POLYMER ENGINEERING
(Professional Elective-1)

Course Code : 15CH1115

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Course Outcomes:

On successful completion of the course, the student should be able to

CO 1 Classify the polymers and also able to identify the structural configurations of any polymer.

CO 2 Distinguish the modification of a polymer and also in a position to examine the mechanism of a polymerization and their effect on engineering design of reactors.

CO 3 Describe the experimental methods for measuring molecular weight distributions of a polymer.

CO 4 Synthesize any elastomer and optimize their deformation properties on applying force.

CO 5 Explain the processing of polymer, identify the mode of deformation of a polymer and test the mechanical strength of a polymer.

UNIT-I **(10 Lectures)**

INTRODUCTION :

Defining Polymers, Classification of Polymers and Some Fundamental Concepts, Chemical Classification of Polymers Based on Polymerization Mechanisms, Molecular-weight Distributions, Configurations and Crystallinity of Polymeric Materials, Conformation of Polymer Molecules, Polymeric Supports in Organic Synthesis.

UNIT-II (10 Lectures)

EFFECT OF CHEMICAL STRUCTURE ON POLYMER PROPERTIES:

Introduction, Effect of Temperature on Polymers, Additives for Plastics, Rubbers, Cellulose Plastics, Copolymers and blends, Cross-linking Reactions, Ion-Exchange Resins.

STEP-GROWTH POLYMERIZATION:

Introduction, Esterification of Homologous Series and the Equal Reactivity Hypothesis.

CHAIN-GROWTH POLYMERIZATION:

Introduction, Radical Polymerization, Ionic Polymerization, Anionic Polymerization.

UNIT-III (10 Lectures)

MEASUREMENT OF MOLECULAR WEIGHT AND ITS DISTRIBUTION:

Introduction, End-Group Analysis, Colligative Properties, Light Scattering, Ultracentrifugation, Intrinsic Viscosity, Gel Permeation Chromatography.

UNIT-IV (10 Lectures)

THEORY OF RUBBER ELASTICITY:

Introduction, Elastic Force Between Chain Ends, Stress-Strain Behavior, The Stress Tensor (Matrix), Measures of Finite Strain, The Stress Constitutive Equation, Vulcanization of Rubber and Swelling Equilibrium.

UNIT-V (10 Lectures)

MECHANICAL PROPERTIES:

Introduction, Stress-Strain Behavior, The Glass Transition Temperature, Dynamic Mechanical Experiments, Time-Temperature Superposition, Polymer Fracture, Crazing and Shear Yielding, Fatigue Failure, Improving Mechanical Properties.

POLYMER PROCESSING:

Introduction, Extrusion, Injection Molding and Fiber Spinning.

TEXT BOOK:

1. Anil Kumar. Gupta, R.K. *"Fundamentals of Polymer Engineering"*, 2nd Ed, Marcel Dekker, 2003.

REFERENCE:

1. Zehev Tadmor, Costas G. Gogos *"Principles of Polymer Processing"*, 2nd Ed, John Wiley & sons, 2006.