

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Rubber Technology (26)
SUBJECT NAME: Rubber Adhesion & Adhesion Science
SUBJECT CODE: 2172608
B.E. Semester-VII

Type of course: (B. 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) PA ALA		ESE (V) ESE OEP		PA (I)		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr.No	Course Content	Total Hrs	% Weightage
1.	Introduction to Adhesives: Different Terminology, Definition of Adhesion & Adhesive Joint, advantage of Adhesive Bonding, Adhesive Action, Development of Adhesive Strength, Physical & Chemical factors influencing Adhesive Action, Types of Adhesives, Applications & Setting etc.	4	05
2.	The Role of Adhesives in the Economy : The Adhesives in the Economy, The Adhesive using Industries, Construction, Abrasives & Friction Materials etc.	2	05
3.	Thermodynamics of Adhesion : Contact angle, Work of Adhesion, Acid-Base considerations.	4	10
4.	Influence of Constitution on Adhesion: Adhesion between Dry Solids, Wettability & Contact angle, Mechanism of Adhesive action, guiding principles in making Adhesion joints.	4	05
5.	Inorganic Adhesives & Cements: Soluble Silicates, Organic Polymer Mixtures, Ceramic Cements, Plastics Cements, Hydraulic Cements, Miscellaneous Cements etc.	4	05
6.	Resins for Rubber Based Adhesives: Types of Rubber based Adhesives, Function of Resins in rubber based adhesives, Adhesive Test Methods etc.	2	05
7.	Natural Rubber & Reclaimed Rubber Adhesives: Introduction, Raw materials, Formulation of solution adhesives from natural rubber, Mastics, Asphaltic & Sealants, use of grafted copolymer Heveaplus MG etc.	2	05
8.	Butyl Rubber & Polyisobutylene Adhesives:	4	10

	Introduction, Basic properties, General compounding-Sealants, Adhesives & coatings, Application areas & Formulations.		
9.	Nitrile Rubber Adhesives: Introduction, Commercial processes & Applications, The commercial Nitrile rubbers employed as Adhesives, Nitrile Rubber Latex Adhesives etc.	4	10
10.	Styrene-Butadiene Rubber Adhesives: Introduction, General properties of SBR in Adhesives, Types of SBR available for adhesive use, Typical formulations & application of SBR solvent base Adhesives, Latex & Dispersions of SBR as Adhesives etc.	4	05
11.	Neoprene Adhesives: Introduction, Disadvantages, solvent- based adhesives, Manufacturing procedures & Equipments, Properties & Testing of Neoprene Adhesive, Methods of applications, End users , Neoprene latex adhesives etc.	4	05
12.	Thermoplastics Rubber (A-B-A Block Copolymers) in Adhesives: Introduction, Basic Concepts-Morphology & Compatibility, Physical properties of TPE- alone & in simple mixtures, Formulating Ingredients, Mixing & Applications, Formulating for specific application etc.	4	05
13.	Epoxy Resin Adhesives: Introduction, Characteristics, Compounding etc	4	05
14.	Cyanoacrylate Adhesives: Introduction, Preparation & Properties of Alkylz- cyanoacrylates, Formulation of Cyanoacrylate Adhesives, Theory of Adhesive action, applications, Properties of Cyanoacrylate Adhesive Bonds etc.	4	10
15.	Water Based & Solvent Based Adhesives: Introduction, Water based adhesives, Properties, Solvent based adhesives, Comparison between Water based Vs Solvent based Vs Hot melts, Adhesive requirements etc.	4	10

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:

- Handbook of Adhesives (second Edition) by IRVING SKEIST
- Rubber Technology Handbook, by Werner Hofmann; Hanser Publishers

- Rubber Engineering, by IRI.
- Rubber Technology & Manufacture by Blow & Hepburn.

Course Outcome:

After learning the course the students should be able to:

- Learn about the Thermodynamics of Adhesion.
- Learn about types of Adhesives, Applications & Setting.
- Able to understand the Physical & Chemical factors influencing Adhesive Action.
- Understand the Influence of Constitution on Adhesion.
- Learn about the types of Rubber based Adhesives.
- Learn about the Water Based & Solvent Based Adhesives.
- understand about the Adhesives in the Economy.
- Know & study about Printing Blankets.

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Design based Problems (DP)/Open Ended Problem:

- Tape adhesive types: Silicone vs. Acrylic vs. Rubber
- Categories of Adhesives.
- Applications of Adhesives in various field.
- Adhesive forces and the thermodynamic work of adhesion

Major Equipments:

Mixing Mill, Calender Machine, Semi Hydraulic Press, Adhesion Tester, Split Tester, Hardness Tester etc.

List of Open Source Software/learning website:

- <http://www.sciencedirect.com/>
- <http://www.capling.com/>
- <https://www.threebond.co.jp/>

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.