

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III EXAMINATION – WINTER 2025

Subject Code:3132005

Date:19-12-2025

Subject Name: Engineering Mechanics

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.

- Q.1** (a) What do you mean by “Equilibrium Condition”? Write equilibrium condition for concurrent and Non concurrent 2D force system. **03**
- (b) How friction is important? Give a brief idea about all types of friction with its application and its sketch. **04**
- (c) Find a single resultant force for given Non concurrent force system with respect to point ‘O’ as shown in fig-1. **07**
- Q.2** (a) For given concurrent force system in fig-2, draw Free body diagram and find reaction at point ‘A’ and ‘B’. **03**
- (b) Calculate load “P” needed to drive the wedge in place as shown in fig-3. Assume angle of friction for all surfaces= 12.6° . **04**
- (c) Enlist the type of beams. Draw their neat sketch with all support reactions. Also write whether they are statically determinant or not? **07**
- OR**
- (c) Analyze the truss shown in fig-4. **07**
- Q.3** (a) Differentiate between “Centroid” and “Centre of gravity”. **03**
- (b) Find Centre of gravity for 2D object shown in Fig-5. **04**
- (c) Calculate all reactions and draw shear force and bending moment diagram for beam given in fig-6. **07**
- OR**
- Q.3** (a) Find reaction of beam given in fig-7 **03**
- (b) Define zero force members of truss and write its importance in design of truss. **04**
- (c) Calculate and draw shear force diagram and bending moment diagram. Also find zero shear point and maximum bending moment, for beam given in fig-7. **07**
- Q.4** (a) Draw shear stress distribution for ‘T’, ‘H’, ‘L’ and ‘+’ shape section. Give the reason for such distribution. **03**
- (b) Find the span of simply supported beam required to carry U.D.L of 60 kN/m over whole span. The beam size is 200 mm X 400 mm. Material is able to carry maximum 110 N/mm^2 stress. **04**
- (c) Calculate Moment of inertia with respect to X and Y axis passing from centroid of the object shown in fig. 8. **07**
- OR**
- Q.4** (a) Draw the stress-strain graph showing stages of behavioral changes in steel under increasing stress, with all limits. **03**
- (b) If bar is having modulus of elasticity ‘E’, length ‘l’, cross sectional area ‘A’ and weight per unit length ‘w’, derive the formula for deformation of a bar under its own weight. **04**

(c) Explain all the assumptions made to derive the theory of pure bending. 07

- Q.5 (a) The principal stresses at a point are 100 N/mm^2 and 40 N/mm^2 both being tensile. Find the Normal and tangential stress across a plane making 60° angle with the plane having the 100 N/mm^2 stress. 03
- (b) Determine the change in length of bar shown in fig-9. Take $E = 2 \times 10^5 \text{ N/mm}^2$. 04
- (c) Briefly explain all types of material. Differentiate between homogeneous and isotropic materials. 07

OR

- Q.5 (a) Solve the same example of Q.5 (a) by Mohr circle method. 03
- (b) The state of stress in two dimensionally stressed body at a point is as shown in fig-10. Determine the principal stresses and maximum shear stress. 04
- (c) Between two fix supports, a copper rod of 700 mm length is fixed with one support with gap of 0.5 mm with other support, and temperature is 24°C . (1) Determine thermal stress at 40°C . (2) find the temperature at which the gap will just close and (3) Find stress and strain in the rod when its temperature is 95°C . Take $E = 100 \text{ Gpa}$ and $\alpha = 16 \times 10^{-6} / ^\circ \text{C}$ 07

