GUJARAT TECHNOLOGICAL UNIVERSITY

RUBBER TECHNOLOGY (40)

NANO RUBBER COMPOSITES (NRC)

SUBJECT CODE: 2724004

SEMESTER: II

Type of course: (Major Elective-III) (M.E.Rubber Technology)

Prerequisite: NA

Rationale: NA

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)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr.No	Course Content	Total Hrs	% Weigh tage
1.	Introduction to Nanocomposites: Various Nano fillers, Rubber Nanocomposites, Future Outlook, Challenges and Opportunities.	6	10
2.	Manufacturing Techniques of Rubber Nanocomposites: Introduction, Melt Compounding, Solution Blending, Latex Compounding.	6	10
3.	Interface Modification and Characterization: Introduction, Rubber Nanocomposites Without Interface Modification, Interface Modification by Nonreactive Routes, Interface Modification by Reactive Routes, Characterization of Interface Modification.	6	15
4.	Natural Rubber Green Nanocomposites: Introduction, Preparation of Polysaccharide Nano crystals, Processing of Polysaccharide Nanocrystal-Reinforced Rubber Nanocomposites, Morphological Investigation, Swelling Behavior, Dynamic Mechanical Analysis, Tensile Tests, Successive Tensile Tests, Barrier Properties.	6	10
5.	Carbon Nanotube Reinforced Rubber Composites: Introduction, Functionalized Carbon Nanotubes, Elastomeric Nanocomposites.	6	10
6.	Rubber/Clay Nanocomposites-Preparation, Properties and Applications: Introduction, Clays and Their Organophilic Modification, Preparation of Rubber/Clay Nanocomposites, Properties of Rubber/Clay Nanocomposites, Applications.	6	15
7.	Nanofillers In Rubber–Rubber Blends : Introduction, Types of Nanofillers, Role of Nanofillers in Reinforcement, Methods to Enhance Polymer–Filler Interaction and Reinforcement, Role of Nanofiller as Compatibilizer, Structure Compatibility Concept of NR-Based Latex Blends, Solubility Parameter and Mixing of Latices, Preparation of Nanocomposites, Rubber Blend Nanocomposites Based on Skim NR Latex and Fresh NR Latex: Preparation, Characterization and Mechanical	6	10

	Properties, Advantages of Nanocomposites and Application of Rubber Nanocomposites.		
8	Aging and Degradation Behavior of Rubber Nanocomposites: Introduction, Types of Fillers Used in Rubber Nanocomposites, Aging of Rubber Nanocomposites, Degradation of Rubber Nanocomposites.	6	10
9	Application of Rubber Nanocomposites: Introduction, Rubber Nanocomposites in Tire Engineering Applications, Rubber Nanocomposite Membranes, Applications of Rubber Nanocomposites in Sporting Goods, Advanced Nanocomposites for Airspace Applications, Nanorubbers in Medicine and Healthcare.	6	10

Reference Books:

- Rubber Nanocomposites Preparation, Properties and Applications; edited by Sabu Thomas and Ranimol Stephen.

Course Outcome:

After learning the course the students should be able to:

- Learn about Various Nanofillers.
- Understand about the Rubber Nanocomposites Without Interface Modification.
- Know about the Natural Rubber Green Nanocomposites.
- Identify the Elastomeric Nanocomposites.
- Understand and identify the Properties of Rubber/Clay Nanocomposites.
- Justify the Role of Nanofillers in Reinforcement.
- Understand about the Degradation of Rubber Nanocomposites.
- Learn the Application of Rubber Nanocomposites.

Major Equipments:

Mixing Mill, Calender Machine, Extruder, Press.

List of Open Source Software/learning website:

- **http://www.crcpress.com**
- **pt.bme.hu/.../Chapter%20in%20**Rubber**%20**Nanocomposites**%20book.pdf**
- **The American Synthetic Rubber Research Program. Philadelphia: University of Pennsylvania Press.**

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website