Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 2130003 Date: 26/11/2019

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.**

			MARKS
Q.1	**(a)**	Define: (i) Equilibriant force (ii) Principle of superposition (iii) Principle of transmissibility	**03**
	(b)	State and explain Lami's theorem.	**04**
	(c)	Determine the resultant of the force system shown in **Fig:[1]**	**07**
Q.2	**(a)**	Explain : Varignon's theorem	**03**
	(b)	Define : (i) Angle of friction (ii) Limiting friction (iii) Coefficient of friction (iv) Angle of repose	**04**
	(c)	Four forces are acting on the rectangle plate as shown in **Fig:[2].** Find out magnitude, direction and location of resultant with respect to point A.	**07**
		OR	
	(c)	A 10 m long ladder rests against a vertical wall with which it makes an angle of 45°. If a man whose weight is one half of that ladder, climbs on that ladder. At what distances along the ladder will be the man, when the ladder is about to slip? (μ = 0.3 between ladder & wall & μ =0.5 between ladder &wall)	**07**
Q.3	**(a)**	Define : (i) Theorem of Parallel Axes (ii) Theorem of Perpendicular Axes (iii) Radius of Gyration	**03**
	(b)	Determine the centroid of given lamina as shown in **Fig:[3].**	**04**
	(c)	Determine the moment of inertia for given lamina about axes passing through centroid as shown in **Fig:[4].**	**07**
		OR	
Q.3	**(a)**	Enlist the assumptions made in theory of pure torsion.	**03**
	(b)	State and explain theorems of Pappus-Guldinus.	**04**
	(c)	A hollow cylindrical steel shaft is 1.5m long. Inner and outer diameters of shaft are equal to 40 and 60mm respectively.(i) Find out the largest torque which may be applied to the shaft if the shearing stress is not to exceed 120MPa (ii) Find out the corresponding minimum value of the shearing stress in the shaft.	**07**
Q.4	**(a)**	Explain : (i) Type of beams (ii) Type of loading on the beams.	**03**

	(b)	Determine support reaction for the given beam shown in **Fig:[5].**	**04**
	(c)	Draw shear force and bending moment diagram of the beam shown in **Fig:[6],** finding values at all important points on the beam.	**07**
		OR	
Q.4	**(a)**	Explain: Neutral axis, Neutral layer, Moment of resistance	**03**
	(b)	A circular beam 200mm dia. is subjected to shear force of 9 KN. Calculate the value of maximum shear stress and sketch the variation of shear stress along the depth of beam.	**04**
	(c)	A beam of I-section, 5 m in length is simply supported at each end and bears a u.d.l. of 8kN/m as shown in **Fig:[7]**. Determine (i) maximum tensile and compressive bending stress, (ii) bending stress at a point 25 mm below the upper surface of the beam at the same section	**07**
Q.5	**(a)**	Define and explain : (i) Modulus of Elasticity (ii) Poisson's ratio (iii) Modulus of rigidity	**03**
	(b)	A load of 1900 kN is applied on a short concrete column 300 mm x 200 mm. The column is reinforced with four steel bars of 10 mm diameter, one in each corner. Find the stresses in the concrete and steel bars. Take E for steel as 2.1×10^5 N/mm^2 and for concrete as 1.4×10^4 N/mm^2.	**04**
	(c)	A steel bar is placed between two copper bars each having the same area and length as the steel bar at 15°C. At this stage, they are rigidly connected together at both the ends. When the temperature is raised to 315°C, the length of the bars increases by 1.5 mm. Determine final stresses in the bar and original length of the bar. E_{steel} = 210 GN/m^2, E_{copper} = 110 GN/m^2, α (steel) = 0.000012 /°C, α(copper)= 0.0000175 /°C	**07**
		OR	
Q.5	**(a)**	Define principal planes and principal stresses.	**03**
	(b)	Determine the Poisson's ratio and Bulk modulus of a material, for which Young's modulus is 1.2×10^5 N/mm^2 and Modulus of rigidity is 4.5×10^4N/mm^2.	**04**
	(c)	For an element shown in **Fig:[8],** find (i) Principal stresses and location of corresponding principal planes (ii) Maximum shear stress and location of planes containing it.	**07**

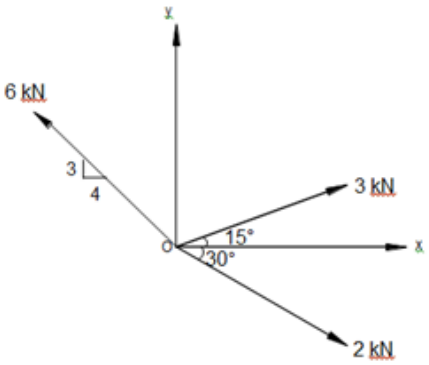

Fig : [1]

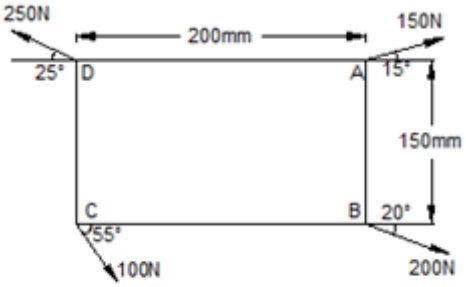

Fig : [2]

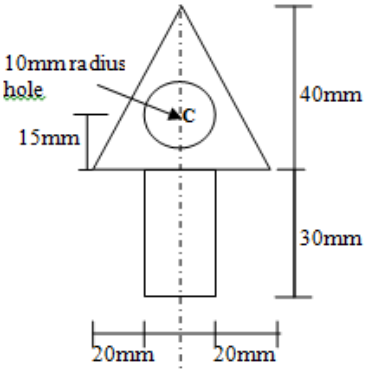

Fig : [3]

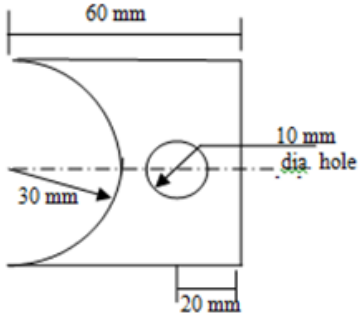

Fig : [4]

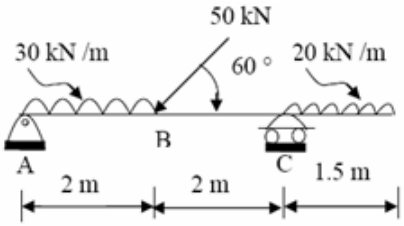

Fig : [5]

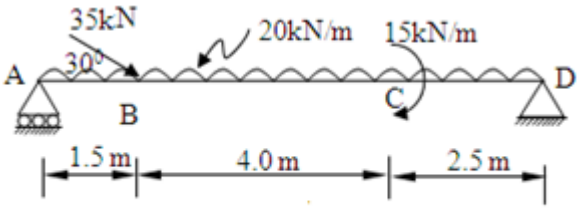

Fig : [6]

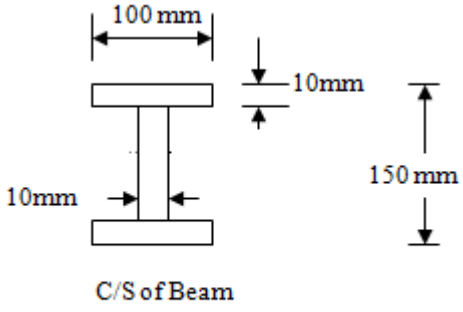

Fig : [7]

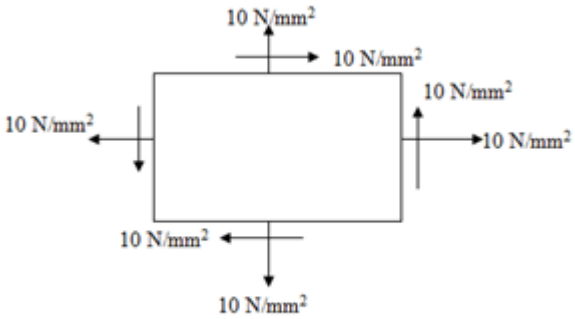

Fig : [8]

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