

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2023****Subject Code:3172114****Date:14-12-2023****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 and list the various stages involved in it.	03
	(b) Explain the importance of fractography in failure analysis.	04
	(c) Discuss the various types of mechanical failures encountered in engineering materials. Provide examples for each type of failure.	07
Q.2	(a) Explain the role of micro structure in failure analysis.	03
	(b) Explain the differences between brittle and ductile fracture. Provide examples of materials that exhibit each type of fracture.	04
	(c) A shaft made of stainless steel failed after two years of service. The failure occurred at the point where the shaft was attached to the motor. Describe the steps involved in analyzing the failure. What tests would you perform to determine the cause of failure?	07
	OR	
	(c) Describe the different stages involved in the creep failure process. Explain the factors that contribute to each stage.	07
Q.3	(a) Discuss fractographic characteristics of Brittle failure.	03
	(b) Discuss a Pitting corrosion phenomena? Which type of Stainless Steel is subjected to this type of corrosion?	04
	(c) What is Galvanic Series? How it can be helpful to decide materials for corrosion resistance application?	07
	OR	
Q.3	(a) A corrosion is observed at the interface of two flanges bolted of alloy steel material. What possible form of corrosion it should be? explain	03
	(b) If the welded joint of the stainless steel material has been sensitized then what kind of corrosion can be formed on grain boundaries? Why ?	04
	(c) Discuss the various factors that influence the occurrence of stress corrosion cracking. Provide examples of materials that are susceptible to stress corrosion cracking.	07
Q.4	(a) What is HIC Cracking phenomena in CS/LAS welded joints?	03
	(b) List out the factors that may lead to heat treatment failures.	04
	(c) Explain the significance of hardness testing in failure analysis. Describe the different methods used to measure hardness.	07
	OR	
Q.4	(a) What is the role of fatigue in corrosion failures?	03
	(b) Describe the fatigue life curve and explain how it is used to predict the failure of materials.	04

- (c) Discuss the DBTT phenomena of BCC structure material. What is the mechanical test to evaluate DBTT behavior at service temperature? **07**
- Q.5** (a) What is fretting corrosion? explain with example. **03**
- (b) What is equi-cohesive temperature in Creep Phenomena? **04**
- (c) Discuss the visual examination tools used for failure investigation work. **07**
- OR**
- Q.5** (a) What is fretting wear and how does it occur? **03**
- (b) Define Wear. Explain abrasion wear. How it can be minimized. **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
