

Enrollment No./Seat No.:

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

Subject Code: 3172114

Date: 26-11-2025

Subject Name: Failure Analysis

Time: 10:30 AM TO 01:00 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) Define failure analysis. Explain the importance of understanding failure modes in engineering materials.	03
(b) Describe the general procedural steps involved in conducting a failure investigation.	04
(c) Explain various tools and techniques used in metallurgical failure analysis with suitable examples.	07
Q.2 (a) Explain the role of micro structure in failure analysis.	03
(b) Draw a Ductile and Brittle mode of fracture with its Micro and Macro fracture characteristics.	04
(c) Discuss the mechanisms of fatigue and creep failures with neat schematics with typical examples from industrial components.	07
OR	
(c) Analyze wear failure mechanisms in Bearing and suggest preventive measures.	07
Q.3 (a) Define stress corrosion cracking and explain its significance in component failure.	03
(b) Why Austenitic Stainless Steel material cannot be used for chloride containing service application ?	04
(c) Explain various corrosion failure modes such as pitting and crevice corrosion. Suggest appropriate preventive methods.	07
OR	
(a) Define Galvanic Corrosion. Give practical example of a metallic assembly susceptible to Galvanic Corrosion.	03
(b) Enlist the set of properties required by a gear material. Enlist the materials used for manufacturing of automobile gears.	04
(c) Evaluate the combined effects of corrosion and stress on structural integrity of a metallic component.	07
Q.4 (a) List common faulty heat treatment operations conducted in Castings, Welding and Forgings that lead to material failure.	03
(b) What is the role of fatigue in corrosion failures? Give suitable example.	04

- (c) Describe the fatigue life curve and explain how it is used to predict the failure of materials. 07

OR

- (a) What is fretting corrosion ? explain with schematics and suitable example. 03
- (b) What is equi-cohesive temperature in Creep Phenomena? Draw with schematics. 04
- (c) Discuss the DBTT phenomena of BCC structure material. What is the mechanical test to evaluate DBTT behaviour at service temperature? 07

- Q.5** (a) State the difference between Endurance limit and Fatigue limit. 03
- (b) Failure case in a quenched and tempered steel component due to improper tempering temperature. 04
- (c) Define Wear. How it can be minimized. List the suitable techniques to minimize wear of excavator bucket teeth. 07

OR

- (a) Discuss the visual examination tools used for failure investigation work. 03
- (b) Discuss residual stress-related failures occurring in welded pressure vessel and propose corrective heat treatment. 04
- (c) Predict the type of failure in engineering components : 07
1. Austenitic Stainless Steel welds in offshore use
 2. Boiler tube
 3. Austenitic SS to Carbon steel welded joints
 4. Hydro turbine buckets
 5. Excavator bucket teeth
 6. Roller Bearing
 7. Shock absorber
