant DNA in manufacture of biological products such as Insulin, Human growth hormones, Interferons and Interleukins.

**Unit –II** Biochemical Engineering –Fermentation Technology Introduction, development and maintenances of industrial micro-organisms, batch and continuous fermentations, process controls, oxygen supply and demand, single and multiple bubble aeration, sparger aeration, foam control equipment, scale-up of Fermentors. Microbiological Assay of antibiotics and Vitamin B12 .Study of culture, media, production conditions, extraction and purification of the following: Antibiotics –Semi synthetic penicillin's, streptomycin and erythromycin as per IP. Hormones -Insulin Production Enzymes –Amylase and Diastase; Immobilization and their applications in drug manufacture. Biomass –Lactobacillus sporogenes

**Unit –III** Immunization Products: Manufacture, Standardization, Storage, Labeling and Specific Applications of the following vaccines: Bacterial vaccines, toxoids, viral vaccines,

Rickettsial vaccines, Rabies, MMR, BCG, DPT, Cholera, Hepatitis B and Polio Standardization and Storage of the following Passive immunization products –Anti toxins, Anti venom, Immune sera and other products related to immunity and Immuno Diagnostics

**Unit –IV** Blood and Glandular Products : Collection, processing and storage of whole human blood, Concentrated human R.B.C. dried human plasma, Human plasma protein fraction, dried human serum, Human fibrinogen, Human thrombin, human normal immunoglobulin, Human fibrin foam, Plasma substitutes –Ideal requirements, PVP, Dextran 40, Control of blood products, Transfusion products. Preparation of extracts and isolation of pure substances and their dosage forms from Pituitary, Adrenal, Pancreas and Thyroid glands

**Unit –V** Biotransformations and Animal Cell Biotechnology Microbial transformation of steroids: Introduction, Types and methods of transformations mediated by microorganisms, design of biotransformation processes and selection of organisms. Animal cell culture: Techniques, Media used and Applications. Hybridoma culture: Production of monoclonal antibodies and their applications.

**Examination:** One question from each unit with internal choice.

**TEXT BOOKS:**

1. Pharmaceutical Biotechnology by S.S. Kori.
2. Principles of Fermentation Technology by P.F. Standury & A. Whitaker, Pergamon Press,
3. Industrial Microbiology by Cassida.

**REFERENCE BOOKS:**

1. Monoclonal Antibody Technology by A.M. Campbeli.
2. Handbook of enzyme Biotechnology by A. Wiseman.
3. Recombinant DNA Technology by J.D. Watson.
4. Molecular Biology and Biotechnology by Smith and Hood.
5. General Pharmacy by Copper and Gunn.
6. A text book of Pharmaceutics, A.O. Bentley, 8th Edition, 1982 Bailler Tindall & Co.,
7. Microbial Biotechnology Alexander N. Glazer & Hiroshi Nikaido, W.H. Freeman Co., 1995.
8. Principles of Fermentation Technology by P.F. Stanbury Whitaker.
9. Bioitechnology by Wulf Crueger and Anneliese Crueger, 2nd edition, Publisher – Panima Publication Corporation, New Delhi

SUBJECT CODE	SUBJECT
PYT4.202	HOSPITAL & CLINICAL PHARMACY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

- CO1. Describe about the objectives of Hospital Pharmacy and its organisation
- CO2. Describe about Hospital formulary, Budget planning, purchasing and inventory control of drugs, surgical instruments and radioisotopes.
- CO3. Explain the basic principles of clinical pharmacy
- CO4. Understand the concept of Essential drugs and Rational drug use
- CO5. Explain diseases, disease system and treatment

**UNIT-I** Introduction to Hospital and Hospital Pharmacy. Hospital and its Organisation, Hospital Pharmacy: Objectives, Functions, Organisation, Planning, Personnel and Administration of Hospital Pharmacy Services; Hospital Drug Policy General Considerations; Hospital Committees: Purpose, Organization and Functions of Pharmacy and Therapeutic Committee (PTC), Role of Hospital Pharmacist in Hospital Committees and Practice of Rational Drug Therapy and Drug Exchange Program;

**UNIT -II** Hospital Formulary Organization, Formulary Content, Preparation and Distribution; Pharmacy Procedural Manual Preparation; Drug distribution, Dispensing to Inpatient and Ambulatory Patient care, Dispensing of ancillary and controlled substance; Procurement and Distribution of alcohol; Manufacturing of Bulk and sterile supplies; Storage and Handling of Radio isotopic Pharmaceuticals; Budget Planning, Purchasing and Inventory Control; Use of Surgical Instruments & Hospital Equipment.

**UNIT -III** Clinical Pharmacy Introduction, Scope, History and Development of Clinical Pharmacy; Investigational use of Drugs and Drug Therapy Monitoring with examples, Adverse Drug Reaction Management; Drug and Poison Information, Medication history review and Patient Counseling; Patient Compliance, Patient Data Analysis and its Use in evaluation of Clinical Tests for Common Disease States and Organ Functional Tests (Liver, Pulmonary and Renal) for Drug Therapy; Definition and Differences of Generic and Prescription Drugs;

**UNIT –IV** Basic Principles of Drug Therapy. Concepts of Essential Drugs and Rational Drug Use; Drug Distribution: Out Patient and In Patient Services; Unit dose drug distribution systems, floor ward stock systems, satellite pharmacy services, central sterile services and bed side pharmacy; Drug-Drug Interactions: Mechanism of Pharmacokinetic and Pharmacodynamic interactions with suitable examples; Food and Drug interactions. Incidence, Classification and Surveillance Methods of Adverse Reactions of Drugs; Therapeutic Aspects of Pharmacogenetics; Drug induced Disease –Dermatological, Hepatic, GI, Renal, Gout, Parkinsonism, Cancer, Depression, Psychosis, Ototoxicity, Ocular toxicity and Teratogenicity. Adverse drug reactions.

**UNIT –V** Pharmacotherapy of Diseases: Diseases: –Symptoms, Manifestation, Pathophysiology and Etiology of -Gastrointestinal diseases: Peptic ulcer, Ulcerative colitis, Hepatitis & Cirrhosis (Liver). Cardiovascular System diseases –Angina Pectoris, Acute Myocardial Infarction, Atherosclerosis, Essential Hypertension, Cardiac arrhythmia. Respiratory diseases –Asthma and T.B.; STD –HIV, Syphilis and Gonorrhoea; Anemia, Parkinsonism, Diabetes, Gout and Rheumatoid arthritis. Pharmacotherapy and Critical Analysis of Rational Use of Drugs in the following Disorders: Cardiovascular, Respiratory, Renal, Gastro-Intestinal, Nervous, Psychiatric, Rheumatic, Hematological, Endocrine and Infections.

**Examination:** One question from each unit with internal choice.

**TEXT BOOKS:**

1. Hospital Pharmacy by Hassan.
2. Clinical Pharmacy and Therapeutics by Herfindal, Herschman.
3. Essential Clinical Medicine R.H. Salter.

**REFERENCE BOOKS:**

1. Remington Pharmaceutical Sciences.
2. Drug Interaction by Hamsten, Kven Stockley.
3. Clinical Pharmacology and Drug therapy Grahame Smith and Aronson.
4. Drug Interactions – J.K. Mehra, Basic Business Publishers, Bombay.

SUBJECT CODE	SUBJECT
PYT.4.203	COSMETIC TECHNOLOGY

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Know and explain the skin structure, functions, ingredients used in cosmetics, related regulatory provision of cosmetic preparation

CO2. Understand and describe formulations, manufacturing, packaging, labeling evaluation of face, eye and body preparations.

CO3. Know and describe the formulation, manufacturing packaging, labeling, quality evaluation of skin, nail, body & shaving preparation.

CO4. Understand & describe the formulation, preparation, packaging, evaluation of hair and dental preparation.

CO5. Acquire knowledge of herbal cosmetics & describe the formulation, manufacturing, packaging labeling and evaluation of herbal cosmetics.

**Unit –I**

Introduction, Definition of cosmetics. Basic knowledge of the skin classification of cosmetics. General aspects of cosmetic preparations: Colouring agents in cosmetics, Preservatives and antioxidants and other additives used in cosmetics, Regulatory provisions related to cosmetics. An approach to the formulation, ingredients, use, method of manufacturing, packing, labeling, and quality control of the following cosmetics.

**Unit –II**

Face Preparations -Vanishing creams, Cleansing creams, Face powders and lipsticks. Eye Preparations -Mascaras, Eye liners, Eye shadows. Baby Specialties -Baby powder, Baby oils, Baby lotions and Baby shampoos.

**Unit –III**

Preparations For Skin -Bleaching preparations, Body Lotions and Body Creams. Preparations For Nails -Nail laquers and Nail polish removers. Body Cosmetic Preparations -Deodorants, Antiperspirants and Talcum powders. Shaving Preparations: Pre-Shave and after-shave lotions, Shaving creams and Soaps.

**Unit –IV**

Preparations For The Hair -Shampoos, Hair Conditioners, Hair Straightners, Hair creams, Hair dyes, Depilatories and Epilatories. Dental Preparations -Tooth powders and pastes, Mouth washes.

#### **Unit –V**

Herbal Cosmetics: Skin care products: Body oils and Moisturising lotions. Hair care products -Shampoos, Hair Conditioners. Cosmetics for face: Face packs.

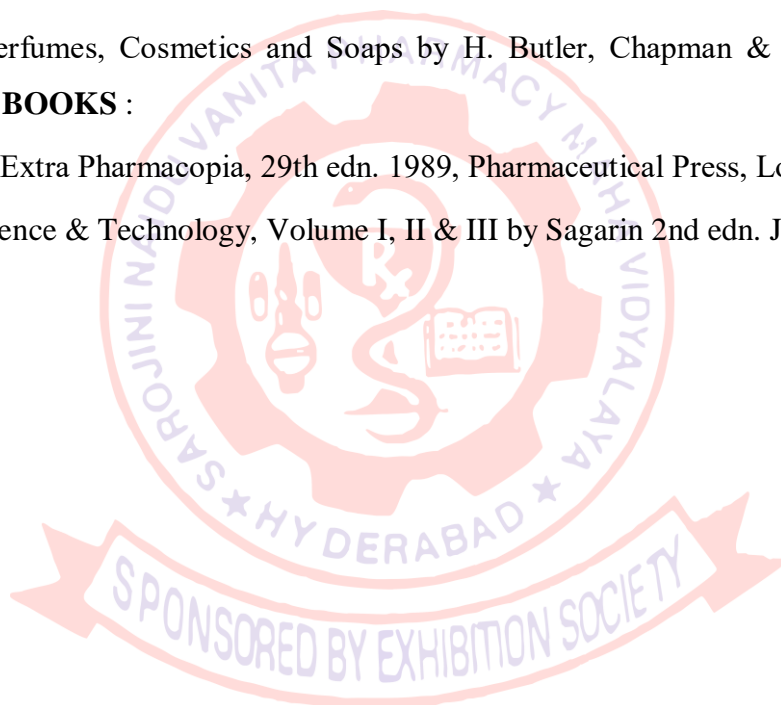
**Examination:** One question from each unit with internal choice.

#### **TEXT BOOKS:**

1. Cosmetics formulation manufacturing & Quality control by P.P. Sharma, Vandana Pub, Delhi.
2. Poucher's Perfumes, Cosmetics and Soaps by H. Butler, Chapman & HALL, London.

#### **REFERENCE BOOKS :**

1. Martindale's Extra Pharmacopia, 29th edn. 1989, Pharmaceutical Press, London.
2. Cosmetic Science & Technology, Volume I, II & III by Sagarin 2nd edn. John wiley & Co.



SUBJECT CODE	SUBJECT
PYT.4.204	PHARMACOINFORMATICS

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Design & classify database, explain the structure of databases & generalize the importance of Biological databases in related to pharmacy.

CO2. Distinguish between different search algorithms. Describe the procedure for storage & retrieval of Biological information.

CO3. Explain about the development of Drug information resources and describe about pharmacy automation.

CO4. Acquire knowledge on Genomics & Proteomics. Explain about different DNA sequencing techniques & How to prepare Gene Libraries.

CO5. Explain different concepts of SAR & QSAR analysis. summarize Biochemical approaches in Drug design.

**Unit –I** Database Design Databases: Structure of databases, Sequence databases, Relational databases; Sequence analysis, Software resources; Sequence alignment and database searches and Phylogenetic analysis; Principles of database organization, Data mining and knowledge discovery in databases, Bibliographic databases and library catalogs and Drug information databases Database Concept, Database Architecture, Codd Rules, Normalization, Access 2000 Database and Accord 2000 Cheminformatics Database; Importance of Biological Databases

**Unit –II** Information Management Search algorithms: Search logic and complex queries and Search in non-text databases (images and chemical structures); Algorithms for alignment of sequences and structures of nucleic acids, proteins and protein families; Substitution of similarity matrices; Dynamic Programming methods; Structural superposition algorithms; Hidden Markov Models (Construction and Use in Alignment and Prediction); Domain detection and Identification of Genes; Storage and retrieval of information: Database Querying, Key work searching, Search Machines, Complex searches, Homology searches, Pattern matching and Bio-PERL;



**Unit –III** Drug information services :Drug Information: Introduction, Resources Available; Design of Literature Searches; Critical Evaluation of drug information and literature, Preparation of Written and Verbal reports, Development of Drug information, Database useful for emergency treatment of poisoning; Pharmacy automation: Automated medication dosage, filling and packaging, Coding of information and bar-codes, Medication distribution, management and Inventory control.

**Unit –IV** Introduction to Genomics and Proteomics : Structure and Functional Genomics; Genome Analysis; DNA databanks, GENE BANK; Libraries: Preparation of ordered cosmid libraries, bacterial artificial chromosome libraries; shotgun libraries; Homology algorithms (BLAST) for Proteins and Nucleic Acids Sequencing: Conventional (Sanger, Maxam and Gilbert Methods) and Automated Sequencing Protein Analysis; Protein Sequence Databanks, (SWISSPORT, PIR and INTERPRO) Conserved Protein motifs related to structure/function (PROSITE, PFAM and profile Scan) and database for Protein Structure (PDB); SCOP/CATH and Introduction to EMBOSS;

**Unit –V** Computational Concepts in Drug Design: Introduction to drug design; Molar Reactivity of Compounds for Structure Activity Relationship (SAR) and Quantitative Structure Activity Relationship (QSAR) analysis; Free-Wilson and Hansch Methods of Analysis; Determination of Partition Coefficient and Dissociation Constant; using computational methods; Application of Quantum Mechanics; Factors Affecting Bioactivity of Drugs: Resonance, Inductive Effect, Isosterism, bioisosterism, Special Considerations: Conformational Space, Energy Calculations, Local and Global Minimization; Energy Minimization; Molecular dynamics simulations; Docking; Theory of Drug Activity: Occupancy Theory; Rate Theory; Induced Fit Theory; Drug-Receptor.

**Examination:** One question from each unit with internal choice.

**TEXT AND REFERENCE BOOKS:**

1. Bioinformatics 2000, Higgins and Taylor. OUP 1. Internet and the New Biology: Tools for genomic and Molecular research By Peruski, Jr
2. Functional genomics: A Practical Approach, Edited by Stephen P. Hunt and Rick Liveey
3. Chemical space navigation in lead discovery by Tudor I. Oprea 4. Database Management and Information Systems, by Henry Korth



SUBJECT CODE	SUBJECT
PYP.4.205	PHARMACEUTICAL BIO TECHNOLOGY LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Describe the standardization of cultures and the procedure involved in it.

CO2. Conduct the microbiological Assay of Antibiotics, vitamins. Describe the Isolation of mutants by gradient plate techniques. Evaluate the pharmaceutical products for sterility and prepare bacterial vaccine.

CO3. Understand the Immobilization of cells/enzymes by different techniques and compare their efficacy. Explain production of Alcohol by fermentation techniques.

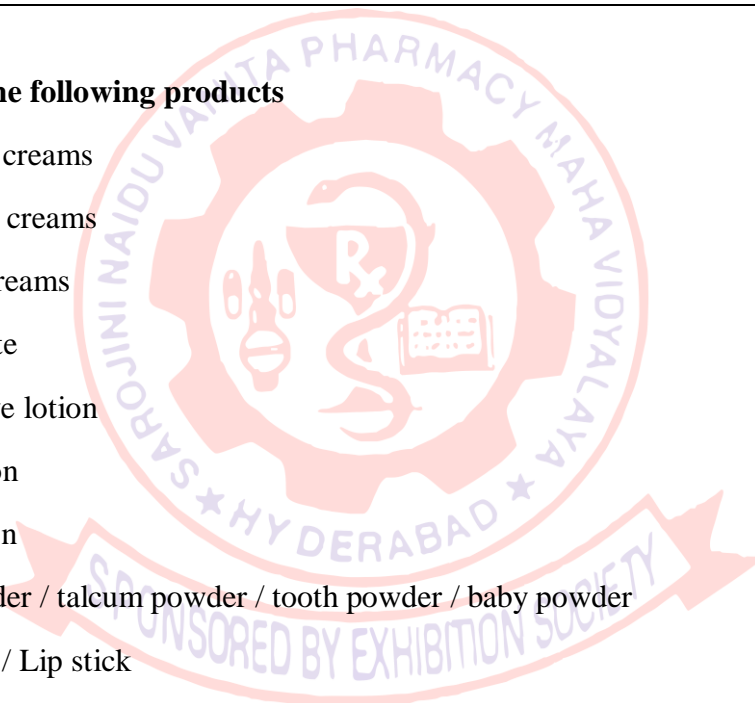
CO4. Explain the extraction of DNA from onions and the preparation of blood products/human normal immunoglobulin injection.

1. Standardization of cultures
2. Microbiological assay of Antibiotics / Vitamins
3. Production of alcohol by fermentation techniques
4. Immobilization of cells / enzymes by different techniques
5. Comparison of efficacy of immobilized cells.
6. Sterility testing of Pharmaceutical products.
7. Isolation of mutants by gradient plate technique.
8. Preparation of bacterial vaccine.
9. Preparation of blood products / human normal immunoglobulin injection
10. Extraction of DNA.

SUBJECT CODE	SUBJECT
PYP. 4. 206.	COSMETIC TECHNOLOGY LAB
<p><b>COURSE OUTCOMES:</b></p> <p><b>Upon completion of the syllabus students should be able to</b></p> <p>CO1. Formulate, prepare, pack and label skin cosmetics</p> <p>CO2. Formulate, prepare, pack and label powders, nail &amp; lip cosmetics.</p> <p>CO3. Formulate, prepare, pack and label body &amp; men's cosmetics</p> <p>CO4. Pack &amp; Label.</p>	

**Preparation of the following products**

1. Cleansing creams
2. Vanishing creams
3. Shaving creams
4. Tooth paste
5. After shave lotion
6. Hand lotion
7. Baby lotion
8. Face powder / talcum powder / tooth powder / baby powder
9. Nail paint / Lip stick
10. Nail paint remover
11. Deodorant formulation.



SUBJECT CODE	SUBJECT
PYP. 4.207	PHARMACOINFORMATICS LAB

**COURSE OUTCOMES:**

**Upon completion of the syllabus students should be able to**

CO1. Acquire knowledge on different literature search engine, pharmaceutical resources, Drug information resources. Sequence alignment Techniques.

CO2. Practicing skills on Virtual library, database & search tools & molecular docking studies.

CO3. Execute programming with SQL & Bioperl.

1. Review of key internet sites for sequence analysis (Hypertext and World Wide Web)
  - Information search in WWW
  - Pharmaceutical resources in WWW
  - Retrieving and installing a program (Tree Tool)
  - Similarity Searching BLAST/FASTA
  - Multiple Sequence Alignment (CLUSTAL W and Bee)
  - Basic Sequence Analysis and Multiple Sequence Analysis
  - GCG sequence Analysis
2. Virtual Library
  - Searching MEDLINE on the PubMed System from the NCBI site
  - Searching the Science Citation Index and Current Contents Connect from the ISI
  - Accessing full text journals on the internet through INFLIBNET and other sources
3. Database and Search Tools
  - Types of indexing tools and search strategies
  - Literature evaluation Methods
4. Basic Programming in BioPERL
5. Problems related Gene Sequencing and Protein Sequencing
6. Basic Programming in SQL

<b>SUBJECT CODE</b>	<b>SUBJECT</b>
<b>PYP.4.208</b>	<b>Seminar</b>

**COURSE OUTCOMES:**

The students should be able to:

CO1. Inculcate self learning process.

CO2. Improve communication skills, gaining expert knowledge, networking with others and renewing motivation and confidence.

CO3. Improve scientific skill writing in a seminar format.

CO4. Learn about recent developments in different fields of pharmacy.

CO5. Develop presentation skills using PowerPoint presentations.

