

GUJARAT TECHNOLOGICAL UNIVERSITY

RUBBER TECHNOLOGY (26)

SYNTHETIC RUBBERS

SUBJECT CODE: 2162602

B.E. 6th SEMESTER

Type of course: B. E. Rubber Technology

Prerequisite: NA

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		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.	(A) General Purpose Synthetic Rubber Styrene-Butadiene Rubber (SBR) : Introduction, Preparation, Structure and Variations of Emulsion SBRs, Structure and Variations of Solution SBRs, IISRP Numbering System, General Properties, Comparison of Solution and Emulsion SBRs, Compounding, Processing, Applications.	4	7
	Polybutadiene Rubber (PBR) : Manufacture, Structure and Properties of Polybutadienes, IISRP Numbering System, Classifications, Processing and Applications.	4	7
	Synthetic Polyisoprene (IR) Rubbers: Preparation of Synthetic Polyisoprene (IR) Rubbers, Properties, IISRP Numbering System, Processing, Applications	3	7
	Ethylene-Propylene Rubbers (EPM & EPDM): Introduction, Manufacture, Structure and Properties, Variables between Grades, General Vulcanizate Properties, Processing, and Compounding.	4	7
	Isobutene-Isoprene (Butyl) Rubbers : Introduction, Manufacture, Structure-Property Relationships, Grades, General Vulcanizate Properties, Processing, Compounding, Applications of Unmodified Butyl Rubbers, Halobutyl Rubbers, Vulcanization, Applications, Cross-linked Butyl Rubbers.	4	7
2	(B) Special Synthetic Rubbers:		
	Chloroprene Rubber (CR) : Introduction, Production of Polychloroprene, Structure of CR & Structural Variables, Classification ,Structure & Properties, Processing, Compounding (Curing Systems & other additives),Applications	4	7
	Acrylonitrile Butadiene (Nitrile) Rubbers:	4	7

	Introduction, Preparation, Structure & Properties General Vulcanizate Properties, Processing, Compounding (Blends with other polymers) Special Grades of Nitrile Rubber, Applications.		
	Silicones/Silicone Rubber : Introduction, Nomenclature of Organosilicone Compounds & Elastomers, Manufacture of Silicone Elastomers, Structure & Properties of Silicone Elastomer Polymers, General Properties, Compounding (Curing Systems, Fillers, Other additives), Processing, Liquid Silicone Rubbers, Room Temperature Vulcanizing Rubbers (RTV), Applications.	4	7
	Acrylic & Other Rubbers with Ester side chain : Introduction	2	5
	Acrylic Rubbers (ACM) : Chemistry, General Properties , Compounding & Processing & Vulcanization.	2	5
	Ethylene-Methyl Acrylate Rubbers (AEM) : Properties, Compounding, Processing ,Applications	2	6
3	Fluoro Rubbers : Introduction, Copolymers based on Vinylidene fluorides & Hexafluoro propylene (Grades, Compounding, Processing, Properties, Applications), Copolymers based on Vinylidene fluorides & Chlorotrifluoro ethylene (CFM), Perfluorinated Elastomers, Tetrafluoro ethylene, Propylene Copolymers, Polyphosphazene, Carboxy, Nitroso Rubbers.	4	6
4	Polysulphides, Polyethers & Halogenated Polyethylene :, Polysulphide Rubbers: Introduction, Manufacturing, Structure & Properties, Vulcanization & Compounding, Liquid Polysulphides, and Applications.	4	6
5	Epichlorhydrin Rubbers (CO, ECO, AECO): Manufacturing, Structure & Properties, General Properties, Processing, Compounding, Applications,	3	5
6	Propylene Oxide Rubbers (GPO): Structure & Properties, Processing, Compounding, Applications	2	5
7	Chlorinated & Chlorosulphonated Polyethylenes (CM & CSM): Structure & Properties of CSM Rubbers, Compounding & Vulcanization of CSM Rubbers, Applications of CSM Rubbers, Properties of CM Rubbers, Compounding & Vulcanization of CM Rubbers, Applications of CM Rubbers.	4	6

Suggested specification table with marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
14	14	14	14	14	0

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. Synthetic Rubbers, their Chemistry and Technology, by D. C. Blackley.
2. Handbook of Elastomers: New Development & Technology by Anil K. Bhowmick, Howard L. Stephenes
3. Rubber Technology, by Maurice Morton
4. Rubbery Materials & their Compounds, by J. A. Brydson

Course outcome:

After learning the content of the subject the students will be able to:

1. Understand the basic difference between natural & synthetic rubbers.
2. Know about different types of synthetic rubbers.
3. Learn about manufacturing process of different synthetic rubbers.
4. Study about chemistry of different types of synthetic rubbers.
5. Learn about Fluoro rubbers..
6. Learn about the sulphide rubbers with their chemistry and manufacturing process.
7. Understand the importance of Epichlorhydrin rubbers.
8. Learn about the Chlorinated & Chlorosulphonated Polyethylenes rubbers.
9. Able to develop various rubber products according their properties.

List of Experiments:

Tutorials/Presentation/Practicals based on above topics

Design based Problems (DP)/Open Ended Problem:

- Polymerization of Conjugated Dienes.
- Corrosion of Polymers & Elastomers .
- Elastomers & Resin Blends.

Major Equipments:

Hardness Tester, Compression Set Tester, Tensile Tester, Specific Gravity tester etc.

List of Open Source Software/learning website:

1. <http://chemwiki.ucdavis.edu/>
2. <http://pubs.acs.org/>
3. <https://www.crcpress.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.