GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3173619
Semester – VII
Subject Name: Polymer Blends and Composites

Type of course: Chemical Technology

Prerequisite: Student should know the basics of polymer and rubber materials, properties and their compounding processes.

Rationale: The main objective of this subject is to provide the knowledge about the different polymeric blends and composites materials.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Polymer Blends & Alloys: Historical outline of industrial development of polymer blends and alloys, Blends of Polymers & rubbers, definitions of terms used in polymer blends & alloys, Compounding of Polymer Blends, Fundamentals of polymer mixing, Blending methods and equipment, Type of blends: RTM DMC, SMC, and IPN. Commercial Polymer Blends.	08
2	Factors affecting miscibility of polymer blends- Thermodynamics, compatibility, solubility parameter, interaction parameter, composition, molecular weight, transition temperature, mechanism of blending, etc. Properties of miscible and immiscible blends.	08
3	Blends of engineering and commodity plastics: like PVC/ABS, PVC/SAN, PVC/NBR, PC/PET, PC/PBT, PC/ABS and PPO/HIPS	06
4	Polymer Toughening: Mechanism and theory of toughening, Toughening of thermoplastics and thermosets; Thermoplastic elastomers (TPEs). Characterization of polymer blends	08
5	Introduction to Composites: Definition, Raw Materials, Functions of constituent phases, Classification of composites, Advantages and limitations of polymer matrix composites over MMC and CMC, Applications.	10
6	Applications of Composites & Nanocomposites- Flame retardant textiles, Toughened plastics, Automotive bodies, Belts, Vacuum cleaners, Covers for mobile phones, Power tools.	05

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Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**05**	**05**	**05**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Composite Polymeric Material, R. P. Sheldon, Applied Science Publishers, 1982.
2. Composites: Design Guide, Industrial Press Inc, 1987.
3. Composite Material Handbook, M. M. Schwartz, McGraw-Hill Company, 1984.
4. Polymer Science and Technology: Plastics, Rubbers, Blends and Composites, P Ghosh, Mc Graw Hill, 2nd ed., 1990
5. L A Utracki. Polymer blends and alloys, Hanser Publication, 1989.
6. Paul and Newman. Polymer blends, Academic press, NewYork, 1978.
7. Lloyd M Robeson. Polymer blends– A comprehensive review, Hanser publishers, 2007.
8. John Mason and Leslie H Sperling. Polymer blends and composites, Plenum Press, New York, 1976.
9. S T Peters. Handbook of Composites, 2nd edition, Chapman and Hall, London, 1998.
10. Sanjay K Mazumdar. Composite manufacturing, materials, product and process engineering, CRC Press, London, 2002.
11. D V Rosato and D V Rosato. Reinforced Plastics Handbook, 3rd edition, Elsevier, UK, 2004.
12. K K Chawla. Composite Materials Science and Engineering, 2nd edition, Springer publications, New York, 1998.
13. T G. Gutowski. Advanced composite manufacturing, 1st edition, John Wily and Sons, New Jersey, 1997.
14. L C Hollaway. Handbook of Polymer Composites for Engineers, 1st edition, Woodhead Publishing, UK, 1994.
15. J C Bittence and F Cverna. Engineering Plastics and Composites, 2nd edition, ASM International, Materials Park, OH, 1990.

Course Outcomes:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	To recognize the fundamentals of polymer blends, alloys and blending equipments.	20
CO-2	To identify the various factors affecting polymer blends.	25
CO-3	To apply this knowledge for the blending of various engineering and commodity plastics.	25
CO-4	To analyze the toughening effect of blends.	10
CO-5	To be able to formulate various polymeric composites.	10
CO-6	To correlate between theoretical and practical concept by applying this knowledge in making various composites material.	10

List of Experiments:

1. Identification of Blends, Alloys and Composites.
2. Single screw extruder: Polymer/Rubber blends
3. Single screw extruder: Polymer composites
4. Single screw extruder: Polymer nanocomposites
5. Fabrication of PVC/ $CaCO_3$ nanocomposites
6. Fabrication of Rubber composites & nanocomposites

List of Open Source Software/learning website:

1) www.iri.net.in
2) www.ipiindia.org
3) Delnet
4) Literature available under R&D in Polymer & Rubber industry.
5) Polymer & Rubber journals
6) Polymer & Rubber dictionaries