



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3724004

Semester – II

Subject Name: Nano Rubber Composites

Type of course: Program Elective-IV (M.E.Rubber Technology)

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		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 to Nanocomposites: Various Nano fillers, Rubber Nanocomposites, Future Outlook, Challenges and Opportunities.	6
2	Manufacturing Techniques of Rubber Nanocomposites: Introduction, Melt Compounding, Solution Blending, Latex Compounding.	6
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
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
5	Carbon Nanotube Reinforced Rubber Composites: Introduction Functionalized Carbon Nanotubes, Elastomeric Nanocomposites.	6
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
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,	6



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	Characterization and Mechanical 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
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, Nano rubbers in Medicine and Healthcare.	6

Reference Books:

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

Course Outcome:

Sr. No.	CO Statement	Marks % weightage
CO-1	Learn about Various Nanofillers.	15
CO-2	Understand about the Rubber Nanocomposites Without Interface Modification.	15
CO-3	Learn about the Natural Rubber Green Nanocomposites	15
CO-4	Identify the Elastomeric Nanocomposites and degradation of Rubber Nanocomposites	20
CO-5	Understand and identify the Properties of Rubber/Clay Nanocomposites and learn the Application of Rubber Nanocomposites	20
CO-6	Justify the Role of Nanofillers in Reinforcement.	15

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Major Equipment:

Mixing Mill, Calender Machine, Extruder, Press.

List of Open Source Software/learning website:

- <http://www.crcpress.com>
- pt.bme.hu/.../Chapter%20in%20Rubber%20Nanocomposites%20book.pdf

[The American Synthetic Rubber Research Program. Philadelphia: University of Pennsylvania Press.](#)