Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 3132005 Date: 5/12/2019

Subject Name: Engineering Mechanics

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)**	Differentiate between following : i) Co-planar & Non coplanar force system , ii) Concurrent & Non concurrent force system , iii) Resultant & Equilibrant	**03**
	(b)	State and Prove with usual notation 'The law of Parallelogram'	**04**
	(c)	Find magnitude and inclination with +X-axis of resultant of force system shown in fig 1. Identify type of force system.	**07**
Q.2	**(a)**	Define: (i) Angle of limiting friction (ϕ_{lim}), (ii) Angle of repose (λ), and (iii) Coefficient of friction (μ)	**03**
	(b)	Define Centroid and With usual notations find the centroid of a triangle by method of integration.	**04**
	(c)	A ladder of length 4 m weighing 200 N is placed against a vertical wall making an angle of 60^o with the floor. The coefficient of friction between the wall and the ladder is 0.2 and that between floor and the ladder is 0.3. The ladder in addition to its own weight has to support a man weighing 600 N at a distance of 3 m from foot of ladder. calculate the minimum horizontal force to be applied at foot of ladder to prevent slipping.	**07**
		OR	
	(c)	Find Ixx and Iyy for symmetrical I-section with flanges 100 mm wide and 10 mm thick, web 280 mm deep and 10 mm thick.	**07**
Q.3	**(a)**	Differentiate between Truss and frame.	**03**
	(b)	Locate zero force members in truss shown in the fig 2. Also find axial forces in remaining members.	**04**
	(c)	State pappus –Guldinus theorems. Using these theorems derive the formula for surface area (A) and volume (V) for sphere of radius r.	**07**
		OR	
Q.3	**(a)**	Enumerate various types of supports with neat symbolic sketches, showing possible reactions.	**03**
	(b)	A simply supported beam of span 10m, having rectangular cross-section 150mm wide x 300mm deep subjected to uniformly distributed load of 20 kN/m. Compute the values of maximum shear stress and bending stress produced in the beam.	**04**
	(c)	Determine the location of centroid of plane lamina shown in fig 3 with respect to point O.	**07**
Q.4	**(a)**	Draw representative shear stress distribution diagrams for a) hollow rectangle, b) I section, c) hollow circle	**03**
	(b)	Derive relation between young's modulus (E), bulk modulus (K), and modulus of rigidity (G) with usual notation.	**04**
	(c)	Draw shear force diagram and bending moment diagram for beam shown in fig 4.	**07**

OR

Q.4 **(a)** State Hook's law. Draw stress strain curve for Mild Steel Specimen and explain. **03**

(b) Derive the formula for the elongation of a rectangular bar under the action of axial load. **04**

(c) A stepped bar made of steel, copper and brass is under axial force as shown in fig 5 and is in equilibrium. The diameter of steel is 12mm, diameter of copper is 16mm and the diameter of brass is 20mm. Determine (i) Magnitude of unknown force P (ii) stresses in each material and (iii) Total change in length of the bar. Take E_{steel} = 200GPa, E_{copper} =100GPa and E_{brass} = 80GPa **07**

Q.5 **(a)** Explain theory of pure bending. **03**

(b) Determine reaction at supports for the Beam as shown in Fig 6. **04**

(c) Determine the 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 20kN-m. **07**

OR

Q.5 **(a)** Define: (i) Lateral strain (ii) Poisson's ratio (iii) Modulus of rigidity. **03**

(b) A bar 3 m long and 20 mm diameter is rigidly fixed in two supports at certain temperature. If temperature is raised by 60°C, find thermal stress and strain of the bar. Also find thermal stress and strain if support yields by 2 mm. Take α =12 X 10^{-6}/°C and E = 2 X 10^5 N/mm^2. **04**

(c) At a point in a strained material the state of stress is as shown in fig 8. Determine (i) Location of Principal planes (ii) Principal stresses. (iii) Maximum shear stress and location of plane on which it acts. **07**

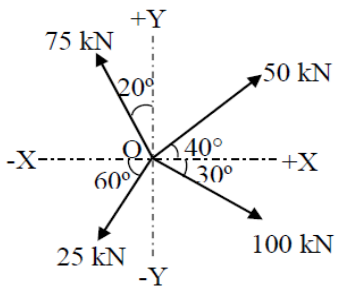

Fig: (1) Q-1(c)

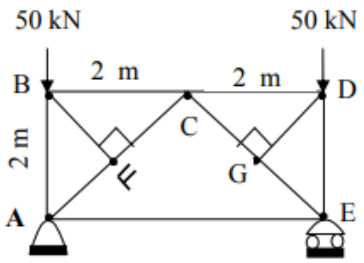

Fig: (2) Q-3(b)

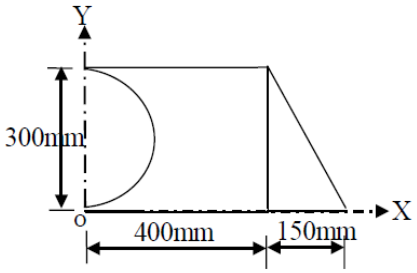

Fig:(3) Q-3(c) OR

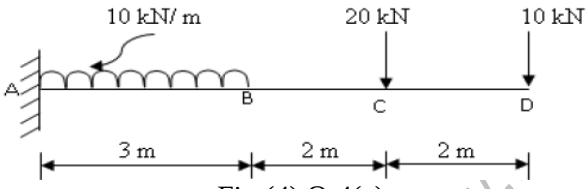

Fig:(4) Q-4(c)

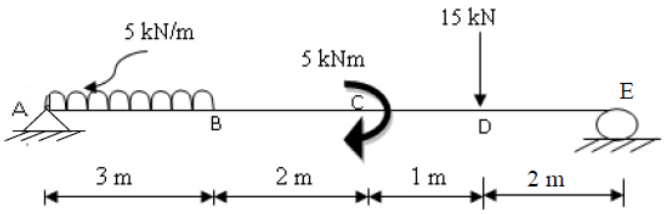

Fig: (6) Q-5(b)

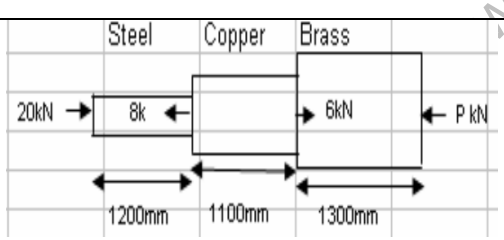

Fig: (5) Q-4(c) OR

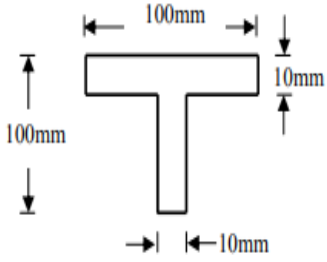

Fig:(7) Q-5(c)

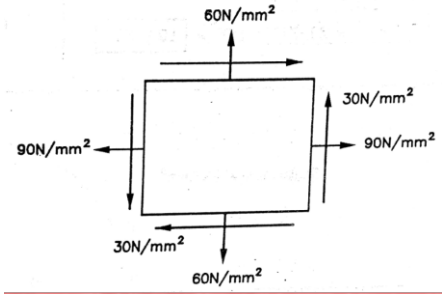

Fig:(8) Q-5(c) OR

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