

**A. Course Outcome:**

CO1	In depth knowledge on blending techniques, miscibility, compatibility, compatibilization techniques.
CO2	To familiarize the basic concepts on composite materials and manufacturing processes.
CO3	To develop an understanding of different types of blends based on their morphology.
CO4	To familiarize the characterization techniques of blends

**B. SYLLABUS****Introduction to polymer blends**

Definition and importance of blending, blending techniques, solution mixing, mechanical mixing, latex blending, mechano-chemical blending, compatibility of polymer in solution, determination of mutual solubility of polymers, miscibility through specific interactions. copolymer effect, phase diagrams of polymer- polymer systems, LCST and UCST behavior, binodal and spinodal curves, critical point, thermodynamic treatment of phase behavior of polymer mixtures.

Flory-Huggins theory, blend morphology- generation and control, capillary number, characterization techniques, commercial blends and their applications.

**Compatibilization of blends**

Compatibilization of immiscible blend: addition of graft or block copolymers, reactive compatibilization by low molecular weight additives, types of compatibilizers, in situ-formed, separately added copolymers, compatibilization theory

**Characterization techniques**

Methods for determining polymer-polymer miscibility, criteria for establishing miscibility, dielectric microscopic, mechanical, cloud point, rheological, dilatometric and viscosity methods, free volume measurement, volume of mixing, fluorescence spectroscopy, IR, FIR, NMR, mutual solvent method, heat of mixing, melting point depression, inverse gas chromatography

**Interpenetrating polymer networks**

Interpenetrating polymer networks (IPNs), Differences of IPNs, polymer blends and alloys, Types of IPNs, Semi IPNs and Pseudo IPNS, Preparation methods, Characterization of IPN, Applications of IPN

**Polymer composites**

Definition and classification, composite fabrication techniques- open mould processes such as hand layup, vacuum and bag molding, pressure bag molding centrifugal casting, pultrusion, closed mould processes such as matched de-molding, resin transfer molding and thermos forming

## Polymer Nanocomposites

Intercalated, exfoliated nanocomposites, Nanofillers, carbon nanotubes (CNTs), Reduced Graphene Oxide, Hummers method, Modified Hummers method, Nanofiller modifications, Characterization of Nanocomposites, SEM, TEM, XRD, FTIR, Applications of polymer Nanocomposites.

### C. Textbooks

- D.R. Paul, S. Newman, Polymer Blends Vol 1-2, Academic Press, 1978
- K.K. Chawla, Composite Materials, 2nd Edn., Springer, 1998.
- L A Utracki, Polymer Blends Handbook, Springer, 2003.

### Reference

- O. Olabisi, L.M. Robeson, M.T. Shaw, Polymer-Polymer Miscibility, Academic Press, 1979.

**Evaluation:** Based on assignments, research projects, presentations, and participation.

### Assignments/Activities:

- Developing a research proposal.
- Conducting a systematic review.
- Writing and peer-reviewing grant applications.

### Evaluation Pattern:

Category	Marks
Continuous Assessment	20
Mid-Term	30
End Semester	50
<b>Total</b>	<b>100</b>