

ANALYTICAL TECHNIQUES IN PHARMACEUTICALS
FIRST YEAR
FIRST & SECOND SEMESTER

ORGANIC CHEMISTRY

FIRST YEAR FIRST SEMESTER

PAPER – I: Organic Chemistry – I

Unit –I

Structural theory-types of organic reagents-types of organic reactions-inductive effect and mesomeric effect-hyperconjugation-free radicals-carbocation and carbanion. Organic Nomenclature system

Unit-II

General methods of preparations of alkanes, substitution reactions of alkanes, conformation isomerism of Ethane and Butane.

Unit- III

Preparation of alkenes Electrophilic addition reactions of alkenes-mechanism of bromination-Markovnikov's rule Reactions of acetylene-acidity of acetylenic hydrogens.

Unit- IV

Structure of Benzene aromaticity, Huckel rule and electrophilic substitution.

FIRST YEAR II SEMESTER

PAPER – I: Organic Chemistry – II

Unit –I

Benzene and its reactivity

Orientation of aromatic substitution – Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO₂ and Phenolic). Orientation of (i). Amino, methoxy and methyl groups (ii). Carboxy, nitro, nitrile, carbonyl and Sulfonic acid groups. (iii). Halogens (Explanation by taking minimum of one example from each type).

Unit –II

Hydroxy compounds

Nomenclature and classification of hydroxy compounds.

Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols.

Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene.

Physical properties- Hydrogen bonding (intermolecular and intramolecular). Effect of hydrogen bonding on boiling point and solubility in water.

Chemical properties:

a. Acidic nature of phenols.

b. Formation of alkoxides/phenoxides and their reaction with RX.

c. Replacement of OH by X using PCl₅, PCl₃, PBr₃, SOCl₂ and with HX/ZnCl₂.

d. Esterification by acids (mechanism).

e. Dehydration of alcohols.

f. oxidation of alcohols by CrO₃, KMnO₄.

g. Special reaction of phenols: Bromination, Kolb-Schmidt reaction, Reimer-Tiemann reaction, Fries rearrangement, azocoupling.

Identification of alcohols by oxidation with KMnO₄, ceric ammonium nitrate, Lucas reagent and phenols by reaction with FeCl₃.

Polyhydroxy compounds: Pinacol-Pinacolone rearrangement.

Unit –III

Carbonyl compounds: Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group.

Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids.

Physical properties: absence of hydrogen bonding, keto-enol tautomerism, reactivity of carbonyl group in aldehydes and ketones. Nucleophilic addition reaction with a) NaHSO_3 , b) HCN , c) RMgX , d) NH_2OH , e) PhNHNH_2 , f) 2,4 DNPH, g) Alcohols-formation of hemiacetal and acetal.

Halogenation using PCl_5 with mechanism. Base catalysed reactions: a) Aldol, b) Cannizzaro reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction. Oxidation of aldehydes- Baeyer-Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with LiAlH_4 and NaBH_4 . Analysis of aldehydes and ketones with a) 2,4-DNP test, b) Tollen's test, c) Fehling test, d) Schiff test, e) Haloform test (with equation).

Unit –IV

Carboxylic acids and derivatives: 6h

Nomenclature, classification and structure of carboxylic acids. Methods of preparation by a) hydrolysis of nitriles, amides and esters. b) carbonation of Grignard reagents.

Special methods of preparation of aromatic acids by a) oxidation of side chain.

b) hydrolysis by benzotrichlorides. c) Kolbe reaction.

Physical properties: Hydrogen bonding, dimeric association, acidity- strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids. Chemical properties: Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Hunsdiecker reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell-Volhard-Zelinsky reaction. Derivatives of carboxylic acids: Reaction of esters (mechanism of the hydrolysis of esters by acids and bases).

Unit –V

Active methylene compounds: 4h

Acetoacetic esters: preparation by Claisen condensation, keto-enol tautomerism.

Acid hydrolysis and ketonic hydrolysis. Preparation of a) monocarboxylic acids. b) dicarboxylic acids.

Reaction with urea: Malonic ester: preparation from acetic acid. Synthetic applications:

Preparation of a) Monocarboxylic acids (propionic acid and n-butyric acid). b) Dicarboxylic acids (succinic acid and adipic acid).

ANALYTICAL CHEMISTRY

FIRST YEAR I SEMESTER

PAPER – I: Analytical Chemistry– I

Unit –I

Methods of expressing concentration percent by weight, percent by volume, Molality, Molarity, and Normality.

Unit –II

Dilutions : Simple dilutions, Serial dilutions, concentrated solutions' strengths, multiple dilutions, mixing concentrations.

Unit –III

Evaluation of Analytical Data: Theory of errors, idea of significant figures and its importance, accuracy, error analysis and minimization of errors, precision Standard deviation and confidence limits

Unit –IV

Sample Preparation, preservation and Storage: Basics of Sample Preparation, preservation and storage, Handling Glassware in Laboratory, Calibration of Glassware. Guidelines for Weighing and measuring the samples,

Unit –V

Chromatography: Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, R_f values, factors affecting R_f values.

a) Paper Chromatography: Principles, R_f values, experimental procedures, choice of paper and solvent systems, developments of chromatogram –ascending, descending and radial. Two dimensional chromatography, applications.

b) Thin layer Chromatography (TLC): Advantages. Principles, factors affecting R_f values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.

FIRST YEAR II SEMESTER

II SEMESTER SYLLABUS

PAPER – I: Analytical Chemistry– II

Unit –I

Chromatography: Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, R_f values, factors affecting R_f values. Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation technique. Applications.

Unit –II

Spectrophotometry:

Optical methods of analysis: Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

Basic principles of instrumentation, *uv-visible* spectrometry, qualitative analysis, infrared spectroscopy, NIR, Raman spectroscopy

Unit –III

Analytical chemistry in pharmaceuticals: analytical parameters to be tested to assess the quality of drug substance and drug product, Identification, solubility, assay by titrimetry, assay by potentiometry, Karl-Fischer titration for water content.

Unit –IV

Electro analytical methods: Classification Electroanalytical methods, basic principle of pH, potentiometric titrations

Unit –V

HPLC: Principles, Basic parameters, retention factor, capacity factor, selectivity factor, plate number, plate height- resolution peak shapes, column selection, column problems, solvents trouble shooting, sample preparation.

I YEAR END PRACTICAL EXAMINATIONS

LABORATORY COURSE – PAPER I (90 hrs 3 hours pe week)

DURATION: 3 Hrs

MAX.MARKS:70

LABORATORY COURSE- I

90 hrs (3 h / w)

Practical Paper – I (Analytical Chemistry)

I. Titrimetric analysis:

- 1) Determination of carbonate and bicarbonate in a mixture
- 2) Determination of Fe(II) using $K_2Cr_2O_7$
- 3) Determination of Fe(II) using $KMnO_4$ with oxalic acid as primary standard.
- 4) Determination of Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard
- 5) Determination of Zinc and Magnesium using EDTA
- 6) Determination of hardness of water
- 7) Determination of Zinc by ferrocyanide

II. CHROMATOGRAPHY-PAPER,TLC DEMONSTRATIONS

III. POLAROMETRY, CALORIMETRY

IV. ANALYSIS OF WATER

FIRST YEAR I SEMESTER

I SEMESTER SYLLABUS

PAPER – III: Pharmaceutical Technology-1

Unit –I

Introduction to Life Sciences Industry, its sub-sectors, regulatory authorities and rules and regulations and their impact on manufacturing in life science industry.

Unit –II

Basics of formulations including Route of Drug Administration and various dosage forms like oral solid dosage, liquid oral dosage, sterile dosage, dermatological dosage and their relevant benefits.

Unit –III

Tablets: Types of tablets, components of tablets, excipients, granulation methods, Mechanism and equipment, processing problems of tablets, working of tablet machine.

Tablet Coating: Comparison of different coating procedures, problems involved in each coating and trouble shooting. Equipment used for sugar coating, film coating, aqueous film coating, compression coating, enteric coating

Unit –IV

Quality control of tablets characteristics, such as size, shape, tablet thickness, hardness, friability, disintegration, weight variation and content uniformity

Unit –V

GMP- A study of Schedule M of Drugs and Cosmetics Act, WHO specifications, US FDA guidelines. The study shall include special emphasis on premises, personnel, sanitation, equipment, manufacturing operations and documentation

Unit –VI

Pharmaceutical Packaging and Labeling controls: Packaging Materials, Glass, Plastic, Metals, Rubber, Evaluation of Packaging materials. Special problems of container product interactions, pharmacopoeial specifications tests and standards for packaging materials.

FIRST YEAR II SEMESTER

II SEMESTER SYLLABUS

PAPER – III: Pharmaceutical Technology-II

20 hrs. (3h / w)

Unit –I

Capsules:

Types of gelatin, Excipients used in preparation of Hard and soft gelatin capsules, related advantages of soft & Hard gelatin capsules, equipment and method of preparation , powder filling choice of Excipients, storage of packaging & stability consideration of hard and soft gelatin capsules.

Unit –II

Oral Liquid :

Monophasic systems : Solutions: Vehicles, Additives used in formulation of solution, Oral solution products, equipment, compounding, filling of liquids.

Biphasic systems: Suspensions: Formulation and manufacturing of suspension, Evaluation of stability of suspension

Emulsions: Theories of emulsification, Preparation of Emulsion, Evaluation of stability of Emulsion and their application in drug delivery.

Unit –III

Parental Products: Routes of administration, categories of parental products based on volumes, Formulation additives, Filling machines, sterilizers, aseptic processing, Important parameters in development of manufacturing of parental product, Quality control requirement.

Pyrogen chemistry and properties of bacterial pyrogens and endotoxins

Mechanism of action of pyrogens. Pharmaceutical aspects, pyrogen test of IP compared to that of BP & USP. Comparison of LAL and other pyrogen test

Microbiological limit tests, tests for effectiveness of antimicrobial preservatives

Practical Paper –III (Pharmaceutical Technology-1)

1. **Quality control tests for tablets** (size, shape, tablet thickness, hardness, friability, disintegration, weight variation and content uniformity)

BIOSTATISTICS
FIRST YEAR I SEMESTER

I SEMESTER SYLLABUS

PAPER – IV:

Unit : 1

Concept of primary and secondary data, Measures of central tendency, Measures of dispersion, Errors

Unit : 2

Binomial Distribution, Poisson distribution, Normal Distribution.

Unit : 3

Large sample test-single mean, difference of means, standard deviation, Small sample tests- Chi-square test, t-test, F-test. ANNOVA.

Unit : 4

Sign test, Run test, Median test.

FIRST YEAR II SEMESTER

PAPER – IV: BIOSTATISTICS-II 20 hrs. (3h / w)

UNIT-I

Concept of Skewness and Kurtosis, Measures of Skewness and Kurtosis. Problems on Skewness and Kurtosis. Concept of Probability. Various Definitions of Probability. Addition Theorem and Multiplication theorem of probability for Two Events.

UNIT-II

Curve Fitting: Least square principle, fitting of straight line, quadratic, exponential and power curves. Problems on curve fitting

UNIT-III

Correlation: Bivariate data, correlation coefficient and its properties. Scattered diagram, Karl Pearson correlation coefficient for grouped. Spearman's rank correlation coefficient and its properties. Problems on Correlation

UNIT-IV

Regression: Principle of least squares, simple linear regression, properties of regression coefficients. Problems on Regression .

Reference Books

- 1.Fundamentals of Mathematical Statistics, V.K.Kapoor and S.C.Gupta
- 2.Inferential Statistics, Telugu Academy.

COMPUTERS
FIRST YEAR I SEMESTER

I SEMESTER SYLLABUS

PAPER – V: Computers

Unit –I Computer Fundamentals

Introduction to computers, What is a computer?, Characteristics of computer & Generations of computers, Types of Computers, Applications of Computers, Using keys of Keyboard and mouse Function keys, Numeric keypad & Tab, Shift, Alt, Enter and Ctrl keys Shortcut keys with windows

Unit –II Hardware components

Internal parts of the system, Peripherals and add, on cards Types of Software: –System software & Applications software Compilers, interpreters, Languages and packages, Introduction to Operating System, MS DOS & MS-windows, features and functions ,Windows applications – Notepad, WordPad, Paint, calculator, character map etc. Using DOS Prompt thru Run option & internal commands DOS External commands

UNIT –III Internet skills

Introduction to networks and Internet & internet protocols ; Browsers Creation of e-mail (gmail & yahoo) –sending, receiving and upload, download attachments Finding content, searching for information using search engines like Google, Bing, etc.

UNIT –III Internet skills & Live Practice

Learning about online applications banking, shopping, social networks etc. Blogs, creation and maintenance, Social networking sites like face book, twitter, LinkedN

FIRST YEAR II SEMESTER

II SEMESTER SYLLABUS

Unit-I (Understanding Word Processing)

1. Word Processing Basics:- Opening Word Processing Package, Menu Bar, Using the Help, Using the Icons Below the menu Bar
2. Opening and closing Documents:- Opening Documents, Save and Save as, Page Setup, Print Preview, Printing of Documents
3. Text Creation and manipulation:- Document Creation, Editing text, Text selection, Cut, Copy and Paste, Spell check, Thesaurus
4. Formatting the Text:- Font and Size selection, Alignment of Text, Paragraph Indenting, Bullets and Numbering, Changing Case
5. Table Manipulation:- Draw table, Changing cell width and height, Alignment of text in cell, Delete/ Insertion of row and column, Border and shading

Unit-II (Using Spread Sheet)

1. Elements of Electronic Spread Sheet:- Opening of Spread sheet, Addressing of Cells, Printing of Spread Sheet, Saving Workbooks
2. Manipulation of Cells:- Entering Text, Numbers and Dates, Creating Text, Number and Date series, Editing worksheet data, inserting and Deleting Rows, Column, Changing Cell Height and Width
3. Formulas and Function:- Using formulas, Function

Unit-III (Making Small Presentations)

1. Basics:- Using Power point, opening a power point presentation, Saving a presentation
2. Creation of Presentation:- Creating a presentation using a template, Creating a Blank Presentation, Entering and editing Text, Inserting and Deleting Slides in a Presentation
3. Preparation of Slides: Inserting Word table or an Excel Worksheet, Adding Clip Art Pictures, Inserting Other Objects, Resizing and scaling an Object
4. Presentation of Slides:- Viewing a presentation, Choosing a setup for presentation, Printing Slides and Handouts
5. Slide Show:- Running a slide show, Transition and slide timings, Automating a Slide Show

Unit-IV (Picture Manager)

1. Basics:- Locating Pictures, Editing Pictures with Microsoft Office Picture Manager, Viewing Detailed Information About an Image
2. Compressing Images with Microsoft Office Picture Manager

Communication skills

FIRST YEAR I SEMESTER

I SEMESTER SYLLABUS

PAPER – V: Communication skills

Unit-1

The sound systems in English: Sounds and letters, Phonetic symbols - vowels, consonants, Stress and Intonation, Problems of Indian speakers, Role of MTI

Unit-2

The Verbal system in English – Auxiliary verbs, Main verbs, Tense forms, prepositions, Articles, Syntax, Errors in English

Unit-3

Vocabulary, synonyms, Antonyms, Words often, Confused, Affixation

Unit-4

How to describe people their appearance, Inner qualities (Adjectives)

FIRST YEAR II SEMESTER

II SEMESTER SYLLABUS

PAPER – V: Communication skills

Speaking and listening Skills

- How to express feelings ideas
- Group Discussion
- How to develop listening skills
- Telephone etiquette.

Writing Skills

- Report Writing
- Writing Instructions
- Summarizing
- Describing in process
- Resume writing
- Formal & informal language

ANALYTICAL TECHNIQUES IN PHARMACEUTICALS
SECOND YEAR
THIRD & FOURTH SEMESTER

SECOND YEAR I SEMESTER

BASIC ORGANIC CHEMISTRY-III

UNIT-I

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1^o, 2^o, 3^o

Amines and Quarternary ammonium compounds. Preparative methods -1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamidereaction (mechanism).

4. Reduction of Amides and Schmidt reaction.

Physical properties and basic character – Comparative basic strength of Ammonia, methylamine, dimethyl amine, trimethyl amine and aniline – comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects.

Use of amine salts as phase transfer catalysts. Chemical properties: a) Alkylation

b) Acylation c) Carbylamine reaction d) Hinsberg separation

e) Reaction with Nitrous acid of 1^o, 2^o, 3^o (Aliphatic and aromatic amines).

Electrophilic substitutions of Aromatic amines – Bromination and Nitration. oxidation of aryl and 3^o Amines. Diazotization .

Cyanides and isocyanides: Nomenclature (aliphatic and aromatic) structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

UNIT-II

Heterocyclic Compounds: Introduction and definition: Simple 5 membered ring compounds with one Hetro atom . Ex. Furan. Thiophene and pyrrole. Importance of ring system – presence in important natural products like hemoglobin and chlorophyll. Numbering the ring systems as per Greek letter and Numbers. Aromatic character – 6-electron system (four-electrons from two double bonds and a pair of non-bonded electrons from the hetero atom). Tendency to undergo substitution reactions.

Resonance structures: Indicating electron surplus carbons and electron deficient hetero atom. Explanation of feebly. acidic character of pyrrole, electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example).

Sulphonation of thiophene purification of Benzene obtained from coal tar.

Preparation of furan, Pyrrole and thiophene from 1,4,- dicarbonyl compounds only,

Paul-Knorr synthesis, structure of pyridine, Basicity – Aromaticity – Comparison

with pyrrole – one method of preparation and properties – Reactivity towards

Nucleophilic substitution reaction – chichibabin reaction.

UNIT-III

Carbohydrates: Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain pentahydroxy aldehyde structure (Acetylation, reduction to n-hexane, cyanohydrin formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acid).

Number of optically active isomers possible for the structure, configuration of glucose based on D-glyceraldehyde as primary standard (no proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation). Cyclic structure of glucose. Decomposition of cyclic structure (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions).

Different ways of writing pyranose structure (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure (formation of penta acetate, formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-n-hexane). Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure and Haworth formula).

Interconversion of Monosaccharides: Aldopentose to aldo hexose – eg: Arabinose to D-Glucose, D-Mannose (Kiliani - Fischer method). Epimers, Epimerisation – Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose eg: Dglucose to D-arabinose by Ruff's degradation. Aldohexose (+) (glucose) to ketohexose (-) (Fructose) and Ketohexose (fructose) to aldohexose (Glucose).

UNIT-IV

SOIL CHEMISTRY:

Introduction to chemical nature of soils-ACID –alkaline-saline soils-PH of soils-Soil analysis-Principles of soil analysis-Soil sampling- Fertilisers-Classification-Nitrogen fertilizers-Ammonium compounds- Phosphorous fertilizers-DAP_Murate , Nitrate and Sulphate of Potash.

INTERNAL PRACTICAL EXAMINATIONS

Practicals – : Organic Chemistry

1. Semi micro qualitative analysis of mixtures containing 2 anions and 2 cations
2. Estimation of Glucose
3. Preparation Derivatives of the compounds
4. Analysis of various solvents for their purity
5. Determining melting point of a given sample
6. Recrystallization of solid samples
7. Preparing samples for elemental analysis

SECOND YEAR I SEMESTER
PAPER – II: INSTRUMENTAL METHODS OF ANALYSIS

UNIT -I

Instruments calibration

- a. Analytical balance calibration.
- b. Calibration of weight box.
- c. Calibration of UV-spectrophotometer.
- d. Calibration of IR spectrophotometer.
- e. Calibration of HPLC system. f. Calibration of Gas Chromatography instrument.
- g. Performance check of HPLC/GC column.
- h. Out of Calibration.

UNIT-II

High Performance Liquid Chromatography (HPLC) : Principle, Types, Instrumentation and Applications

Liquid Chromatography-Basic Principles of liquid chromatography-Components of HPLC-Quantitative use of HPLC – Pure compounds- Trace analysis-Gradient and Isocratic Conditions-Sample Injections-Mobile phase-HPLC Columns-Separation modes- Temperature control-Detection principles

UNIT –III

HUMIDITY CHAMBERS, INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS.

Instrumentation, Humidity calibration Procedure-Air Temperature calibration Procedure, I/O Board Calibration Procedure, Relative Humidity Equilibration- Humidity calibration Repeatability.

UNIT-IV

MODELING OF CHEMICAL KINETICS AND REACTOR DESIGN.

1. Reaction Mechanisms and Rate Expressions- Typical Reaction Mechanisms - Reaction Mechanisms - Elementary and Non-Elementary Reactions - Types of Intermediate -The Arrhenius Equation and the Collision Theory - Transition State Theory - Chain Reactions - Catalytic Reactions - Guidelines to Formulating Reaction Mechanism - Testing Kinetic Models - Chain Length
2. Industrial and Laboratory Reactors- Batch Isothermal Perfectly Stirred Reactor - Semi-Batch Reactors - Continuous Flow Isothermal Perfectly Stirred Tank Reactor - Continuous Isothermal Plug Flow Tubular Reactor - Continuous Multiphase Reactors - Fluidized Bed System - Fluid Catalytic Cracking (FCC) Unit - Deep Catalytic Cracking Unit - Determining Laboratory Reactors - Guidelines for Selecting Batch Processes - Reaction Rate Expression
3. Fluid Mixing in Reactors
Fluid Mixing in Reactors - Introduction - Mixing and Agitation of Fluids - Similarity - Mixing Time Correlation -Scale-up of Mixing Systems - Static Mixers - Heat Transfer in Agitated

Vessels - Liquid-Solid Agitation - Batch Heating and Cooling of Fluids - Design of Mixing Systems

INTERNAL PRACTICAL EXAMINATIONS

Practicals – : Instrumental methods of analysis

Instruments calibration

- a. Analytical balance calibration.
- b. Calibration of weight box.
- c. Calibration of UV-spectrophotometer.
- d. Calibration of Calorimetry
- e. Calibration of HPLC system.
- f. Calibration of pH meter
- g. Preparation of Iodine chamber

Preparing samples for IR analysis such as making solid pellets and nujol mixtures

Preparing samples for spectrophotometry analysis such as specific concentration samples and handling cuvettes

SECOND YEAR I SEMESTER
PAPER – IV: DRUG & INTERMEDIATES

UNIT-I

1. National and International Status of bulk drugs industry Introduction to basic Pharmaceutical and fine chemical Chemistry. Definition of Drug, Drug Intermediates, Fine Chemicals

UNIT-II

Chemical Technology Involved in Synthesis of some Selected Drug 12 hrs Optimization of Organic Reactions and Processes : Introduction-the purpose of chemical development, Discovering the best synthetic route; Selecting the best route for scale-up, Choice of raw materials, reagents etc; case studies, The investigative approach to chemical development, Effect of process variables on yield and quality of products.

UNIT-III

Equipments in bulk drugs manufacturing

UNIT-IV

Detail manufacturing aspects i.e. process and operation involved in production of aspirin, chloramphenicol, sulfathiazole

Synthesis of benzoyl glycine from glycine

. Synthesis of Mebendazole

Synthesis of 5,5-diphenyl-2-thioimidazoline-4-one from benzyl

Synthesis of Aspirin

Synthesis of Sulphathiazole

Synthesis of Benzodiazepine

INTERNAL PRACTICAL EXAMINATIONS

Practicals – : Drug & Intermediates

1. Synthesis of Aspirin
2. Determination of melting point of the given sample

SECOND YEAR I SEMESTER
PAPER-V: INDUSTRIAL SAFETY AND MANAGEMENT

UNIT I

Safety

Management: - Safety Management – Principle & practices., Need for safety – Humanitarian, economics, Legal & Social considerations, Role of management in Industrial Safety. Fundamentals Definitions, Unsafe acts, Unsafe conditions / hazards. Types of accident and damages, Accident prevention – theories of accident causation, Safety Education & Training:

UNIT-II

Machine safeguarding: Principles, Ergonomics of machine guarding. Type of guards & selection, incidental safety devices. Manual handling & storage of materials Mechanical handling of materials: Lifting machinery, lifts & hoist, lifting tackles, safety aspects in design & construction, testing use & care, Inspection & Maintenance. Hand tools & Portable tools: Main causes of tool accidents, Portable tools & their selection, inspection, maintenance, repair & safe use. Safety at work station: Preventive maintenance in safety. Importance of standards & codes of practices for plant & equipment. Safety & Housekeeping: Disposal of scraps & other trade wastes. Prevention of spillage. Marking of aisles, space & other locations. Use of colors as an aid for good housekeeping. House keeping contest. Inspection & checklist. Industrial lighting: - Purpose, benefits of good illumination. Phenomenon of Lighting. Source & types of artificial lighting. Recommended standards of illumination. Ventilation & Heat control: - Purpose, physiology of heat regeneration. Thermal environment measurement. Thermal comfort. Heat stress indices. Natural & Mechanical ventilation. Engineering control methods. Noise & Vibration: - Effect of noise, Measurement & evaluation of Noise, Noise isolation. Noise absorption techniques, silencers. Control of Noise. Vibration – effect, measurement & control by vibration damping.

UNIT-III

Safety Laws and Quality control in safety: Safety Audits, Hazard identification Techniques: Hazard analysis – inductive & deductive. Fault Trees analysis, Event Tree analysis, FMFA, MCAA, examples of each, Hazop etc. Acts & Rules: The Factories Act 1948 & Factories rule 1963: Safety related provision. ESI & Workmen compensation Act & rules. Indian Boiler Act & Regulations, Explosive Act, Gas Cylinder Rules, SMPV Rules. Environment Protection Act – Water & Air Act, MSIH rules. Citizen Safety

SECOND YEAR I SEMESTER
PAPER –VI : ENTREPRENEUR SHIP DEVELOPMENT

UNIT NO.

- 1 **Entrepreneurship:** Traits of Entrepreneur – Kinds of Entrepreneurship- Objectives of Business Organizations- Incorporation of Business - Role of Entrepreneurship in Economic Development – Start – ups.
- 2 **Idea Generation & Opportunity Assessment:** Idea Generation- Sources of New Business Ideas – Techniques for generating Business Ideas – Opportunity Recognition – Steps in Tapping Opportunities.
- 3 **Funding Agencies in India: Central Level Institutions:** NABARD, SIDBI, NIC, KVIC, SIDIO, NSIC Ltd etc., - State Level Funding Agencies: DICs, SFC, SSIDC – others.

References SS KHANKA – Entrepreneurship Development, S. Chand, New Delhi.
Rudra Sai Baba – Entrepreneurship, Kalyani Publications.

SECOND YEAR I SEMESTER
PAPER-: ENVIRONMENTAL SCIENCE

Unit-I : Natural Resources:

Definition, Scope and Importance. Need for public awareness.

Brief description of;

- ❖ Forest resources: Use and over-exploitation. Deforestation; timber extraction, mining, dams. Effect of deforestation environment and tribal people
- ❖ Water resources: Use and over-utilization. Effects of over utilization of surface and ground water. Floods, drought.
- ❖ Food resources: World food problems, Effects of modern agriculture; fertilizer-pesticide, salinity problems.
- ❖ Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

Unit-II : Ecosystems, Biodiversity and its conservation

- ❖ Concept of an ecosystem
- ❖ Structure and function of an ecosystem
- ❖ Producers, consumers and decomposers
- ❖ Food chains, food webs and ecological pyramids
- ❖ Characteristic features of the following ecosystems:-
Forest ecosystem, Desert ecosystem, Aquatic ecosystem.
- ❖ Value of biodiversity: Consumptive use, productive use. Biodiversity in India.
- ❖ Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts.
- ❖ Conservation of biodiversity

Unit-III : Environmental Pollution

- ❖ Definition
- ❖ Causes, effects and control measures of :-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
- ❖ Solid waste management; Measures for safe urban and industrial waste disposal
- ❖ Role of individual in prevention of pollution
- ❖ Disaster management: Drought, floods and cyclones

Unit-IV : Social Issues and the Environment

- ❖ From Unsustainable to Sustainable development
- ❖ Water conservation, rain water harvesting, watershed management.
- ❖ Climate change, global warming, ozone layer depletion,
- ❖ Environment protection Act
- ❖ Wildlife Protection Act, Forest Conservation Act

Unit-V : Human Population and the Environment

Population explosion, impact on environment.

- ❖ Family welfare Programme
- ❖ Environment and human health
- ❖ Women and Child Welfare
- ❖ Value Education
- ❖ Role of Information Technology in Environment and humanhealth.

Reference Books :

1. Environmental Studies by Dr.M.Satyanarayana, Dr.M.V.R.K.Narasimhacharyulu, Dr.G. Rambabu and Dr.V.VivekaVardhani, Published by Telugu Academy, Hyderabad.
2. Environmental Studies by R.C.Sharma, Gurbir Sangha, published by Kalyani Publishers.
3. Environmental Studies by Purnima Smarath, published by Kalyani Publishers.

SECOND YEAR I SEMESTER
PAPER:- PC & PERIPHERAL ARCHITECTURE

1. WHAT IS A COMPUTER?

What is computer? Five basic operations of a computer. Block diagram of a computer system .Input Devices and output devices The Main Memory. Main Memory Organization. RAM & its types, ROM, PROM, EPROM, EEPROM. Cache Memory Number Systems: Binary, Octal, Hexadecimal number system, Logic Gate OR, AND & NOT, Universal Gate NAND & NOR Secondary Storage Devices ,Storage Organization, Floppy Disks, Floppydisk Drive, 3½-inch Floppy Disk, Hard Disks: Zip Disks, Optical Disk, Basic principle of operation Types of Optical Disks: CD-ROM, DVD ROM. What is Software? Hardware Vs Software, Types of Software: System Software, Application Software

2. COMPONENTS OF A PC

CPU Identifying the right CPU for any motherboard: CPU manufacturers, Processor models, CPU speeds, Processor packages. RAM Types of RAM Technologies: SDRAM, DDRSDRAM, RDRAM, RAM Packages: SIMMS, DIMMS and RIMMS. Motherboard and BIOS Common motherboard features, Types of Motherboards: AT, ATX, microATX, Proprietary Motherboards. The System BIOS: Why do we need BIOS Expansion Bus Expansion Buses, Internal Buses: ISA, PCI, AGP, External Expansion Buses: USB. Power Supplies and Cases Case Form Factors: AT, ATX, microATX, Power Supply: Wattage, Connectors. Cooling: Power supply Fan.

3. ELECTRONIC COMPONENTS

Introduction to Passive & active components. RESISTANCE Standardization, color codes, power rating specifications and properties of fixed and variable resistors. CAPACITORS Introduction, standardization, and color codes characteristics of capacitor tolerance, type of capacitors and their applications. INDUCTIVE COMPONENTS Introduction to inductor, characteristics, types of inductors, their features and specifications, transformers, Principle, Turns ratio, types of transformers. Step up and step down Transformer. SEMICONDUCTOR MATERIALS Properties of Semiconductors, Commonly used semiconductors, Intrinsic Semiconductor, Extrinsic Semiconductor, PN Junction Diode, Zener diodes, Rectifiers (Half Wave, Full Wave). Transistor: NPN and PNP schematic symbols. Transistor as a switch MEASURING INSTRUMENTS Basics of Digital Multimeter

4. ARCHITECTURE OF PC PERIPHERALS

Switch Mode Power Supply: Discrete components, principle of operation SMPS, converter topologies, PWM IC's and case study. Monitors: CRT construction and working, 9 pin input type-monitor, block Diagram of color monitor. Printer: Types &

components of printers, printer interface with computer, principle of operation of Laser and Inkjet printers, general maintenance aspects. Hard disk drive. Hard disk drive types and interfaces, construction of HDD.

Reference Reading:

1. Principles of Electronics By V.K.Mehta and Rohit Mehta, Publisher: S.Chand and Company Limited New Delhi
2. IBM PC and Clones Hardware Troubleshooting and Maintenance By B.Govindarajalu Publisher:Tata McGRAW-Hill publishing company limited New Delhi
3. Power Supplies, Switching Regulators, Invertors and Converters, by Irving M. Gottlieb, , BPB Publication, New Delhi. 4. Switching Mode Power Supply Design, by P.R.K.Chetty.

SECOND YEAR SECOND SEMESTER

PAPER 1 UNIT OPERATIONS IN PHARMACEUTICAL INDUSTRY

UNIT: I

Transportation of Solids:

Construction details, advantages and disadvantages of belt conveyor, screw conveyor and pneumatic conveyor, bucket elevator.

Transportation of Fluids:

Cocks, valves- gate valve, check valve, pump- centrifugal pump.

Theory of filtration, filter media, construction and operation of filter press, metafilter, disc filter, rotary vacuum filter. Filtration of air- Mechanism and equipment.

Mixing:

Mixing of liquids and liquids, design of impellers, construction and application of dry mixer, v-type mixer, and power consumption of mixer, impellers, kneading machine, and colloidal mill.

UNIT: II

Distillation:

Concept of distillation of binary miscible, immiscible mixtures. Rectification, azeotropic distillation, distillation under reduced pressure, steam distillation, simple distillation, extractive and fractional distillation, and molecular Distillation,

Drying:

Theory of drying, drying curves, shrinkage of materials, construction, operation and application of different dryers, atmospheric and vacuum compartment dryer, rotary dryer, spray dryer, freeze dryer and fluidized bed dryer.

SECOND YEAR SECOND SEMESTER

PAPER II ASEPTIC PROCESSING OPERATIONS

UNIT : I

Parenteral production Techniques:

Area planning and Environmental control-Environmental Zones

Utilities and Utility Equipment Location-List of Equipment as per Schedule-M

Design of Facility: Air Handling System Design, Heating Ventilation and Air Conditioning (HVAC) Systems, Typical Air flow for Sterile Area, HEPA Filter; LAMINAR AIR FLOW (LAF) SYSTEM

Sterilization by moist and dry heat, construction and operation of autoclave, Hot air oven. Sterilization monitors.

Environmental monitoring-

Personnel (Operators/Working personnels) Air (For Both viable & Non-viable & compressed air) Surfaces (Floors, Walls, Equipment, etc.)

Drains (In the MFG Areas)

Water System in plant

UNIT : II

Care, handling and breeding techniques of laboratory animals. Regulations for laboratory animal care and ethical requirement. Knowledge of the CPCSEA perform for performing experiments on animal

SECOND YEAR SECOND SEMESTER

PAPER III & IV Project Work