Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – SUMMER 2025

Subject Code:3130608 Date:04-06-2025

Subject Name:Mechanics of Solids

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)**	Define : (i) Space (ii) Resultant (iii) Couple	**03**
	(b)	Determine resultant of coplanar concurrent force system shown in fig.1	**04**
	(c)	Find support reactions for the beam shown in fig.2	**07**
Q.2	**(a)**	Enlist Fundamental principles of mechanics. State principle of transmissibility.	**03**
	(b)	A cord supported at A and B carries a load of 10 kN at D and a load of W at C as shown in Fig.3. Find the value of W so that CD remains horizontal.	**04**
	(c)	Analyse the truss shown in fig. 4	**07**
		OR	
	(c)	For the system of force on a lamina OABC shown in figure 5, find magnitude and direction of the resultant force. Also locate the resultant by perpendicular distance from point "O".	**07**
Q.3	**(a)**	Determine resultant of coplanar concurrent force system shown in fig.1 using graphical method.	**03**
	(b)	Derive relation between uniformly distributed load, shear force and bending moment with usual notations.	**04**
	(c)	Draw shear force and bending moment diagrams for the beam shown in fig. 6	**07**
		OR	
Q.3	**(a)**	Define (i) Shear force (ii) Point of zero shear (iii) Point of contraflexure	**03**
	(b)	State assumption made in theory of pure bending.	**04**
	(c)	Find centroid of lamina shown in fig. 7	**07**
Q.4	**(a)**	State and explain Pappus Guldinus first theorem using appropriate example.	**03**
	(b)	A rectangular beam 300 mm deep is simply supported over a span of 4.0 m. What uniformly distributed load the beam may carry if the bending stress is not to exceed 120 MPa? Take $I = 8 \times 10^6$ mm^4	**04**
	(c)	Calculate stresses in each portion and the total change in length for steel bar ABCD as shown in figure 8. Take E = 200 GPa	**07**
		OR	
Q.4	**(a)**	Define : (i) Shear Stress (ii) Modulus of Rigidity (iii) Volumetric strain	**03**
	(b)	Determine moment of inertia about its horizontal centroidal axis for T section having flange and web dimensions 100mm x20 mm each.	**04**
	(c)	A short concrete column 300mm x 300mm in section is carrying axial load of 360 kN. The column is reinforced by four 12mm diameter steel bars each one at corner. Calculate stresses in concrete and steel.	**07**

Take Ec = 14GPa and Es = 210Gpa.

Q.5 **(a)** Sketch qualitative shear stress distribution diagrams for following sections **03**
(i) Circular (ii) I section and (iii) T section

(b) A steel tube of 2 m length is subjected to 50° C rise in temperature. Determine **04**
(i) free natural expansion and (ii) stress developed in the tube, if expansion is prevented. Take Es = 2.0 x 10^5 N/mm^2 and α = 12 x 10^{-6} per ° C.

(c) Define: (i) Poisson's ratio (ii) Bulk modulus (iii) Modulus of Elasticity. **07**
Derive relation between bulk modulus, Poisson's ratio and modulus of elasticity.

OR

Q.5 **(a)** Define (i) Torsional Rigidity (ii) Principal Plane (iii) Neutral axis **03**

(b) A solid steel shaft of 60 mm diameter is subjected to torque of 5 kNm. **04**
Determine maximum shear stress developed in the shaft. G= 80GPa

(c) For an element shown in fig.9. **07**
Determine (i) Principal stresses and location of corresponding principal planes.
(ii) Maximum shear stress and location of planes containing it

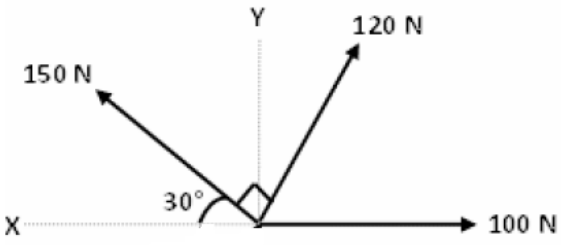

Fig. 1

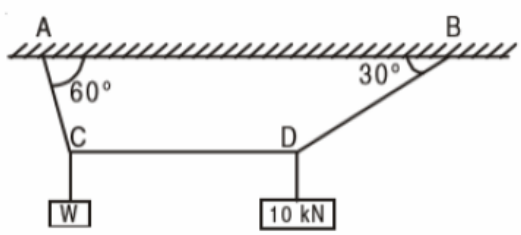

Fig. 3

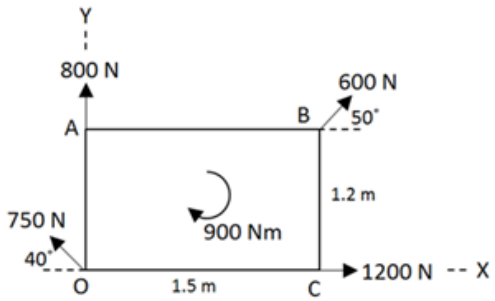

Fig. 5

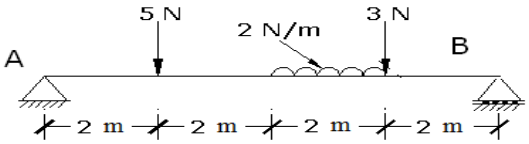

Fig. 2

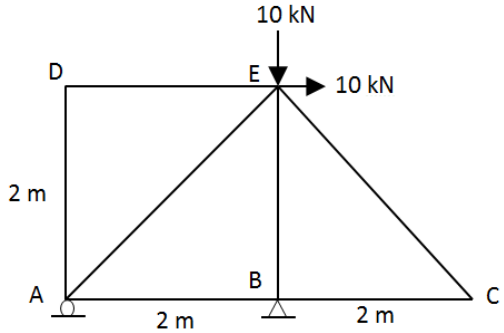

Fig. 4

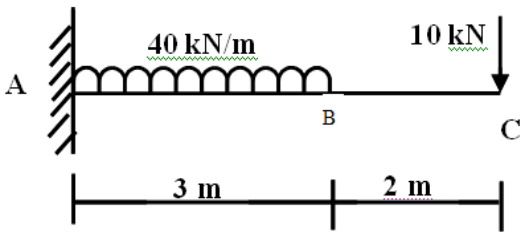

Fig.6

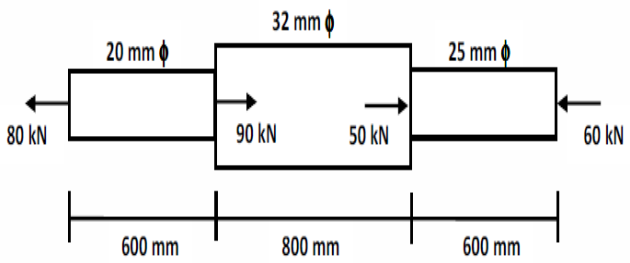

Fig. 8

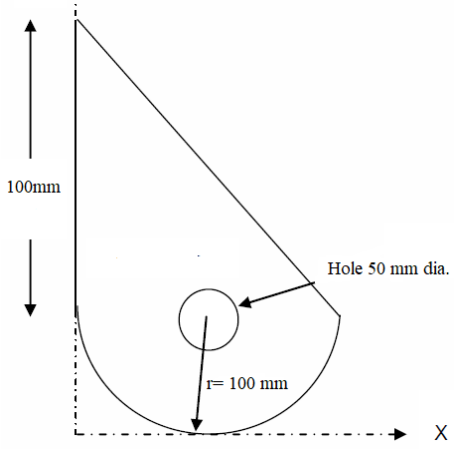

Fig. 7

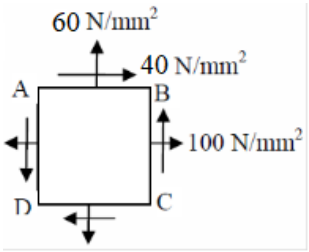

Fig. 9

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