SEMESTER-II
M 2 IC 01-CT 05

Environmental Green Chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits : 4

Unit-I

Principle and concept of Green Chemistry: Introduction, definition, principles, atom economy, atom economic and atom uneconomic reaction, reducing toxicity.
Waste: Production, Problems and Preventions: Introduction, Problem caused by waste, source of waste, cost of waste, waste minimization techniques, on-site waste treatment, design for degradation, polymer recycling.

Unit-II

Green Solvents: Organic solvents, solvent-free systems, controlling of solvent-free reaction, supercritical fluids (H_2O and CO_2), fluorous biphase solvents.
Green reagents: Introduction, methods of designing safer chemicals, avoidance of toxic functional groups, examples of greener reagents including replacement of phosgene, methylations using dimethyl carbonates and other polymer supported reagents, solid state polymerization, alternative nitrile synthesis. Introduction of catalysis, Biocatalysis and phase transfer catalysis.

Unit-III

Green Synthesis: Design for energy efficiency, classification and application of green synthesis including Microwave Assisted Synthesis, green synthesis of polycarbonates, paracetamol, ibuprofen, citral, urethane, adipic acid, styrene, α, β-unsaturated nitroalkenes.

Unit-IV

Environmental Chemistry: Atmosphere chemical and photochemical reaction in the atmosphere, oxygen and ozone chemistry, green house gases and effect, hydrosphere- physical chemistry of sea water, eutro-phication, sewage treatment, lithosphere and chemistry involved, smoke formation acid rains. A brief idea of toxicological effects of arsenic, lead, cadmium, mercury, ozone,PAN, cyanide, pesticides. Oxide of nitrogen, sulphur and carbon, carcinogens.

Unit-V

Analysis of pollution: Sampling and monitoring of air and water, determination of total dissolved solids, conductivity, acidity, alkalinity, hardness, chloride, slphate, fluoride, phosphate and different forms of nitrogen, phenols, pesticides, surfactants DO, BOD and COD microorganism. Catalysis of aquatic chemical reactions, water pollution lows and standards.

SEMESTER-II
M 2 IC 02-CT 06

Instrumental Techniques

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

UNIT-I

Thermo Gravimetry Analysis(TGA) and Derivative. Hermogravimetry(DTG): Principle, instrumentation and application, factor affecting TG curves,

Differential Thermal Analysis(DTA): Principle, instrumentation and application, factor affecting TA curves

Differential Scanning Calorimeter(DSC): Principle, instrumentation and application, factor affecting DC curves, comparison with DTA.

UNIT-II

D.C.Polarography: Basic principle, types of currents, experimental technique, Illovic equation (no derivation) and application of polarography

Principle, technique and application of;

(i) Voltametric and cyclic voltametery
(ii) Amperometry
(iii) Anodic stripping voltametery

UNIT-III

High Performance Liquid Chromatography(HPLC): Introductory knowledge of adsorption basic principle, instrumentation and applications of HPLC, comparison with gas liquid chromatography.

Gas Liquid Chromatography: Principle, instrumentation and applications.

Gel Permeation or Size Exclusion Chromatography: Introduction, theory and application

UNIT-IV

Ion Exchange: Introduction, types-cationic, anionic, chelating and liquid ion exchangers, preparation, action and properties of exchangers and applications of ion exchangers

Solvent Extraction, ion association complexes

Gel Electrophoresis: Introduction, Factors affecting ionic migration, detection of separated components and applications of Gel electrophoresis.

UNIT-V

Radioactive Technique: Tracer technique, neutron activation analysis, counting technique such Geiger-Muller, ionization and proportional counters

Light Scattering Techniques: Principle, instrumentation and applications of nephelometery and Raman spectroscopy.

Books recommended:

1. Ion exchange separations in Analytical Chemistry. O.Samuelson, John Wiley
2. Exchangers amd Solvent Extractions, J.A.Marinsky and Y.Parcus, Marcel Dekker
3. Polagraphic Techniques, I.Metes, Interscience
4. Gel Chromatography, Tibor Kremmer and Laszol Boross, Wiley

SEMESTER-II
M 2 IC 03-CT 07
Fundamental of polymer chemistry

Time: 3 Hrs. **M.M. 80 marks**
Credits : 4

Unit – I

Introduction of Polymer: Definition of Polymer, Classification of Polymer, Bonding in Polymer, History of Polymer.
Raw Materials: Oil, Natural gas, Coal, Types, Grades and indication of manufacturing, Source of natural Polymers and derivatives

Unit – II

Addition Polymerization: Cationic, Anionic, and Free-radical.
Kinetics of Polymerization – Free radical, cationic, anionic.

Unit – III

Coordination Polymerization: Ziegler Natta Catalysts and Stereo regular polymers **Condensation Polymerization**: Types, extent and degree of Polymerization and kinetics. Carother's equation, ring opening Polymerization.

Unit – IV

Copolymerization: Mechanism, reactivity ratio and composition – Block and graft copolymers. Kinetics of copolymerization.

Unit – V

Polymerization techniques: Bulk, Solution, Suspension, Emulsion, Melt Polycondensation, Solution Polycondensation, Interfacial condensation, solid and gas phase polymerization. Their advantages and disadvantages with application.

Recommended Books:

1. Polymer science: V.R. Goowarikar,N.V. Viswanathan,Jayadev Sridhar

2. Text book of polymer science: Fred W. Billmeyer

3. Polymer science & Technology: Joel R. Fried

4. Polymer Science and Technology: Premamoy Ghosh

SEMESTER-II
M 2 IC 04-CT 08

Spectroscopy in analysis-II

Time: 3 Hrs. **M.M. 80 marks**
Credits: 4

Unit-I

Mass Spectrometry: Introduction, ion production-EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds common functional groups, molecular ion peak, meta stable peak, McLafferty rearrangement, Retro Diels-Alder reaction, nitrogen rule, high resolution mass spectrometery. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Unit-II

Nuclear magnetic resonance spectroscopy: General introduction and definition, chemical shift, spin-spin interaction, Shielding mechanism, mechanism of measurement, chemical shift values and correlation for proton bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercaptols), chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), virtual coupling stereochemistry, hindered rotation.

Karplus curve variation of coupling constant with dihedral angle. Simplification of complex spectra-nuclear magnetic double resonance, contact- shift reagents, solvent effects. Fourier transform techniques, nuclear overhouser effect (NOE). Resonance of other nuclei-^{19}F,^{31}P.

Carbon-13 NMR Spectroscopy: General consideration, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon) coupling constants. Two dimension NMR spectroscopy, COSY, NOESY, DEPT, INEPT, APT and INADEQUATE techniques.

Unit-III

Electron spin resonance spectroscopy: Hyperfine coupling, spin polarization for atoms and transition metal ions , spin-orbit coupling and significance of g-tensors, applications of transition metal complexes (having one unpaired electron) including biological systems and to inorganic free redicals such as PH_4, F_2, and $[BH_3]$.

Unit-IV

X-ray Diffraction: Bragg-condition, Miller indices, Laue method, Bragg method, Debye-Scherrer method of x-ray structural analysis crystals, Index-reflaction, Identification of unit cells from systematic absence in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem, description of the procedure for an x-ray structure analysis, absolute configuration of molecules, Ramchandra diagram**.**

Electron diffraction: Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structures of surfaces.

Neutron diffraction : Scattering of neutron by solid and liquid , magnetic scattering, measurement techniques, elucidation of structure of magnetically ordered unit cell.

Unit-V

Mossbauer spectroscopy : Basic principles, spectral parameters and spectral display, application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds, nature of M-L bond, coordination number, structure (3) detection of oxidation state and inequivalent MB atoms.

SEMESTER-II

M 2 IC 05-CP 03

(Practical-A-II**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

Organic synthesis (two stage preparation) including Crystallization, Percent Yield and M.P. and FTIR spectral studies

1. Synthesis of azo dyes
2. Synthesis of Eosin from Pthalic Anhydride
3. Preparation of benzanilide using Beckmann rearrangement
   Some preparation to be added

Chromatography

1. Separation and identification of amino acids by TLC
2. Separation and identification of organic compounds by TLC
3. Extraction and Identification of artificial food colours

SEMESTER-II

M 2 IC 06-CP 04

(Practical-B-II**)**

Credits 4; Time 8h **M.M. 100**

80 marks (External)
20 marks (Internal)

Coal Analysis :

1. Moisture contents
2. Volatile matter
3. Ash contents
4. Fixed carbon

Oil Analysis

1. Determination of acid value of vegetable oils mineral oil/ lubricating oil
2. Determination of saponification value of vegetable oils
3. Determination of Iodine value of vegetable oils
4. Flash point determination of mineral oil/ lubricating oil
5. Aniline point determination of mineral oil/ lubricating oil
6. Determination of viscosity of mineral oil/ lubricating oil

Conductometric and spectrophotometric analysis

1. Acid strength by conductometric titration
2. Spectrophotometric analysis of Rock phosphate
3. Spectrophotometric estimation of Iron in synthetic sample
4. Spectrophotometric estimation of Chromium in synthetic sample