

Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - VI EXAMINATION - WINTER 2025

Subject Code: 3162608

Date: 21-11-2025

Subject Name: Reverse Engineering and Analysis of Rubber Products

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

	Marks
Q.1 (a) List out different analytical techniques used in reverse engineering of rubber and rubber related material.	03
(b) Categorize the different chemical methods used in reverse engineering of rubbery materials. Outline anyone.	04
(c) Summarize the standard process flow chart for the reverse engineering of rubber, highlighting its essential critical aspects.	07
Q.2 (a) What do you mean by Optical Microscopy (OM)? How it differs from Electron Microscopy (EM)?	03
(b) Compare Small Angle X-Ray Scattering (SAXS) with Wide Angle X-ray Scattering (WAXS).	04
(c) With schematic diagram, explain construction and working of Scanning Electron Microscopy (SEM).	07
OR	
(c) Explain in detail about the application of electron microscopy with respect to rubber and rubber related materials.	07
Q.3 (a) List out the properties measured by Thermomechanical Analysis (TMA) of rubber and rubber related materials.	03
(b) Distinguish the Heat Flux Differential Scanning Calorimetry and Power Compensated Differential Scanning Calorimetry with schematic diagram.	04
(c) Illustrate an idealized Dynamic Mechanical Analysis (DMA) scan showing types of transitions observed in rubber.	07
OR	
(a) List out the properties measured by Differential Thermal Analysis (DTA) of rubber and rubber related materials.	03
(b) Categorize the different regions observed in Thermogravimetric Analysis curve with suitable examples.	04
(c) Classify the Dynamic Mechanical Analyzer according to its working principle. Write on anyone.	07

- Q.4 (a)** With labeled diagram, brief out the term 'Rf value'. **03**
- (b)** Compare performance of bulk property detector and solute property detector with suitable examples **04**
- (c)** Outline the concept of 'Polymer 'Fractionation'. Mention the techniques available for it. Write on any one. **07**

OR

- (a)** What do you mean by column efficiency with respect to Gas Chromatography? List the factors affecting it. **03**
- (b)** Categorize the different columns used in 'Gas Chromatography'. Also elaborate them. **04**
- (c)** Outline the concept of 'Polymer Purification'. Mention the techniques available for it. Write on anyone. **07**
- Q.5 (a)** What do you mean by monochromator? Give it's practical significance. **03**
- (b)** Differentiate single beam spectrophotometer and double beam spectrophotometer. **04**
- (c)** Name the principle law followed to carry out the spectroscopic analysis of rubber and related material. Also describe it. **07**

OR

- (a)** Define the term 'Interferogram'. Also give it's practical significance. **03**
- (b)** Analyze the advantages of Fourier Transform Infrared Spectroscopy (FTIR) over Infrared Spectroscopy (IR). **04**
- (c)** Explain in detail about Nuclear Magnetic Resonance Spectroscopy (NMR). **07**
