GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3152612
Semester – V
Subject Name: Reclaimed Rubber & its Technology

Type of course: Open 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)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Difference between Recycle rubber and Reclaim rubber, Tire Reuse and recovery in developing countries, Application of Reclaim rubber	02
2	Devulcanisation Techniques: Introduction, Structure of Sulfur Vulcanised Rubber and the Properties of Sulfur Crosslink's, Thermal Devulcanisation Processes, Mechanical Devulcanisation Processes, Mechanical Devulcanisation in the Presence of Chemical Agents, Ultrasonic Devulcanisation, Microwave Devulcanisation, Microbiological Devulcanisation, Miscellaneous Devulcanisation Processes	04
3	Types and Manufacturing process of Reclaimed Rubber: Whole tire reclaim (WTR), Minimum Staining Reclaim, Drab and Coloured Reclaims, Butyl Reclaim, Production of Whole Tire Reclaim, Digester Process (Neutral or Alkali), Thermal Process, Reclaimator Process, Pan Process	06
4	Characterisation of Devulcanised Rubber: Chemical Analysis Tests, Quality of Devulcanised Rubber, Determine Processing Properties of Devulcanised Rubber, Physical Properties of Vulcanisates Containing Devulcanised Rubber	06
5	Blends of whole tire reclaim with natural and synthetic rubber: • Natural rubber / Whole tire reclaim blends Preparation of blends, Cure Characteristics, Mechanical Properties, Ageing Resistance • Butadiene rubber / Whole tire reclaim blends Preparation of blends, Cure Characteristics, Mechanical Properties, Ageing Resistance • Styrene butadiene rubber / Whole tyre reclaim blends Preparation of blends, Cure Characteristics, Mechanical Properties, Ageing Resistance • Acrylo nitrile butadiene rubber / Whole tire reclaim blends Preparation of blends, Cure Characteristics, Mechanical Properties, Ageing Resistance	06
6	Effect of grafting Maleic anhydride on to whole tire reclaim: Grafting of Maleic anhydride on reclaimed rubber, NBR/ MA-g- WTR blends, CR/ MA-g-	06

	WTR blends, SBR/MA-g- WTR blends,	
7	Effect of coupling agent on whole tire reclaim blends: Effect of silane coupling agent on NBR/WTR blends, Effect of silane coupling agent on CR/WTR blends, Effect of silane coupling agent on SBR/WTR blend	**06**

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:

- Recycling and Re-use of Waste Rubber by Martin Forrest
- Rubber Recycling Challenges and Developments by Edited by Jin Kuk Kim , Prosenjit Saha, Sabu Thomas, Józef T. Haponiuk, M. K. Aswathi
- Studies on tue Utilisation of Rubber Reclaim in Elastomers by P.A.NELSON
- Rubber Products Manufacturing Technology By: Anil K. Bhowmick.

After learning this course students will be able to:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Differentiate between Recycle Rubber and Reclaimed Rubber	15
CO-2	Select the proper Devulcanisation technique according to application	15
CO-3	Explain the different types of reclaimed Rubber and its manufacturing process	15
CO-4	Analyze the effects of Devulcanised rubber on reclaimed rubber	15
CO-5	Solve the problems related to compounding, mixing and environment	10

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Major Equipment:

Pilling Tester, Specific gravity balance, Weighing balance, Adhesion Tester, Tensile Testing Machine, Abrasion tester etc.

List of Open Source Software/learning website:

- http://www.seas.columbia.edu/earth/RRC/documents/recycling_rubber.pdf
- https://dyuthi.cusat.ac.in/xmlui/bitstream/handle/purl/2191/Dyuthi-T0543.pdf?sequence=1