GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: III

Chemical Engineering (CAPD)

Subject Name: **Polymer Structure and Properties Prediction (Major Elective –IV)**

Sr. No	Course content
1.	**The Nature of Polymers:** Polymers, Polymer Additives.
2.	**Morphology and structuring of Polymers:** Definition of Structuring, Polymer Single Crystal Morphology, Polymer Melt Crystallized Morphology, Effects of Crystallization Temperature, Effects of Crystallization Pressure, Strain and Flow- Induced Crystallization, Effects of Cold Drawing, Amorphous Polymers, Experimental Determination of Polymer Molecular Orientation.
3.	**Surface Properties:** Surface Tension, Adhesion, Tribology, Triboelectricity.
4.	The Relationship between Structure, Properties and Application.
5.	**Submolecular Structure:** Chemical Composition of the Polymer Molecule, Monomeric Ingredients in the Final Polymer Composition.
6.	**Molecular Structure:** Processibility, Mechanical Properties, Thermal Properties, Electrical Properties, Optical Properties, Chemical Properties, Balance of Properties
7.	**Molecular Flexibility:** Molecular Structure, Molecular Flexibility, Properties, Applications.
8.	**Effect of Polymer Structure on Properties:** Molecular Weight, Strength, Deformation, Physical state of Polymers, Elastic property, Chemical resistance, Solubility, Intermolecular forces in monomers and polymers, Plastics-Elstomers & Fibers, Mechanical behaviour of Polymers.
9.	**Different Unit Structure of Polymers:** Introduction, The causes of different unit structure of polymers, Amomalous groups, typical reactions of polymer chemical modification, the effect of unit structure on the properties of polymers.

10.	**Polymer Structure and Physical Properties:** The Crystalline Melting Point, The glass Transition, Properties Involving Large Deformation, Properties Involving small Deformation, Property Requirements and Polymer Utilization.
11.	**Chemical Structure and Polymer morphology:** Introduction, Molecular weight & intermolecular forces, The amorphous state-rheology, Glass Transition Temperature, Stereochemistry, Crystallinity, Chemical Crosslinking, Physical Crosslinking, Polymer blends.
12.	**Morphology and Order in Crystalline Polymers:** Configuration of Polymer Chains, Crystal Structures of Polymers, Morphology of Crystalline Polymers, Crystallization and Melting, Stain-Induced Morphology.
13.	**Chemical Structure and Polymer Properties:** Introduction, Fabrication methods, Mechanical Properties, Thermal Stability, Flammability and Flame Resistance, Chemical Resistance, Degradability Electrical Conductivity, Nonlinear Optical Properties, Additives.
14.	**Rheology and the Mechanical Properties of Polymers:** Viscous Flow, Kinetic Theory of Rubber Elasticity, Viscoelasticity, The Glassy State and the Glass Transition, The Mechanical Properties of Crystalline Polymers.

Reference Books:

1. Polymer Structure, Properties and Applications, by R.D. Deanin.
2. Principles of Polymer Processing by Zethew Tadmor and Costas G. Gogos.
3. Polymer Chemistry An Introduction by Malcolm P. Stevens.
4. Textbook of Polymer Science by Fred W. Billmeyer.