

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3171925

Date: 08/06/2026

Subject Name: Advanced Machine Design

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.

- Q.1**
- (a) Explain three modes of fracture with neat sketches. 03
 - (b) Explain: (i) Surface fatigue damage (ii) Stress intensity factor (SIF). 04
 - (c) What is stress concentration? Explain terms theoretical stress concentration Factor and fatigue stress concentration factor. Establish a relation between them. 07
- Q.2**
- (a) Discuss limitations of LEFM. 03
 - (b) What is Mechanical Seal? State the required properties of material for mechanical seal. 04
 - (c) Compare in detail with examples adhesive and abrasive wear. 07
- OR
- Q.2**
- (c) Using the Griffith approach, justify that critical stress required to advance a crack for plane stress cases is a function of modulus E, surface energy γ , crack length a. 07
- Q.3**
- (a) Explain the Sherby-Dorn and Larson-Miller creep parameters. 03
 - (b) Explain the Creep curves and stress relaxation 04
 - (c) A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by : ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. Take Fatigue stress concentration factor as 1. Compare the design according to Goodman's formulae and Soderberg's formulae. 07
- OR
- Q.3**
- (a) Explain the types of creep. 03
 - (b) Explain the factors affecting the creep. 04
 - (c) The work cycle of a mechanical component subjected to completely reversed bending stresses consists of the following three elements: 07
 - (i) $\pm 350 \text{ N/mm}^2$ for 85% of time
 - (ii) $\pm 400 \text{ N/mm}^2$ for 12% of time
 - (iii) $\pm 500 \text{ N/mm}^2$ for 3% of timeThe material for the component is 50C4 ($S_{ut}=660 \text{ N/mm}^2$) and the corrected endurance limit of the component is 280 N/mm^2 . Determine the life of the component.
- Q.4**
- (a) Distinguish the difference between high-cycle fatigue and low-cycle fatigue. 03

- (b) What are the important theories of elastic failures & explain why it is required to consider? **04**
- (c) Explain (1) Miner's rule for cumulative damage in fatigue. (2) The strain based approach to determine fatigue life. **07**

OR

- Q.4** (a) What are the factors that may affect S-N curves. **03**
- (b) Discuss the Strain versus Life Curve for variable load. **04**
- (c) Derive relationship between crack tip opening displacement (CTOD) and stress intensity factor for Mode I (KI) for small scale yielding. **07**

- Q.5** (a) Explain SINES METHOD for assessment of fluctuating simple multiaxial stresses. **03**
- (b) Define: (i) Failure due to fatigue (ii) Failure due to creep **04**
- (c) What is Mechanical Housing? Discuss stresses and deformation induced in housing. **07**

OR

- Q.5** (a) What is simple Multi axial stresses and complex multi axial stresses? **03**
- (b) Write the three effects of creep on life of machine element. **04**
- (c) Explain the following **07**
1. Split Housing
 2. Non Contact Seals.
