

# Community College

## M. Voc. (Polymer and Coating Technology)

(A) POLYMER

### 1. Polymer Science

Classification of Polymers – natural – synthetic, methods of polymerization (addition and condensation, ring opening etc.), biodegradable and non-biodegradable polymers, Concept of Molecular Weight in Polymers, Polymer reaction (Cyclization, crosslinking, curing etc.)

**Physical Properties of Polymer** – Molecular weight, density, degree of polymerization, Deformation (Plastic and Elastic), Chemical Resistance and Solubility, Physical State of Polymers (Crystalline, Amorphous and Semi-crystalline), Effect of Heat (Glass Transition Temperature T<sub>g</sub>).

**Mechanical Properties of Polymers**, Hardness, Elongation, Modulus, Toughness, Stiffness, Density, Tensile Strength, Abrasion Resistance Resilience, Wear and Tear.

**Polymeric Materials** – Commodity Plastics, Engineering Plastics, Speciality Plastics, Thermosets Plastic, and Polymer Blends.

**Polymeric Material Testing & Characterization** – Testing of Polymers, National and International standards – ISO, ASTM & BIS. Water absorption, moisture analysis, sieve analysis, environmental stress cracking resistance of Polymer.

**Polymer Processing** – Extrusion, Injection Moulding, Blow Moulding, Compression and Transfer Moulding

**Bioplastics** – Types of bioplastics, such as starch based, cellulose based plastics and polyester polyamides, Bio-Based Composites. Applications of biopolymer in cosmetic implants, bone replacement, dental applications etc.

### 2. Coatings and Rubber Technology

**Methods of coatings** – Chemical vapour deposition, Physical vapour deposition, Electro-deposition and Thermal Sprays Process.

**Rubbers** – Manufacturing of rubber, vulcanization, and application of synthetic Elastomer viz. SBR, NBR, CR, Silicon Rubber, PU Elastomer, Compounding and Processing techniques, mechanism of reinforcement and mastication of rubber.

**Rubber Processing** – Mastication process using Mixing roll mills, Kneaders and spreading machines.

**Heat and Mass Transfer Operation** – Fourier's law of Conduction, Heat conduction through Plane wall, hollow. Heat transfer coefficient, Heat transfer by Radiation : Basic definition, laws of Radiation, Black body, Grey body, Heat Exchanger.

### **Mass Transfer Operations**

Species transfer, Definition of Concentrations, Velocities and Fluxes in Multi Species. Systems. Fick's law of diffusion, diffusion of species through stagnant species, Fick's 2<sup>nd</sup> law of diffusion.

## **(B) CHEMISTRY**

### **1. Inorganic Chemistry**

#### **Atomic Structure**

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements.

#### **Periodic Properties**

Atomic and ionic radii, ionization energy, electron affinity and electronegativity definition, effective nuclear charge, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour, Chemical Bonding, Chemical Bonding, Chemistry of Elements of First Transition Series.

#### **Chemistry of Noble Gases**

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon Compounds.

**Acids and Bases** : Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases. Hard and Soft Acids and Bases (HSAB)

### **2. Organic Chemistry**

#### **Structure Bonding**

Hybridization and its effect on bond length and bond angles, bond energy, localized and delocalized chemical bond, inductive, resonance, hyperconjugation, hydrogen bonding.

#### **Mechanism of Organic reactions**

Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Reactive intermediates-Arenes, Aromaticity, Aldehyde-Ketones and Carboxylic acid and Aliphatic Hydrocarbons.

#### **Stereochemistry of Organic Compounds**

Concept of isomerism. Optical isomers, enantiomers and diastereomers. Geometrical isomerism – E & Z system of nomenclature, in alkenes oximes and cyclopropane derivative compounds. Spectroscopy.

### 3. Physical Chemistry

**Gaseous State** Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of state. Critical Phenomena.

**Solid State** – Definition of space lattice, unit cell, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Laws of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

**Colloidal State** – Definition of colloids, classification of colloids. Sols : properties – kinetic, optical and electrical; stability of colloids, protective colloids, Hardy – Schulze rule, gold number. Emulsions : types of emulsions, preparation. Gels : Classification, preparation and properties

**Chemical Kinetics and Catalysis** – Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst.

**Thermodynamics** – First law of thermodynamics, Thermochemistry, Second law of thermodynamics, Concept of entropy.

**Chemical Equilibrium constant and free energy** – Thermodynamic derivation of law of mass action. Le-Chatelier principle. Reaction isotherm and reaction isochore – Clapeyron equation and Clausius – Clapeyron equation, applications and Electrochemistry.

### (C) APPLIED MATHEMATICS & STATISTICS

#### 1. Mathematics

##### Indefinite Integrals

**Indefinite integral and its properties**, fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions, integration by substitution and by parts, integration of rational functions, integration involving partial fractions.

##### Partial Differentiation and Elementary Partial Differential Equations

Function of several variables, partial differential and related results, homogeneous function, Euler's theorem, elementary partial differential equation.

##### Numerical Analysis

General iteration method, Newton – Raphson method, application of Newton-Raphson method, solution of system of linear equations by Gauss elimination method and Gauss Siedel method.

#### 2. Statistics

##### Measures of Central Tendency and Dispersion

Arithmetic Mean, Median, Mode, Geometric mean, harmonic mean, mean of combined series, quantiles, range, quartile deviation.

## **Correlation and Regression Analysis**

Bivariate data, scatter diagram, simple, partial & multiple (3 variables only) correlation, rank correlation, repeated (tied) ranks.

## **Probability Theory**

Deterministic and non-deterministic models, sample space, events and trials, definitions of probability – mathematical, statistical and axiomatic, laws of addition and multiplication, independence of events, conditional probability, Bay's theorem and its application.