

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Name of the Course: **Polymer Technology (900229)**

Proposed By: Dr. Anjula Gaur

Department: Applied Science

Credits: 03

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Course Objective: The objective of this course is to provide students with an integrated view of polymer science and engineering, including the chemical structure of various polymers, methods of measuring the molecular weight, polymerization kinetics and reactors, rheological behaviour, polymer processing technologies. The course also focus on processing of polymers as well as on the behaviour of different polymeric materials

Unit 1 Definitions, origin, nomenclature, classification and types of macromolecules;
Chain Polymerization, step Polymerization, Miscellaneous Polymerization reaction, Polymerization Techniques viz. bulk, solution, emulsion, suspension polymerization
Glass transition temperature. Factors influencing the glass transition temperature, glass transition temperature and molecular weight.

Unit 2 Molecular weight (MW) and its distribution, Number average, Weight average and Viscosity average MW; Molecular weight and degree of polymerization, the practical significance of polymer molecular weight, Size of polymer Molecule.
Colligative properties, osmotic pressure, light scattering, refractive index, viscosity, small angle X-ray scattering.

Unit 3 Kinetics of chain polymerization, Kinetics of cationic and anionic Polymerization, Kinetics of poly condensation.
Copolymerization: types of copolymers, copolymer compositions, Block and Graft copolymer synthesis, examples.

Unit 4 Polymer Rheology and Morphology; Polymer Rheology, Stress and strain, ideal elastic solid, idea and Newtonian fluid, non nutonian fluid, hysteresis, Creep and relaxation of plastics, Polymer morphology, development of crystallinity, crystallization of rubber on cooling, Mechanism of c rystallization, stress induce crystallization.

Unit 5 Polymer processing techniques; Plastic, Elastomer and fibers, compounding of polymer, Calendering, Die Casting, Rotational casting, Flim Casting, Compression Moulding, Injection Moulding, Blow moulding, Extrusion moulding, thermoforming, Foaming and Fiber spinning.

Course outcome – Upon successful completion of the course, the student will be able to

CO1 Acquire knowledge of different polymerization mechanisms and techniques.

CO2 Determine polymer molecular weights and molecular weight distributions and other properties of polymer.

CO 3 Illustrate an ability to explain and distinguish the kinetics of different ionic and Step growth and co-polymerization.

CO 4 Describe the Polymer Rheology, Morphology and crystalline.

CO 5 Evaluate the various process parameters employed during Processing of polymers.

Reference Books: -

1. NPTEL Polymer Chemistry Course, D. Dhara, IIT Kharagpur.
2. Polymer chemistry and Physics of Modern Materials, 2nd edn, J. M. G. Cowie, Stanley Thornes, UK, 1998.
3. Contemporary Polymer Chemistry, 3rd edn. H. R. Allcock, F. W. Lampe and J. E. Mark, Pearson.
4. Polymer Science, V R Gowariker, N V Viswanathan, Jayadeep Sreedhar, New age international (P) limited.
5. Polymers: Chemistry and Physics of Modern Materials, J.M.G. Cowie, CRC Press.
6. Introduction to Physical Polymer Science, L. H. Sperling, Wiley.
7. Polymer Chemistry, 2nd edn, P. C. Hiemenz and T. P. Lodge, CRC Press 2007.
8. Polymer Science and technology of Plastics and Rubbers, Premamoy Ghosh, Tata McGraw-Hill Publishing Company Limited