

B. Tech (Metallurgical & Materials) Syllabus from Admission Batch 2018-19
5th Semester

5th Semester	RMM5D003	Introduction to Polymers	L-T-P 3-0-0	3 Credits
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Module I: **(8 Hours)**

Characteristics of Polymers

Introduction to polymers structures and polymer technical merits; structures; Physical behaviour: Crystallization, Melting, Glass Transition Phenomena and mixing behavior; Factors affecting Melting and Glass Transition Temperatures. Mechanical Behaviour: Stress–Strain Behaviour, Macroscopic Deformation, Viscoelastic Deformation – viscoelasticity; Viscoelastic Relaxation Modulus; Viscoelastic Creep, Fracture of Polymers, Impact Strength, Fatigue, Tear Strength and Hardness.

Module II: **(8 Hours)**

Deformation And Strengthening Of Polymers : Deformation of Semicrystalline Polymers- Mechanism of Elastic Deformation, Mechanism of Plastic Deformation. Factors That Influence the Mechanical Properties of Semicrystalline Polymers- Molecular Weight, Degree of Crystallinity, Predeformation by Drawing, Heat Treating. Deformation of Elastomers, Vulcanization; Chemical behaviour.

Module III: **(8 Hours)**

Synthesis and Processing of Polymers

Polymerization: Addition polymerization, Condensation Polymerization
Polymer Additives: Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants

Module IV: **(8Hours)**

Forming Techniques for Plastics: Moulding – Compression and Transfer Moulding; Injection Moulding, Reaction and Reinforced Reaction Injection Moulding, Thermoforming, Extrusion, Blow Moulding, Casting. Fabrication of Elastomers. Fabrication of Fibers and Films: Spinning, Calendaring.

Module V: **(8 Hours)**

Polymers in advanced engineering

Polymer Matrix Composites (PMCs); Types, Manufacturing, Processing methods, Interfaces, Properties, Applications, Toughening Mechanisms, Matrix –Reinforcement Interface, Wettability, Interactions at Interface, Interfacial Bonding Types, Interfacial Strength Tests, The role of the interface. Conductive Polymers, Liquid crystal polymers, Industrial Polymer adhesive, Polymer in biomedical applications, Ultrahigh Molecular Weight Polymers, high performance polymers.

Books:

- [1] Materials Science and Engineering - An Introduction by William D. Callister, Jr., John Wiley & Sons.
- [2] Plastics: Materials and Processing by Brent A Strong, Prentice Hall Inc., USA. 1997.
- [3] An Introduction to Polymer Chemistry by Raymond Seymour, McGraw-Hill Book Co., New York, USA, 1971.
- [4] Principles of Polymer Engineering by McCrum N.G., Buckley C P. and Bucknall C.B., Oxford University Press, UK, 1992.

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Digital Learning Resources:

Course Name:	Introduction to Polymer science
Course Link:	https://nptel.ac.in/courses/104/105/104105124/
Course Instructor:	Prof.DibakarDhara, IIT KGP

Course Name:	Introduction to Polymer Physics
Course Link:	https://nptel.ac.in/courses/103/107/103107139/
Course Instructor:	Prof. Prateek kumar Jha, IIT Roorkee
Course Name:	Introduction to Polymer Physics
Course Link:	https://nptel.ac.in/courses/103/103/103103139/
Course Instructor:	Dr. Amit Kumar, IIT Guwahati