GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Rubber Technology (26)
SUBJECT NAME: Rubber Recycling & Waste Management
SUBJECT CODE: 2172606
B.E. Semester-VII

Type of course: (B. E. Rubber Technology)

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)	
					PA	ALA	ESE	OEP		
3	0	3	6	70	20	10	20	10	20	150

Content:

Sr.No	Course Content	Total Hrs	% Weightage
1.	**Processing of Industrial Wastes:** **Types and specification of the Wastes:** Wastes from tyre Manufacture, Wastes from tyre- rebuilding industry, Wastes from reclaim production, Wastes from the rubber-mechanical goods industry and rubber footwear production. **Waste re-use in main production practice:** Rubber mix and cord wastes, Vulcanized wastes. **The manufacture of other materials and articles from wastes:** Production of corrugated asbestos boards, roofings, and tie plates, Production of Rezdor slab and floor slabs for stock farms, Other trends and directions in the use of production wastes.	**8**	**15**
2.	**Production of reclaim from scrap tyres and its employment in rubber compounds:** **Production of reclaim:** The physical and chemical principles of the rubber reclaiming process, Raw materials and compounding ingredients in obtaining reclaimed rubbers, Grinding of Scrap tyres and inner tubes, Methods of 'devulcanizing'(reclaiming) cured rubbers, Mechanical treatment of devulcanizates, The properties of commodity reclaim, The effect of structure of a reclaim on the properties of reclaimed rubber and vulcanizates. **Applications of reclaim:** The effect of reclaim on the properties of rubber compounds and their vulcanizates, Fields of reclaimed rubber use,	**8**	**15**

	Technical and economic effectiveness of employing reclaim in rubber compounds, Current situation and future prospects for reclaim manufacture and consumption.		
3.	**Fine-dispersed materials from scrap tyres:** The properties of compositions and rubbers based on polymer blends. **The properties of cured rubbers incorporating ground vulcanizate:** Influences due to the loading and particle size of the ground vulcanizate, The effect of the degree of cross-linking in polymeric phases, The effect of raw rubber types involved in polymeric phases, The effect of diffusion processes, The effect accelerator type, The effect of premodifying a ground vulcanizate, Various technological procedures using ground vulcanizates. **Preparation of finely- dispersed cured rubbers:** Cryogenic grinding of cured rubbers, Grinding of cured rubbers at temperatures above freezing point. **Preparation, Properties, and use of aqueous dispersions of cured rubber.**	**8**	**15**
4.	**USE of ground rubbers in road construction and in the manufacture of building and industrial materials:** Road construction: Preparation of binder, Manufacture of asphaltic concretes, Other ways of using crushed vulcanizates in road construction. **Production of building and industrial materials.**	**8**	**15**
5.	**Processing of rubbers by pyrolysis :** Pyrolytic process engineering**,** Use of pyrolysis products**.**	**8**	**15**
6.	**Other trends in the utilization of scrap tyres.**	**7**	**10**
7.	**Waste Disposal:** Introduction, RCRA, SARA, General Compliance Rules, Waste tyre Disposal, Physical waste reduction.	**7**	**15**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	**Understanding U Level**	**Application A Level**	**Analyze N Level**	**Evaluate E Level**
10	**15**	**15**	**15**	**15**

Reference Books:

- Recycling from the Rubber Products Industry, by Vladimir M. Makarov & Valerij F.Drozdovski
- Rubber Products Manufacturing Technology By: Anil K. Bhowmick.
- Rubber Technology & Manufacture by Blow & Hepburn.

Course Outcome:

After learning the course the students should be able to:

- Learn about the Processing of Industrial Wastes.
- Learn about Types and specification of the Wastes.
- Able to understand the Waste re-use in main production practice.
- Understand the Production of reclaim.
- Learn about the Fine-dispersed materials from scrap tires**.**
- Learn about the use of ground rubbers in road construction and in the manufacture of building and industrial materials.
- understand about the Processing of rubbers by pyrolysis.
- Know & study about Waste Disposal.

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Design based Problems (DP)/Open Ended Problem:

- Crum Rubber Asphalt Paver.
- Energy generation from Rubber Waste.
- Application of waste tyre for garden & decoration.

Major Equipments:

Mixing Mill, Calender Machine, Semi Hydraulic Press, Muffle Furnace, Oven, Hardness Tester etc.

List of Open Source Software/learning website:

- http://www.sciencedirect.com/
- http://www.caplinq.com/
- http://www.azom.com/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along

with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.