GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3152609
Semester – V

Subject Name: Thermoplastic Elastomers and Polymer Blends

Type of course: Professional Elective Course
Prerequisite:
Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				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 : Introduction of Thermoplastic elastomers, Synthesis, Morphology of Thermoplastic Elastomers, Properties & Effect of Structure, Thermodynamics of Phase Separation, Rheology & Processing of Thermoplastic Elastomers, Technological Application.	06
2	Thermoplastic Styrene Block Copolymers: History, Structure and Composition, Synthesis and Manufacturing, Availability of Polymer, Properties, Compounding, Mixing & Processing, Applications.	06
3	Polyester Thermoplastic Elastomers: Introduction, Basic Structure, Synthesis, Manufacturing and chemistry, Commercial Elastomer grades, Engineering Properties, Special Polyester Thermoplastic Elastomers (Hytrel), Processing, Applications.	06
4	Thermoplastic Polyolefin Rubbers: Introduction, Properties, Processing , Application Vistaflex thermoplastics: Properties, Fabrication, Environmental resistance, application.	06
5	Emerging Thermoplastic Elastomers: Ethylene Vinyl Acetate Copolymer (EVA), Ethylene-ethyl Acrylate Copolymer(EEA) : Manufacturing, Properties, Processing, Compounding, Applications.	06
6	Thermoplastic Polyurethane Elastomers (TPU): Introduction, types of Polyurethane, Preparation & Chemistry, Reaction components & structure effects, Polymerization processes, characteristics of TPU , polymerization processes,chain structure organization and behavior, Molecular weight effects, chemical cross linking effects, Environmental Stability and Stabilization, Compounding of TPU, Preparation & Structure, Properties, Processing, Applications, Commercial Polymers & their properties.	08

7	Thermoplastic Natural Rubber Blends: Elastomer-Thermoplastic Blends as Thermoplastic Elastomers: Rubber & Plastics used in Blends: Introduction, Preparation of Rubber-Plastic Blends, Phase Morphology, Properties of Unvulcanised Rubber-Plastic Blends, 6 Properties of Blends prepared by Dynamic Vulcanisation, Technological Applications, Poly (Vinyl Chloride) Blends, Nitrile Elastomers with PVC: Research & Development, Structure-Property Relationships, Polyesters with PVC, Ethylene Copolymers with PVC, Other Polymeric Plasticizers with PVC, Thermoplastic Polyolefin Rubbers (TPO) : Formulation & Structure, General Properties, Applications, Butyl Rubber with Polyethylene & Polypropylene, Ethylene/Propylene Copolymers & Terpolymers with Polyethylene & Polypropylene Other Blends: Ethylene-Acrylate Copolymers with Polyethylene, Poly (Dimethylsiloxane) with Polyethylene. Polyester amides & Polyether ester amides: Thermoplastic Polyamide Elastomers : Introduction, Segmented Block Copolymers, Structure & Morphology Polyester amides & Polyether ester amides Thermoplastic Elastomers : Synthesis & Morphology, Physical Properties of PEA & PEEA, Tensile Properties, High Temperature Tensile Properties, Dry Heat Aging, Humid Aging, Chemical & Solvent Resistance, Tear Strength, Abrasion Resistance, Compression Set, Flex Properties, Adhesion, Weatherability, Electrical Properties, Processing Characteristics, Potential Applications.	**06**
8	Additional Types of Thermoplastic Elastomers : Thermoplastic 1,2-Polybutadiene, Trans-1-4-Polyisoprene, Polysiloxane based Thermoplastic Elastomers	**05**
9	Crosslinked Polyethylene: Introduction, Basic Structure, Compounding & Mixing of Polyethylene, Processing, Physical Properties of Crosslinked Polyethylene, Applications of Crosslinked Polyethylene	**05**

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**
12	12	16	10	10	10

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:

- Handbook of Elastomers: New Development & Technology, Edited by Anil K. Bhowmick, Howard L. Stephens
- Thermoplastic Elastomers: A Comprehensive Review, Edited by N. R. Legge, G.Holden, H. E. Sehroeder
- Rubber Materials & Their Compounds, by J. A. Brydson
- Handbook of Thermoplastic Elastomer, Edited by Benjamin M. Walker
- Science & Technology of Rubber, Edited by James E. Mark, Burak Erman, Frenrick R. Eirich
- Handbook of Rubber Technology, Volume-3: Recycling & Pollution Control in Rubber Industries, Edited by J. M. Martin, W. K. Smith

Course Outcomes:

After learning this course students will be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain the importance of thermoplastic elastomers in rubber field.	15
CO-2	Evaluate the rheology & processing of thermoplastics Elastomers.	15
CO-3	Identify the Properties of Unvulcanised Rubber-Plastic Blends	10
CO-4	Classify the analytical methods for blend characterisation.	15
CO-5	Differentiate between Polyester amides & polyether ester amides thermoplastic Elastomers.	15

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Major Equipment:

Melt Flow Index Tester, U-Tube Viscometer, Cup & Bob Viscometer etc.

List of Open Source Software/learning website:

- http://onlinelibrary.wiley.com/
- http://www.sciencedirect.com/
- https://www.crcpress.com/