Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:2130003 Date:12-01-2024

Subject Name:Mechanics of Solids

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 principle of transmissibility and superposition	**03**
	(b)	State and explain parallelogram law of forces	**04**
	(c)	Find magnitude and direction of resultant of force system shown in Fig.1	**07**
Q.2	**(a)**	Differentiate moment and couple	**03**
	(b)	Find the moment of all the forces about point O given in fig. 2 Consider size of the square as 1 cm x 1 cm.	**04**
	(c)	Determine support reaction for the given beam shown in Fig.3	**07**
		OR	
	(c)	Two shafts A of 700 kN and B of 400 kN are supported as shown in fig. 4 Neglecting friction at the contact surfaces P, Q, R and S, determine the reactions at all contact surfaces.	**07**
Q.3	**(a)**	Explain (a) Homogeneous material (b) Yield strength (c) Prismatic section	**03**
	(b)	A circular brass rod of 2m length is subjected to axial pull of 15kN. What should be the diameter of the rod so that stress should not be more than 120 N/mm^2 and elongation should not be more than 6mm. Take E = 120 GPa.	**04**
	(c)	Draw shear force and bending moment diagram of the beam shown in Fig. finding values at all important points on the beam.	**07**
		OR	
Q.3	**(a)**	Illustrate stress Vs strain graph for a standard mild steel bar. Show all the salient points on the graph.	**03**
	(b)	In a standard tensile test, a bar of 20mm diameter undergoes elongation of 14mm in a gauge length of 150mmand a decrease in diameter of 0.85mm at a tensile load of 6 kN. Determine the Poisson's ratio.	**04**
	(c)	A rectangular block of 525mm x 230mm x 115mm is subjected to following load (i) on 230 x 115mm face 1550 kN tensile (ii) on 525 x 230 mm face 2575 kN tensile (iii) on 525 x 115mm face 2100 kN compressive. Find the strain on all directions. Take Poisson's ratio as 0.25 and E = 2 $x10^5$ N/mm^2.	**07**
Q.4	**(a)**	Differentiate centroid and center of gravity.	**03**
	(b)	Explain laws of friction	**04**

(c) Find moment of inertia of a given section in fig. 6 about its centroidal axis **07**

OR

Q.4 **(a)** Explain different types of supports with their reactions. **03**

(b) Locate the Centre of Gravity of composite 3d object shown in fig.7 (all dimensions are in mm) **04**

(c) Determine the horizontal force on block required to cause (i) impending motion downward and (ii) impending motion upward. Refer fig. Take $\mu = 0.55$. **07**

Q.5 **(a)** Write assumptions made in theory of pure torsion. **03**

(b) Draw shear stress distribution diagram for following sections (i) rectangle (ii) Hollow circular (iii) hollow rectangular (iv) L section. **04**

(c) A simply supported beam of 3m span is subjected to central load 'W' and having rectangular cross section 275mm x 425mm. If permissible shear stress is 3 N/mm^2 **07**
Calculate maximum permissible load on beam in bending and shear.

OR

Q.5 **(a)** Write the assumptions made in the theory of pure bending. **03**

(b) A shaft is required to transmit 1MW at 240 rpm. If the shear stress is not to exceed 55 N/mm^2 determine the required diameter of the shaft. **04**

(c) A material is stressed by shear 5 N/mm^2, axial compression 3 N/mm^2 in X-direction and axial tension 7 N/mm^2 in Y direction. Calculate **07**
(i.) Normal and tangential stress on plane making 60º with X-axis.
(ii) Maximum normal stress with their locations.

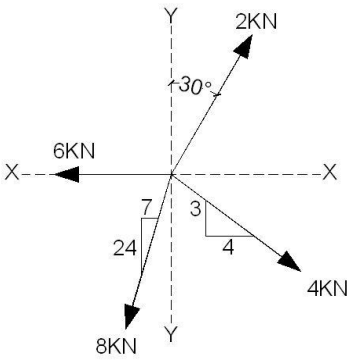

Fig. 1

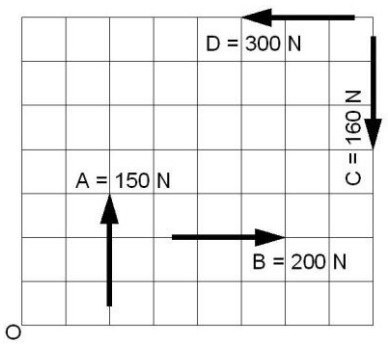

Fig. 2

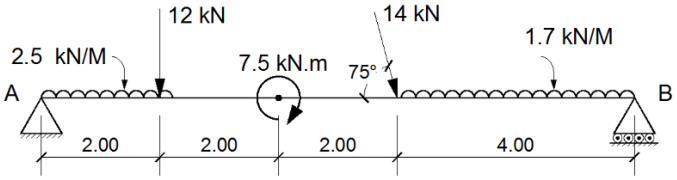

Fig. 3

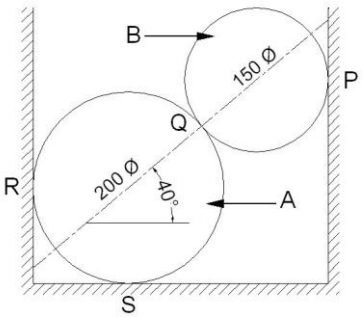

Fig. 4

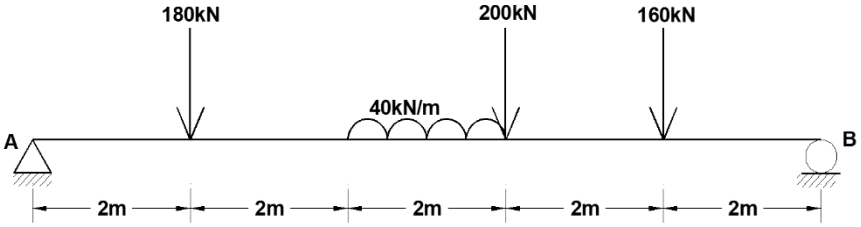

Fig. 5

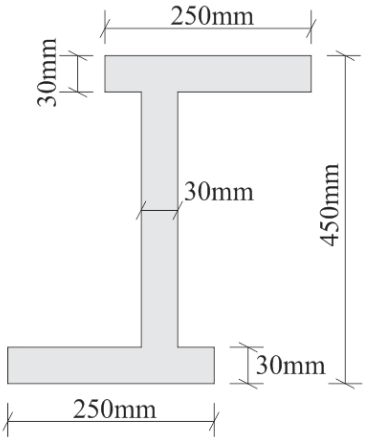

Fig. 6

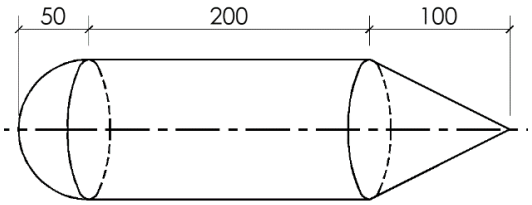

Fig. 7

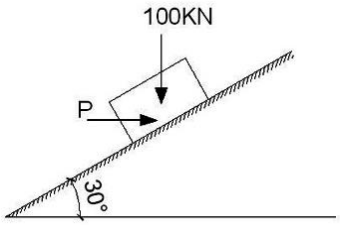

Fig. 8

****