Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (New) EXAMINATION – WINTER 2018

Subject Code:2130003 Date:22/11/2018

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.**

Q.1	**(a)**	Define (1) Kinematics (2) Inertia force (3) Particle (4) Continuum.	**03**
	(b)	State & prove varignon's theorem.	**04**
	(c)	For a coplanar non-concurrent force system shown in Figure.1 Determine magnitude, direction and position with reference to point A of resultant force.	**07**
Q.2	**(a)**	Distinguish between centroid & Centre of gravity.	**03**
	(b)	Find C.G. of plane lamina shown in figure.2	**04**
	(c)	Find second moment of area of circular lamina about its centroidal axis.	**07**
		OR	
	(c)	Find the moment of inertia about centroidal x-axis of the plane lamina shown in figure.3	**07**
Q.3	**(a)**	Define (1) Ductile material (2) Compound bar (3) Axial load	**03**
	(b)	Derive relation between young's modulus (E), bulk modulus (K), and modulus of rigidity (G) with usual notation.	**04**
	(c)	A steel bar ABC having 30mm diameter and 700mm length of AB and 16mm diameter 450mm length of BC is rigidly held between two supports at A & C. if the temperature is raised by 30° Celsius. Determine the stresses developed in part AB & BC. Take E=200 GPA and $\alpha=12x\ 10^{-6}$	**07**
		OR	
Q.3	**(a)**	Define (1) Lateral strain (2) Bulk modulus (3) Poisson's Ratio.	**03**
	(b)	Draw stress-strain curve for mild steel specimen, explain each point in detail.	**04**
	(c)	Two copper rods and one steel rod together support a load as shown in figure.4 If the stresses in copper and steel are not to exceed 80 N/mm^2 & 140 N/mm^2, find the safe load that can be supported. Modulus of elasticity for steel is twice that of copper.	**07**
Q.4	**(a)**	Write the assumption made in theory of pure torsion.	**03**
	(b)	A simply supported beam of 5m span is having triangular cross section as shown in figure.5 If permissible bending tensile and compressive stresses are 80 N/mm^2 & 60 N/mm^2 respectively. Calculate the permissible uniformly distributed load the beam can carry.	**04**
	(c)	A solid circular shaft of 120mm diameter is running at 170 RPM, if the maximum shear stress in shaft should not exceed 80 Mpa. Calculate the power transmitted by the shaft. Also calculate the angle of twisting per meter length of shaft. If G= 80Gpa.	**07**
		OR	
Q.4	**(a)**	Define beam and sketch various types of beam.	**03**

(b) Draw shear stress distribution across the following section. (1) Hollow rectangular (2) H-section (3) Circular section (4) T – section. **04**

(c) Calculate reaction and draw shear force and bending moment for the beam shown in figure.6 **07**

Q.5 **(a)** State type of friction and define static friction & dynamic friction. **03**

(b) Find the reaction of beam shown in figure.7 **04**

(c) A ladder 7m long rests on horizontal ground and leans against a smooth vertical wall at an angle of 20° with vertical, its weight is 1200 N acting on its middle. It is on the point of sliding when a man weighing 600 N stands on it at a distance 2.5 m along the ladder from foot of the ladder. Calculate the co-efficient of friction shown in figure 8. **07**

OR

Q.5 **(a)** Define (1) Principal plane (2) Principal stress (3) Neutral axis **03**

(b) Prove with usual notation that the shear stress at a layer in the section of beam is given by $\tau = FA\bar{Y}/IB$ **04**

(c) For an element shown in figure 9 find (1) principle stresses and location of corresponding principle planes. (2) Maximum shear stress and location of planes. Containing it. **07**

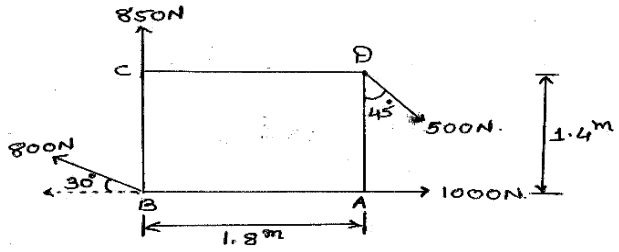

FIG-1, Q-1 (c)

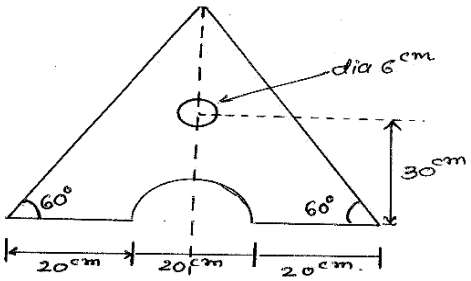

FIG-2, Q-2 (b)

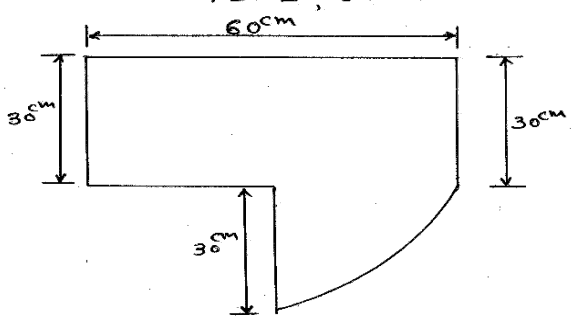

FIG-3, Q-2 (c)

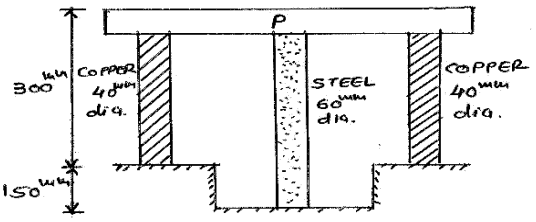

Fig-4, Q-3 (OR) (c)

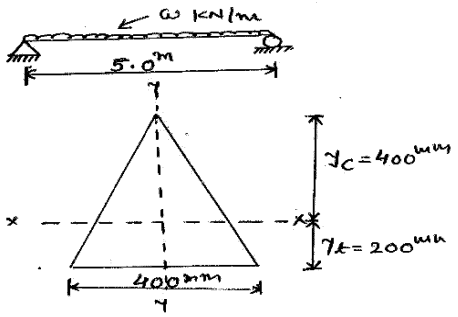

FIG-5, Q-4 (b)

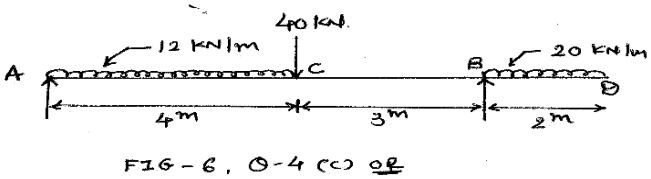

FIG-6, Q-4 (c) OR

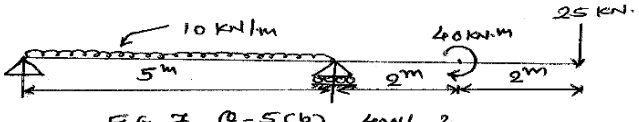

FIG-7, Q-5 (b)

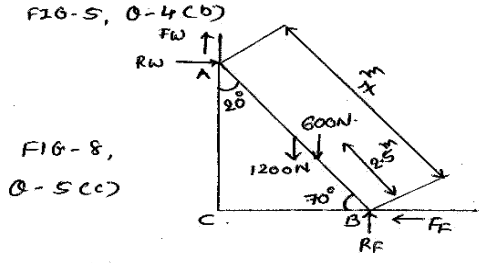

FIG-8, Q-5 (c)

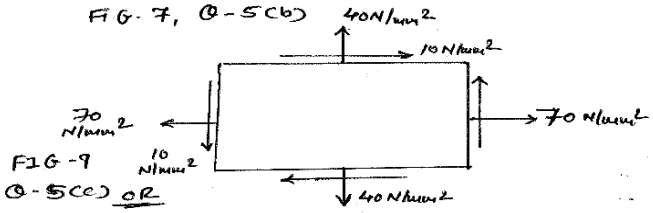

FIG-9 Q-5 (c) OR