

# GUJARAT TECHNOLOGICAL UNIVERSITY

## RUBBER ENGINEERING (40) RUBBER BONDING & ITS TECHNOLOGY SUBJECT CODE: 2714008 SEMESTER: I

**Type of course:** Core-II (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)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2	2	5	70	30	20	10	10	10	150

**Content:**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction to Rubber bonding: Types of Bonding, Overview of Bonding Process, Development of Bonding.	7	10
2	Substrate Preparation Methods: Metal Preparation, Pre-treatments of Plastics and Rubbers, Bonding Rubbers to Plastic Substrates, Substrate Preparation for Bonding Using the Wet Blast Process.	8	15
3	Rubber to Metal Bonding: Bond System Characteristics, Adhesion, Effective Bond Formation, Post Vulcanisation Bonding, Factors Affecting Bond Integrity, Bond Failure Types, Bond Test Procedures.	8	15
4	Rubber to Metal and Other Substrate Bonding: Substrates and their Preparation, Bonding Agent Preparation, Bonding Agent Application and Use, Post Vulcanisation Bonding, Waterborne Bonding Systems, Bonding Agent Testing, Shelf Life Considerations.	8	15
5	Rubber to Rubber Bonding: Bonding of Unvulcanised Rubbers, Bonding of Vulcanised Rubbers to Unvulcanised Rubbers, Bonding of Vulcanised Rubbers.	8	15
6	Rubber to Metal Bonding Using Metallic Coagents : Introduction, Metallic Coagents, Adhesion to Metals, Adhesion to Fibres and Fabrics.	7	15
7	Failures in Rubber Bonding to Substrates: Incorrect Moulding Procedures, Incorrect Production Quality Testing Procedures, Corrosion in Service, Product Abuse, Factors Affecting Adhesion of Rubbers, Topography of Substrate, Surface Conditions of Adherend, Bonding - Interphase or Interface Considerations, Undesirable Adhesion Occuring Under Service Conditions.	8	15

**Reference Books:**

1. Handbook of Rubber Bonding edited by Bryan Crowther, Rapra Technology

**Course Outcome:**

After learning the course the students should be able to:

1. Understand about Overview of Bonding Process.
2. Learn the Development of Bonding Process.
3. Develop the Pre-treatments of Plastics and Rubbers & Metals used for bonding.
4. Identify the Factors Affecting Bond Integrity& Bond Failure.
5. Prepare the different bonding agents and their testing according to the requirement.
6. Develop the Metallic Coagents for adhesion of Rubber, Metal, Fabrics& Fibres.
7. Identify the bonding failures in rubber bonding to substrate under service conditions.

**List of Experiments:**

Tutorials/Presentation/Practicals based on above topics

**Open Ended Problems:**

1. Bonding of Urethane Rubber with Metal.
2. Bonding of EPDM Rubber with Metal.
3. Efficient use of Butyl Rubber in bonding application.
4. Application of Rubber to metal bonding in Space Industry.

**Major Equipments:**

Adhesion Tester, Pilling Tester, Spilt Tear Tester, Mixing Mill, Press

**List of Open Source Software/learning website:**

- <http://www.crcpress.com>
- <http://www.taylorandfrancis.com>
- The American Synthetic Rubber Research Program. Philadelphia: University of Pennsylvania Press.
- [www.lord.com/products-and-solutions/adhesives/product.xml/254/2](http://www.lord.com/products-and-solutions/adhesives/product.xml/254/2)