Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III(NEW) EXAMINATION – WINTER 2022

Subject Code:2130003 Date:20-02-2023

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) rigid body, (ii) deformable body, (iii) Elastic body.	**3**
	(b)	Explain various types of load, beams and their support system.	**4**
	(c)	Determine magnitude and direction of resultant of force system shown in Fig-1	**7**
Q.2	**(a)**	State and explain Varignon's theorem.	**3**
	(b)	Find the reaction as shown in fig-2	**4**
	(c)	For the beam shown in fig-3 calculate and draw shear force and bending moment diagrams.	**7**
		OR	
	(c)	Find magnitude, direction and location of forces system with respect to 'O' shown in fig-4 (distance are in meter).	**7**
Q.3	**(a)**	Derive relation between young's modulus (E) and bulk modulus (K) with usual notation	**3**
	(b)	Using Pappus-Guldinus theorems, determine the lateral area (surface area) and volume of the right circular cone of base radius 'r' and altitude 'h'	**4**
	(c)	Determine centroid of lamina as shown in fig-5	**7**
		OR	
Q.3	**(a)**	Define: (i) Bending Moment (ii) Point of Contra-flexure	**3**
	(b)	Two forces act an angle of 120°. If the greater force is 50 kg and their resultant is perpendicular to the smaller force, find the value of smaller force	**4**
	(c)	Determine moment of inertia of I section as shown in fig-6 about centroidal axes, AB axis and CD axis.	**7**
Q.4	**(a)**	Define principal planes and principal stresses	**3**
	(b)	Explain Stress-Strain diagram for Ductile Material	**4**
	(c)	A rectangular copper bar 175mm wide,80mm thick and 400mm long is subjected to axial pull of 250kN. If modulus of elasticity is 110 $kN/mm^2$and Poisson's ratio 1/3, find the change in length, width and thickness. Also calculate the change in volume of the bar.	**7**
		OR	
Q.4	**(a)**	Write assumption made in the theory of pure bending	**3**
	(b)	Derive the relation $T/Ip = C\theta/L$ for circular shaft with usual notations	**4**
	(c)	A solid circular shaft of 78 mm diameter and 1.6 m long is made from material which can resist maximum shear stress of 55 N/mm^2. Find the maximum torque that the shaft can transmit. Calculate also the angle of twist.if modulus of rigidity is 60 GPa.	**7**

Q.5	**(a)**	Define: Angle of Friction and Coefficient of Friction?	**3**
	(b)	Explain Mohr's circle method?	**4**
	(c)	Determine maximum bending stress and draw bending stress distribution in a section as shown in Fig-7 if it is subjected to a bending moment of 20 kN.m.	**7**

OR

Q.5	**(a)**	Define: (1) Centroid, (2) Center of gravity, (3) Center of mass	**3**
	(b)	State and explain the Lami's theorem	**4**
	(c)	A steel bar 1.6m long is acted upon by a forces as shown in fig-8 find the elongation of the bar. Take E=210 GN/m^2.	**7**

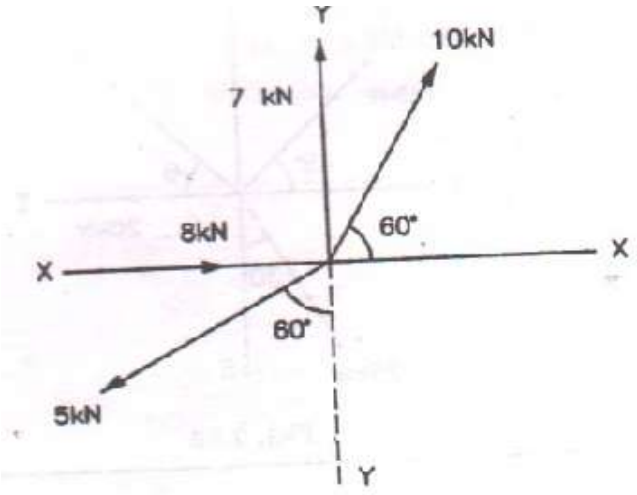


FIG-1

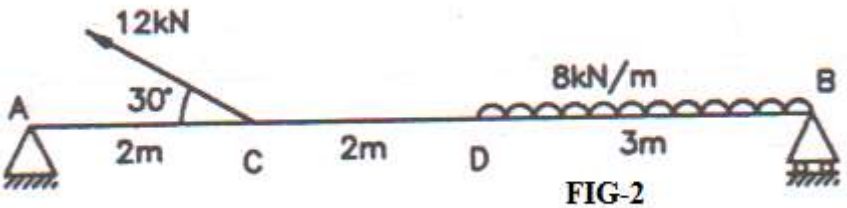


FIG-2

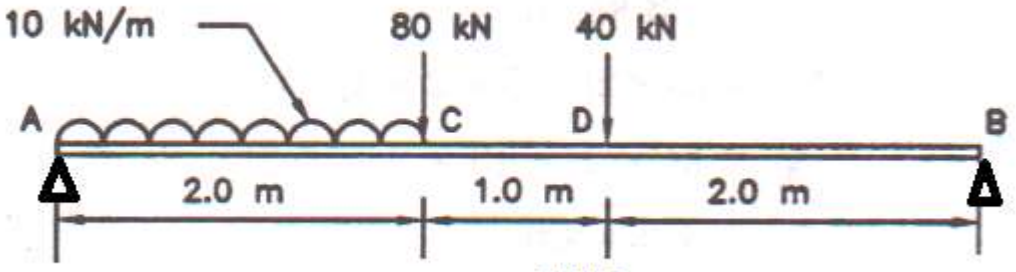


FIG-3

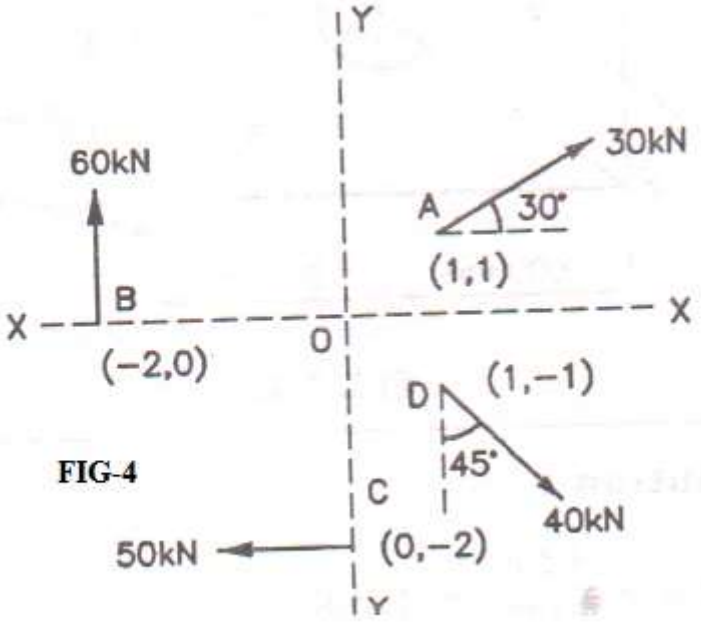


FIG-4

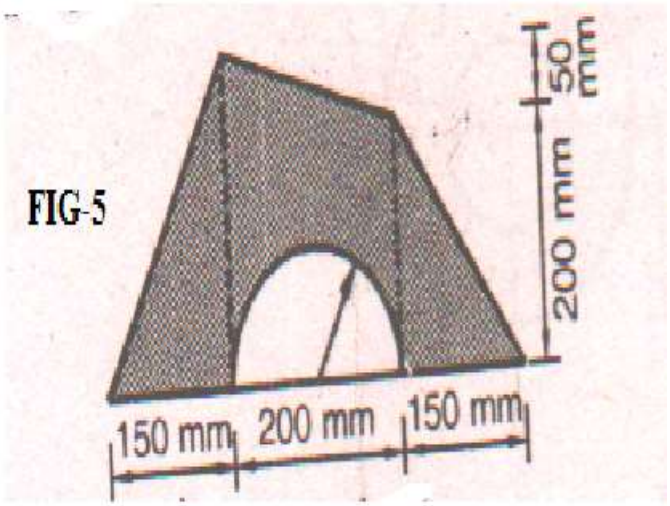


FIG-5

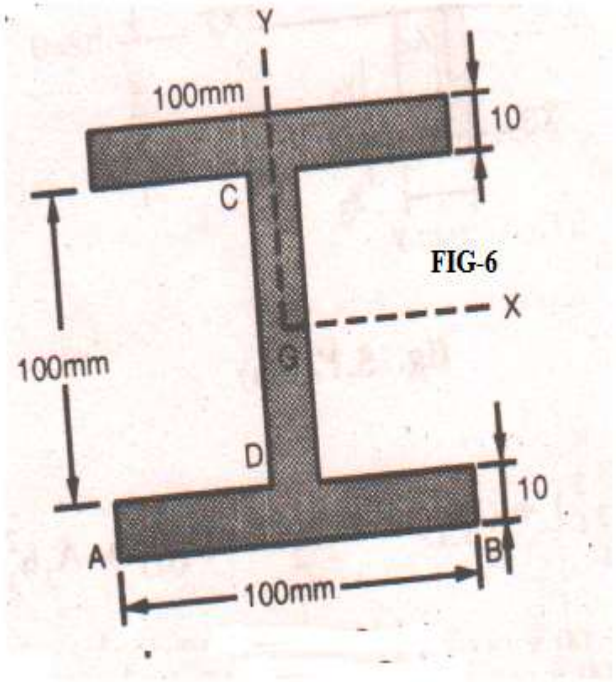
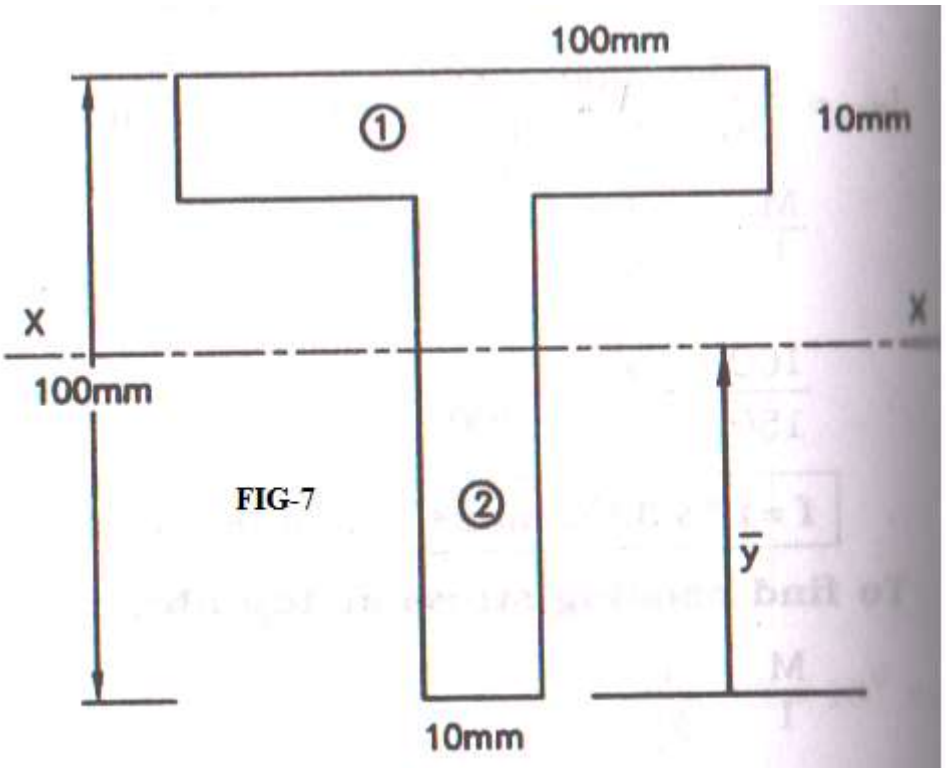


FIG-6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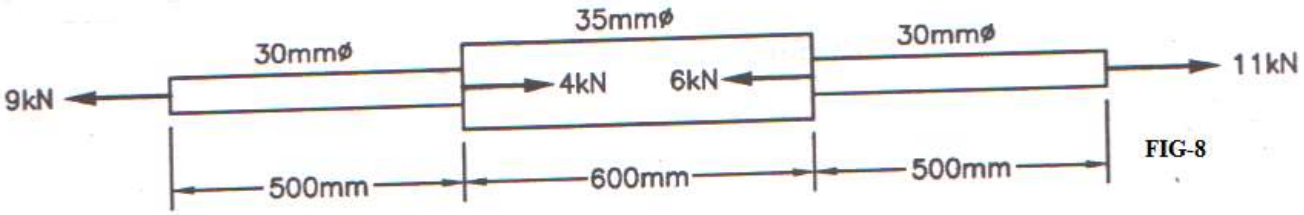
X
X
100mm
②
$\bar{y}$
10mm

FIG-7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9kN
4kN
6kN
11kN
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FIG-8