

CY-401
B.Tech. III semester

EC& Eng.

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Department of Chemistry

OPEN ELECTIVE TO BE OFFERED BY THE DEPARTMENT

TITLE OF THE SUBJECT : POLYMERIC MATERIALS AND
THEIR APPLICATIONS(CY-401)

Syllabus :

1. Basic Polymer Chemistry : Definition, classification, Types of polymerization
2. Resins and plastics : Thermoplastic and thermosetting resins, constituents of plastics, fabrication of plastic materials, Important resins, Cellulose derivatives, Polyethylene, Teflon, Polystyrene, Polyvinylacetate, PVC, Nylons, Phenolic resins, Phenol-Formaldehyde, Urea and Malamine - Formaldehyde resins, Epoxy resins, Polyester, Silicones, Ion exchange resins.
3. Rubbers/Elastomers : Natural rubber, compounding of rubber, Properties, uses, reclaimed rubber, Synthetic rubber, Buna- S, Nitrile rubbers, Butyl rubbers, Neoprene rubber, Thiokols, silicone rubbers, fibre reinforced plastics (FRP)
4. Biopolymers : Importance and applications of few important biopolymers eg. proteins, carbohydrates etc.

Maximum Strength of students allowed : 60

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chemical and physical properties; role of free radicals in chemical (e.g. polymerization), environmental and biological systems.

Reaction Mechanism : Brief study of elimination (E1 & E2), nucleophilic substitution (SN1 & SN2) reactions, Pinacole-Pinacolone rearrangement, Cannizzaro reaction, Skraup synthesis, Baeyer-reaction and Darzens glycidic ester condensation.

Chemistry-I (CY-101) (Credit -4)

Chemical Bonding : Nature of the bond, chemical constitution and physical properties, atomic and molecular orbitals, metallic and covalent bonds, directional nature of covalent bond, polarity and hydrogen bonding, application of surface tension, viscosity, dipole moment and refractive index.

Chemical Kinetics : Rate of reaction, order of reactions, determination of the rate equation, reversible first order reactions, parallel first order reactions, Zero order reactions, Effect of temperature, Relation between rate constants of the forward and backward reactions. Simple second order reactions, half life and its relations to reaction order, Steady-state approximations, Method of initial slopes to determine reaction order, Ostwald's isolation method.

Physical and Chemical Analysis : Redox, Argentometric and complexometric titration and calorimetric analysis, a brief introduction to instrumental method for quality control in Engineering Industries.

Chemistry of Materials : Chemical, Physical properties and applications of glass, refractories, porcelain, lime and cement.

Coordination compounds and Organometallics: Introduction, classification and nomenclature of coordinate and organometallics compounds, chemical and physical properties and their applications.

Stereo Chemistry : Asymmetric carbon atoms, chirality, configuration, specificity of absolute configuration (D and L) and (R and S), racemic mixture, elements of symmetry, diastereomerism and atropisomerism; Electronic effects,

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4. Fuel :

Coal (origin and analysis of coal; FSI, calorific value and its units, Gasification of coal, mobile process and selective synthesis through Zeolites), natural gas, petroleum and their industrially useful fractions, their performance, analysis of coal and fuel gas, combustion, calculations and hydrogen as fuel.

5. Introduction to:

- Proteins: Amino acids, classification, synthesis of α -amino acids, peptides, classification of proteins, structure of proteins, structure elucidation of peptides, structure and importance of proteins.
- Carbohydrates: Classification, chemistry of glucose, constitution of glucose, configuration of glucose, cyclic structure of glucose, properties of glucose.
- Vitamins: Structure, occurrence and importance of vitamins mainly A, B1, B2, B6, C, D, E, and K.
- Antibiotics: Importance of antibiotics mainly Penicillin, Chloramphenicol and Streptomycin.

6. Environmental Chemistry:

Pollutions and their control : Environmental air pollution, pollution due to industrial chemicals and their toxicology, acidification, water and marine pollution, pollution due to agricultural activities, Eutrophication, oil pollution, solid waste disposal, Radiation and thermal pollution, Noise pollution, Green house gases and their effects to the global environment, industrial techniques in environmental chemical analysis and techniques for pollution control.

Chemistry-II (CY-102) (Credit-4)

1. Principles of Photochemistry and their applications:

Mechanism of fluorescence and phosphorescence as explained by Jablonski diagram, Beer Lambert law, Grothaus Drapper law, Stark Einstein law, Quantum yield and its determination, Photosensitization and quenching, Photochemical rate law and kinetics of photochemical reactions, application of photochemistry.

2. Adsorption and desorption +equilibria:

Physisorption and chemisorptions, desorption activation energy, sticking probability and fractional coverage. Derivation and use of Langmuir adsorption isotherm, the Temkin isotherm and Freundlich isotherm. Derivation of Gibb's adsorption isotherm, capillary active and capillary inactive substances, use of adsorption measurements to determine surface area, BET theory.

3. Chemistry of various polymers:

Illustration of principles with reference to polymeric materials, their engineering uses, thermo plastic and thermosetting resins, fibres, rubber, biopolymers and their applications.

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Structure Activity Relationship: Structure Activity Relationship (SAR) in simple organic molecules like salicylic acid analogues, P-aminophenols barbiturates etc.

Nucleophilic substitution reactions: Aliphatic nucleophilic substitution, aromatic nucleophilic substitution, mechanism and factors affecting nucleophilic substitution.

Dienes & Polyenes: Nomenclature, preparation and important reactions like cycloaddition reactions.

Chemistry of Polymers: Polymerization and some commercially important polymers: Thermoplastic and thermosetting resins, fibres, rubbers etc.

Heterocyclic Chemistry: Introduction to heterocyclic chemistry including synthesis, reactivity and application mainly 3,4,5,6-membered rings containing N/S/O as hetero atom eg Pyrrole, Furan, Thiophene and Pyridine.

Organic Catalysis: Catalysis involving transition metal complexes with examples eg. Wacker's Catalyst.

Pericyclic reactions: Electrocyclic reactions, sigmatropic reaction, cycloaddition reactions, their mechanism & stereochemistry with the help of suitable examples.

Organic reagents: Preparation, properties and uses of few important reactions namely: sodium borohydride, Lithium aluminium hydride, N-bromosuccinimide, Lead tetraacetate, Diazomethane, Aluminium isopropoxide, Grignard reagent etc.

Books:

1. Organic Chemistry : Morrison and Boyd
2. Reaction Mechanism : Jerry March
3. Reaction Mechanism : Peter & Sykes
4. Medicinal Chemistry : Foye et al
5. Engineering Chemistry : S. S. Dara

Question paper pattern:

For examination, the number of questions to be set are **Eight**, with atleast one from each unit. Students are required to answer any five full questions.