

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023

Subject Code:3132005

Date:03-08-2023

Subject Name:Engineering Mechanics

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) Prove Lami's Theorem.	03
	(b) Define 1) static friction 2) kinetic friction 3) cone of friction 4) angle of repose.	04
	(c) Find a single resultant force for given Non concurrent force system with respect to point 'O' as shown in fig-1. 10 N force is applied at the center point. Also find the "Equilibrant".	07
Q.2	(a) Draw free body diagram for all three spheres shown in fig-2. Name all the forces and find angles between them.	03
	(b) As shown in fig-3, two objects need to set on the shelf having inclination of 33° . Calculate load 'P' and tension 'T' which is required to place the objects properly. Coefficient of friction between two objects is 0.4 and 0.485 between shelf and the second object.	04
	(c) Analyze the beam shown in fig-4 for shear force and bending moment at all salient points of the beam.	07
	OR	
	(c) Define determinacy and indeterminacy with the help of truss structure.	07
Q.3	(a) Give brief details about both the analysis methods for the truss.	03
	(b) Find reaction at A and B for beam given in fig-5	04
	(c) Find the balance point for the shape shown in fig-6.	07
	OR	
Q.3	(a) Explain moment of inertia.	03
	(b) Calculate moment of inertia with respect to X axis passing through the center of the section shown in fig-7.	04
	(c) Derive the relation between force, shear force and bending moment.	07
Q.4	(a) Explain shear stress distribution for rectangular section with help of formula.	03
	(b) For the same beam given in fig-5, draw shear force and bending moment diagram with value of maximum value of bending moment.	04
	(c) Find the depth of simply supported beam having UDL of 50 kN/m throughout its 8 m long span. Width of beam is 150 mm and maximum stress allowed by the material is 100 N/mm^2 .	07
	OR	
Q.4	(a) Explain pure bending.	03

- (b) A circular steel bar is 4 m long. It's diameter at one end is 100 mm and at other end it is 50 mm. The bar is under tensile force of 50 kN. Calculate the change in length for this tapered bar. 04
- (c) Explain all types of material with the graph of their behavior under axial stress. 07
- Q.5 (a) Define 1) Poisson's ratio, 2) bulk modulus, 3) modulus of rigidity. 03
- (b) A copper bar is 0.8 m long and it can expand by 0.48 mm under thermal expansion. Will any stress be generated if temperature is increased to 40°C from current temperature 24°C? $\alpha_c = 16 \times 10^{-6}/^\circ\text{C}$, $E = 100 \text{ GPa}$. 04
- (c) Write the steps to draw Mohr circle for stress condition with two normal stresses and one tangential stress. 07
- OR**
- Q.5 (a) Derive relation between Young's modulus, bulk modulus and modulus of rigidity. 03
- (b) Find total deformation of the bar shown in fig-8. $E = 200 \text{ GPa}$. 04
- (c) Find the principle stresses and angles of principal planes, if one tensile stress of 300 N/mm^2 , one compressive stress of 200 N/mm^2 and shear stress of 150 N/mm^2 is applied to the system. 07

