

**B.Sc., III YEAR CHEMISTRY**  
**SEMESTER- VI**  
**DSC-3F: CHEMISTRY PAPER – VI**  
**(04 Credits) 60 Hrs (04 Hrs/week)**

**UNIT-I: SEPARATION TECHNIQUES**

**15 Hrs**

**Solvent Extraction-** Principle, Methods of extraction: Batch extraction, continuous extraction and counter current extraction. Application– Determination of Iron (III).

**Chromatography:** Classification of chromatographic methods, principles of differential migration, adsorption phenomenon, nature of adsorbents, solvent systems.

**Thin layer Chromatography (TLC):** Advantages, preparation of plates, development of the chromatogram, Detection of the spots, factors effecting  $R_f$  values and applications.

**Paper Chromatography:** Principle, choice of paper and solvent systems, development of chromatogram – ascending, descending, radial and two dimensional chromatography and applications.

**Column Chromatography-** Principle, Types of stationary phases, Column packing – Wet packing technique, Dry packing technique. Selection criteria of mobile phase solvents for eluting polar, non-polar compounds and its applications.

**Gas Chromatography:** Theory and instrumentation (Block diagram), Types of stationary phases and carrier gases (mobile phase).

**UNIT-II: DRUGS AND GREEN CHEMISTRY**

**15 Hrs**

a) **Drugs:** Introduction: Drug, Disease (definition), Historical evolution, Sources-plant, animal synthetic, Biotechnology and human gene therapy.

**Terminology:** Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors-brief treatment) Metabolites and Anti metabolites.

**Nomenclature:** Chemical name, Generic name and trade names with examples.

**Classification:** Classification based on structures and therapeutic activity with one example each.

**Synthesis:** Synthesis and therapeutic activity of the following drugs- L-Dopa, Chloroquin, Omeprazole, Albuterol and Ciprofloxacin.

b) **Green Chemistry:** Introduction: Definition of green chemistry, need of green chemistry, basic principles of green chemistry.

**Green synthesis:** Evaluation of the type of the reaction (i) Rearrangements (100% atom economic), (ii) Addition reaction (100% atom economic), Pericyclic reactions (no by-product)

**Selection of solvent:** Aqueous phase reactions, Reactions in ionic liquids, Solid supported synthesis and solvent free reactions (solid phase reactions) **Green Catalysts:** Phase transfer catalysts (PTC), Biocatalysts.

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### UNIT-III: ELECTRO ANALYTICAL METHODS

15 Hrs

**Potentiometry:** Principle, Electrochemical cell, Electrodes- (i) Indicator and (ii) Reference electrodes – Normal Hydrogen Electrode, Quinhydrone Electrode, Saturated Calomel Electrode. Numerical Problems. Application of Potentiometry – Assay of Sulphanilamide

**Conductometry:** Conductivity Cell, Specific Conductivity, Equivalent Conductivity. Numerical Problems. Applications of Conductometry. Estimation of  $\text{Cl}^-$  using  $\text{AgNO}_3$ , Determination of Aspirin with  $\text{KOH}$ .

**Colorimetry:** General features of absorption – spectroscopy, transmittance, absorbance, and molar absorptivity. Beer -Lambert's law and its limitations. Verification of Beer's law. Estimation of iron in water samples by thiocyanate method. Estimation of (i) Chromium and (ii) Manganese in steel.

**Spectrophotometry:** Instruments – Single and Double beam UV- Visible Spectrophotometers, IR-Spectrophotometer- Principle, Sources of radiations, Sampling, Block diagram of FT-IR Spectrophotometer.

### UNIT-IV: MOLECULAR SPECTROSCOPY

15Hrs

Introduction to electromagnetic radiation, interaction of electromagnetic rations with molecules, various types of molecular spectra.

**Electronic spectroscopy:** Bonding and anti-bonding molecular orbitals, electronic energy levels of molecules ( $\sigma$ ,  $\pi$ ,  $n$ ), types of electronic transitions:  $\sigma\text{-}\sigma^*$ ,  $n\text{-}\sigma^*$ ,  $n\text{-}\pi^*$ ,  $\pi\text{-}\pi^*$  with suitable examples. Selection rules, Terminology of chromophore, auxochrome, bathochromic and hypsochromic shifts. Absorption of characteristics of chromophones: diene, enone and aromatic chromophores. Representation of UV-Visible spectra.

**Infra red spectroscopy:** Energy levels of simple harmonic oscillator, molecular vibration spectrum, selection rules. Determination of force constant. Qualitative relation of force constant to bond energies. Anharmonic motion of real molecules and energy levels. Modes of vibrations in polyatomic molecules. Characteristic absorption bands of various functional groups. Finger print nature of infrared spectrum.

**Proton Magnetic Resonance Spectroscopy ( $^1\text{H-NMR}$ ):** Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals – spin-spin coupling, representation of proton NMR spectrum – Integrations.  $^1\text{H}$  NMR spectrum of – ethyl bromide, acetaldehyde, 1, 1, 2- tri bromo ethane, ethyl acetate and acetophenone.

**Mass Spectrometry:** Electron Impact Mass: Basic principles, Nitrogen rule, types of ions: Molecular ion, fragment ion and isotopic ions, representation of mass spectrum, types of peaks (molecular ion, fragment and isotopic ion peaks). Determination of molecular weight, Mass spectrum of ethyl chloride, ethyl bromide and acetophenone.

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## REFERENCES:

### Unit-I

1. Analytical Chemistry by David Krupadanam, Universities Press (India) Limited.
2. D. A. Skoog, D.M. West, F.J. Holler, Fundamentals of Analytical Chemistry 6<sup>th</sup> Edn. Saunders College Publishing, Fort worth (1992).
3. M.N Sastry, Separation Methods, Paperback (2004), Himalaya Publications.
4. Usharani Analytical Chemistry Paperback (2000) Narosa Publications.
5. Analytical Chemistry 7<sup>th</sup> edition by Gary D. Christian (2004).

### Unit-II:

1. Drugs by G.L.David Krupadanam, D.Vijaya Prasad, K.Varaprasad Rao, K.L.N.Reddy C.Sudhakar, Universities Press (India) Limited 2007.
2. An Introduction to Medicinal Chemistry by Graham L. Patrick, Oxford University Press, New York. 1995.
3. David William and Thomas Lemke, Foye's Principles of Medicinal Chemistry, Lippincott Williams & Wilkins, 2008.
4. Ashutosh Kar Medicinal Chemistry, New Age International, 2005.
5. O.D.Tyagi & M.Yadav Synthetic Drugs by, Anmol Publications, 1998.
6. Medicinal Chemistry by Alka L. Gupta, Pragati Prakashan.
7. Ahluwalia, V.K. & Kidwai, M.R. New Trends in Green Chemistry, Anamala Publishers (2005).
8. Anastas, P.T. & Warner, J.K.: Green Chemistry - Theory and Practical, Oxford University Press (1998).
9. Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker (2001) Cann, M.C. & Connely, M.E. Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).

### Unit-III:

1. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc, New York (1995).
2. B. K. Sharma, Industrial Chemistry (including Chemical Engineering). Edn. (1997).
3. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. 7<sup>th</sup> Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman. 2007.

### Unit-IV:

1. Organic spectroscopy, William Kemp

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2. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
3. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7<sup>th</sup> Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
4. C.N. Ban well: Fundamentals of Molecular Spectroscopy.

**LABORATORY COURSE**  
**CHEMISTRY LAB PAPER-VI**  
**(Qualitative analysis of Organic Compounds)**  
**(03 Hrs per week, 01 Credit) 45 Hrs**

**I. Qualitative analysis of Organic Compounds:**

1. Identification of an organic compound through the functional group analysis. Determination of melting point and preparation of suitable derivatives of the following: Carboxylic acids, Phenols, amines, urea, thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene.
2. Spectral & Chromatography analysis:
  1. Spectral analysis of organic compounds with different functional groups using UV, IR, <sup>1</sup>HNMR and Mass spectroscopy. (Eg:-Ethanol, Acetophenone and Aniline)
  2. Thin layer chromatography (TLC): Determination of R<sub>f</sub> values and identification of organic compounds: preparation and separation of 2,4-dinitrophenyl hydrazones of acetone and 2-butanone using toluene and light petroleum(40:60)

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**B.Sc. Chemistry III Year**  
**Semester-VI, Paper-VI**  
**Discipline Specific Elective-A (4 Credits)**  
**Medicinal Chemistry**

60Hrs

15Hrs

**Unit- I: Introduction and Terminology**

**S6-E-A-I: Diseases:** Common diseases, infective diseases—insect borne, air-borne, water-borne and hereditary diseases.

**Terminology in Medicinal Chemistry:** Drug, Active Pharmaceutical Ingredient (API), Pharmaceuticals, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics, metabolites, anti metabolites and therapeutic index.

**Drugs: Nomenclature:** Chemical name, Generic name and Trade names with examples;

**Classification:** Classification based on structures and therapeutic activity with examples.

**ADMET:** a) Absorption: Definition, absorption of drugs across the membrane – active and passive absorption, routes of administration of drugs. b) Distribution: definition and effect of plasma protein binding. c) Metabolism: definition, phase I and phase II reactions. d) Elimination: definition and renal elimination. Toxicity.

15Hrs

**Unit-II: Enzymes and Receptors**

**S6-E-A-II: Enzymes: Introduction.** Mechanism and factors affecting enzyme action, Specificity of enzyme action (including stereo specificity), Enzyme inhibitors and their importance. Types of inhibition - reversible, irreversible and their subtypes with examples.

**Receptors:** Introduction, Drug action-receptor theory, Mechanism of drug action, concept of agonists and antagonists with examples. Drug receptor interactions involved in drug receptor complex. binding role of -OH group, -NH<sub>2</sub> group, quaternary ammonium salts and double bond. Structure – activity relationships of drug molecules, explanation with sulfonamides.

15Hrs

**Unit- III: Synthesis and Therapeutic Activity of Drugs**

**S6-E-A-III: Introduction,** synthesis and therapeutic activity of

**Chemotherapeutics:** Sulphanilamide, dapsone, Pencillin-G (semi synthesis), Chloroquin, Isoniazid, Cisplatin and AZT.

**Drugs to treat metabolic disorders:** Anti diabetic - Tolbutamide; Antiinflammatory – Ibuprofen; Cardiovascular- Glyceryl trinitrate; Antipyretic (paracetamol, aspirin) and Antacid- Omeprazole.

**Drugs acting on nervous system:** Anesthetics-definition, Classification-local and general. Volatile- Nitrous oxide, chloroform uses and disadvantages. Local anaesthetics – benzocaine.

**Unit- IV: Molecular Messengers, Vitamins and Micronutrients**

15Hrs

**S6-E-A-IV: Molecular Messengers:** Introduction to hormones and neurotransmitters, Thyroid hormones, Antithyroid drug-Carbimazol. Adrenaline: Adrenergic drugs- salbutamol, atenelol. Serotonin: SSRIs- fluoxetine. Dopamine: Antiparkinson drug- Levodopa .

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**Vitamins and Micronutrients:** Introduction, vitamin sources, Deficiency disorders and remedy of Vitamins A,B, C, D, E K and micronutrients – Na, K, Ca, Cu, Zn and I .

**Recommended Text Books and Reference books**

1. Introduction to Medicinal Chemistry, G.L. Patrick, Oxford University Press, New York. 2013.
2. Medicinal Chemistry, Thomas Nogrady, Oxford Univ. Press, New York. 2005.
3. Foye's Principles of Medicinal Chemistry, David William and Thomas Lemke, Lippincott Williams & Wilkins, 2008.
4. Medicinal Chemistry, Ashutosh Kar , New Age International, 2005.
5. Synthetic Drugs, O.D.Tyagi & M.Yadav, Anmol Publications, 1998.
6. Medicinal Chemistry, Alka L. Gupta, Pragati Prakashan.
7. Drugs, G. L. David Krupadanam, D.Vijaya Prasad, K.Varaprasad Rao, K. L. N. Reddy, C. Sudhakar, Universities Press (India) Ltd. 2012.

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**B.Sc. Chemistry III Year**  
**Semester –VI, Paper-VI**  
**Discipline Specific Elective-B (4 Credits)**  
**Agricultural and Fuel Chemistry**

60 Hrs

**Unit I: – Pesticides**

15Hrs

**S6-E-B-I: Introduction**, Definition, classification of pesticides based on use (target). Toxicity and chemical structure with examples. Adverse effects of pesticides and its impact on environmental pollution.

Synthesis, manufacture and uses of representative pesticides: Organochlorines (Cypermethrin); Organophosphates (Parathion); Carbamates (Carbaryl); Quinones (Chloranil), Anilides (Alachlor).

**Pesticide formulations:** Dusts, Granules, Wettable powders, Emulsions and Aerosols.

**Biopesticides :** Introduction: Potential pesticidal plants of India, Role of Neem in plant protection-constituents, Azadirachtin and its role in pest control, Structure and mode of action of Pyrethrins (pyrethrin-1) and Pyrethroids (permethrin) and nicotinoids (Imidacloprid).

**Unit II: – Fertilizers**

15Hrs

**S6-E-B-II: Introduction:** (need of fertilizers), functions of essential plant nutrients (N, P, K), Classification formula and uses of fertilizers:

**Nitrogenous fertilizers:** Ammonium nitrate, Urea, Calcium Cyanamide, Calcium Ammonium Nitrate, Sodium Nitrate, Ammonium Chloride and their uses.

**Phosphate fertilizers:** Normal super phosphate, Triple Super Phosphate, Ammonium Phosphate and their uses.

**Potassium fertilizers:** Potassium chloride, potassium nitrate, potassium sulphate and uses.

**Complex fertilizers:** Diammonium Phosphate and mixed fertilizers their uses. Manufacture of urea and Super phosphate of lime and their reactions in the soil.

**Biofertilizers –** Introduction, definition, classification, Rhizobium, Azatobactor, Azospirillum, Azolla, Blue Green Algae, Vermicomposting and uses.

**Organic farming:** The principal methods, crop rotation, green manures and compost, biological pest control, and mechanical cultivation and uses.

**Unit III: Energy Sources and Coal**

15Hrs.

**S6-E-B-III: Review of energy sources** (renewable and non-renewable). Classification of fuels and their calorific value.

**Coal:** Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar based chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

**Unit IV: Petroleum and its products, petrochemicals and non petroleum fuels**

15Hrs.

**S6-E-B-IV:**

**Petroleum and its products**

**Petroleum:** Origin, Composition of crude petroleum and classification. Properties- flash point and its determination, Knocking and antiknocking compounds; Octane number. and Cetane number. Distillation of crude petroleum, Fractional Distillation - Principle and process, refining, Fractions and uses. Cracking -Thermal and catalytic cracking, Reforming

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