GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3172316
Semester – VII
Subject Name: Plastic Additives, Compounding and Blends

Type of course: Professional Elective Course

Prerequisite:

Rationale:
Plastic additives and blends are used to alter or enhance various properties of plastic materials. At the end students are able to select the proper additives and blends according to application of plastics. They will be able to understand various compounding methods. They will be able to identify the proper characterization techniques used for blends.

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
	Additives	
1	**Introduction** – Technological Requirements – Classification – chemistry and Mechanism – Selection Criteria – General effect on Properties – Evaluation and functions of additives.	3
2	**Fillers – Reinforcements** – Thermal Stabilizers- Antioxidants (Heat & UV) – Plasticizers - Impact Modifiers – Lubricants - Processing aids – Blowing agents – Flame Retardants – Anti-static agents – Anti blocking agent- Slip and anti slip agent- processing aids- Mould releasing agents. Conductive additives- Toughening agents – Nucleating agents – Colorants – Additives for Recycling – aids – mould releasing agents, coupling agents, antislip, etc. Commercially available fillers and Additives	10
	Compounding	

3	**Selection of Polymers and Compounding ingredients** – General objectives – possibilities and limitations of mixing and compounding – Methods of incorporation of additives into polymer materials, Dispersive and distributive mixing, Mixing and Mixing Equipments. **Mixing equipment for Compounding & Blending of Plastics.** Principles – Operating characteristics – Machine construction – Specifications – Process control systems and working details of Batch mixers and continuous mixers – High speed mixer – Two roll mill – Banbury Mixer – Ribbon blender – Planetary mixers –Twin screw extruders [co rotating / counter rotating].	**8**
	Blends	
	Introduction: Definitions, need to alloy & blend polymers - reasons for blending - Difference between blends and composites - raw material selection criteria, historical outline of industrial development of polymer alloys and blends	**3**
	Alloys & blends. Methods of blending-how to select blend components, steps in blending, Polymer-polymer miscibility, Compatibilizers, Compatibilization, methods of Compatibilizations.	**6**
	Commercial polymer alloys and blends: Blends of engineering and commodity plastics like PVC/ABS, PVC/SAN, PVC/NBR, PC/PET, PC/PBT, PC/ABS; PPO/HIPS, Thermoplastic elastomers etc. study along with properties and applications.	**7**
	Characterization of Blends: characterization techniques like differential scanning Calorimetry (DSC), TGA, FTIR, Scanning electron micrographs (SEM) , TEM etc.	**5**

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
20	**25**	**10**	**5**	**5**	**5**

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Plastics Materials: J. A. Brydson
2.The Additives for Plastics Handbook : John Murphy
3.Mixing and compounding of polymers Theory and Practice: Manas-Zloczower, Ica
4. Polymer Alloys and Blends: L.A.Uttracki
5. Polymer Blends and Alloys by M.J Folkes
6.Polymer Blends and Alloys by R.P Singh and C.K Das

Course Outcomes:
The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Sr. No.	CO statement	Marks % weight age
CO-1	Classify various additives used in Plastics.	10
CO-2	Explain the characteristics of various additives for Plastics.	25
CO-3	Explain working and construction of compounding equipment.	15
CO-4	Describe the importance, reasons and steps to prepare polymer blends and its miscibility.	15
CO-5	Identify properties and applications of commercially available alloys/blends.	20
CO-6	Explain the characterization techniques for alloys/blends.	15

List of Experiments: - As per the syllabus topics

Major Equipment:

List of Open Source Software/learning website:

i. https://nptel.ac.in/

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