

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-III (NEW) EXAMINATION – WINTER 2024

Subject Code:3132005

Date:06-12-2024

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.

		MARKS
Q.1	(a) Explain Parallel axis theorem.	03
	(b) Explain all type of indeterminacies in truss with figure.	04
	(c) Find magnitude and direction of resultant of force system shown in fig. 1	07
Q.2	(a) Define equilibrium conditions for coplanar concurrent and non-concurrent force system.	03
	(b) What is Polygon law of forces? Explain graphical procedure to find resultant of the forces using polygon law of force.	04
	(c) Explain in detail different types of “loads” and “supports”.	07
	OR	
	(c) Derive the relation between force, shear force and bending moment.	07
Q.3	(a) State the laws of dry friction.	03
	(b) Define 1) static friction 2) kinetic friction 3) cone of friction 4) angle of repose.	04
	(c) Coefficient of Static Friction for both pairs of wedge = 0.3 Coefficient of Static Friction between block and horizontal surface = 0.6 Find the least P required to move the block. Refer fig. 2.	07
	OR	
Q.3	(a) Define point of zero shear and point of contra-flexure, also write its importance.	03
	(b) Derive the relation between angle of friction and coefficient of friction.	04
	(c) Determine the range of values which the mass m_0 may have so that the 100-kg block shown in the fig. 3 will neither start moving up the plane nor slip down the plane. The coefficient of static friction for the contact surfaces is 0.30.	07
Q.4	(a) Explain why and how thermal stresses are generated.	03
	(b) State Hook’s law. Draw stress strain curve for Mild Steel Specimen and explain.	04
	(c) A steel bar is 900 mm long; its two ends are 40 mm and 30 mm in diameter and the length of each rod is 200 mm. The middle portion of the bar is 15 mm in diameter and 500 mm long. If the bar is subjected to an axial tensile load of 15 kN, find its total extension. Take, $E = 200 \text{ GN/m}^2$.	07

OR

- Q.4** (a) Define the terms: 1) Ductility 2) Homogeneous material 3) Isotropic material. **03**
- (b) Derive relation between bulk modulus (K), Poisson's ratio (ν), and modulus of elasticity (E). **04**
- (c) A copper rod of 40 mm diameter is surrounded tightly by a cast iron (CI) tube of 80 mm external diameter, the ends being firmly fastened together. When put to a compressive load of 30 kN, what load will be shared by each? Take $E_{CI} = 175 \text{ GN/m}^2$ and $E_{\text{copper}} = 75 \text{ GN/m}^2$. **07**

- Q.5** (a) Explain Parallel axis theorem. **03**
- (b) Define principal planes and principal stresses. **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) Differentiate between "Centroid" and "Centre of gravity". **03**
- (b) Explain shear stress distribution for rectangular section with help of formula. **04**
- (c) A cantilever, 2.5 m long carries a UDL of 20 kN/m. The breadth of the section remains constant and is equal to 100mm. Determine the depth of the section at midspan of the cantilever and at fixed end if stress remains same throughout as 120 N/mm^2 . **07**

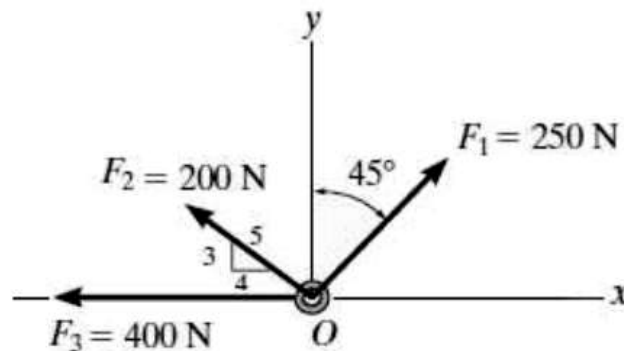


Fig. 1

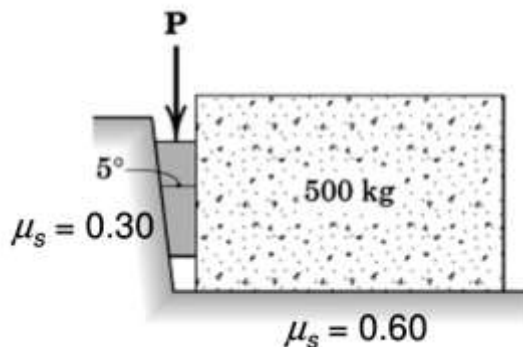


Fig. 2

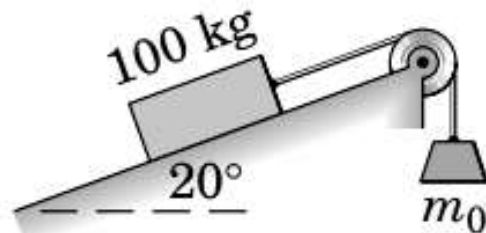


Fig. 3
