Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2130003 **Date: 29/05/2017**

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.**

			MARKS
Q.1		Short Questions	14
	1	As per _____ law. Whenever a body exerts force on other body, the other body exerts similar force on the former body. (Newton's, Pappu's guldinus theorem, Lami's theorem)	
	2	Newton-meter is unit of _____from following. (Pressure, Force, Angular Torque)	
	3	_____ is the property by virtue of which a body offers resistance to any change of its state of rest or motion. (Inertia, Matter, Mass, Motion)	
	4	_____ is the branch of dynamics, which deals with the bodies in motion due to the application of forces.	
	5	Speed and distance are _____ quantity. (Vector, Scalar)	
	6	Moment is a _____ vector, whereas couple is a _____ vector. (Fixed, Free, Null)	
	7	Define Modulus of rigidity.	
	8	Define section modulus.	
	9	One of the assumption in theory of pure bending is the value of _____ is same in tension as well as compression. (Moment of Inertia, Modulus of Elasticity, Shear Stress, Bending Stress)	
	10	Define principle of Superposition.	
	11	Sketch qualitative shear stress distribution diagrams of 'I' section of the beams.	
	12	Give mathematical expression of Lami's theorem.	
	13	The process of finding components of a force is called _____ of forces. (Resolution, Splitting, Composition)	
	14	Twisting of an object due to applied torques is known as _____. (Bending, Shearing, Torsion, Rotation)	
Q.2	(a)	State and prove Pappu's guldinus theorem for surface area of bodies.	03
	(b)	Two tensile forces of 20 kN and 30 kN are acting at a point with an angle of 60° between them. Find the magnitude and direction of the resultant force.	04
	(c)	A point in a strained material is subjected to a tensile stress of 100 MPa and a compressive of 90 MPa acting on two mutually perpendicular planes and a shear stress of 25 MPa acts along these planes. (Figure 1) Determine following stresses on a plane inclined at 35° with plane of compressive stress. (i) Normal Stress, (ii) Tangential Stress, (iii) Resultant Stress.	07
		OR	
	(c)	Four forces are acting tangentially to a circle of radius 3 m as shown in figure 2. Determine the resultant in magnitude and it's direction and location	07

with respect to center or the circle.

Q.3 (a) Write assumption made in the theory of pure bending. 03

(b) An electric lamp in street as shown in figure 3 is having 50 N weight is suspended by two wires of 4 m and 3 m length. The horizontal distance between two fixed points are 5 m from which two wires were suspended. Find out tension in both wires. 04

(c) Find out centroid of thin homogeneous wire as shown in figure 4. 07

OR

Q.3 (a) Draw representative shear stress distribution diagrams for 03
Hollow rectangle, b) I section, c) Hollow circle

(b) Find support reactions for beam shown in figure 5. 04

(c) For the beam shown in figure 6 calculate shear force and bending moments at salient points and draw shear force and bending moment diagrams. 07

Q.4 (a) Explain various types beams and their support system. 03

(b) Calculate center of gravity of T-section having flange 20 X 2 cm and web 30 X 2 cm. also show position of C. G. on figure. 04

(c) A beam having an I section with top flange 80 X 40 mm, web 120 X 20 mm and bottom flange 160 X 40 mm, simply supported over a span of 6m, is subjected to uniformly distributed load over entire span. If bending stress is limited to 40 N/mm^2 tensile and 120 N/mm^2 compressive, find max. value of U.D.L. the beam can carry if the larger flange is in tension. 07

OR

Q.4 (a) Define: (i) coefficient of friction (ii) Angle of friction 03

(b) A block weighing 150 kN is placed on a rough inclined plane making angle 30° with horizontal. If coefficient of friction is 0.25, find out the force applied on the block parallel to the plane. So that the block is just on the point of moving up the plane. Also find angle of friction. 04

(c) Calculate the diameter of the shaft required to transmit 45 kW at 120 rpm. The maximum torque is likely to exceed the mean by 30% for a maximum permissible shear stress of 55 N/mm^2. Calculate also the angle of twist for a length of 2 m. G = 80 X 10^3 N/mm^2. 07

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

(b) An M. S. bar of 20 mm diameter is acted upon by a tensile force of 60 kN. If the length of bar is 1.2 m and modulus of elasticity is 2.0 X 10^5 N/mm^2. Find stress, strain and elongation of the bar. 04

(c) Determine moment of inertia of a plane area as shown in figure 7 about its base line a-a. 07

OR

Q.5 (a) Explain following terms: 03
(i) rigid body, (ii) deformable body, (iii) Elastic body.

(b) A 50 mm X 100 mm in depth rectangular section of a beam is simply supported at the ends with 2m span. The beam is loaded with 20 kN point load at 0.5 m form R.H.S. Calculate the maximum shearing stress in the beam. 04

(c) For a bar shown in figure 8 find the diameter of the middle portion, if the stress at that location is to be limited to 140 N/mm^2. Also find the total change in the length of the bar. E = 2 X 10^5 N/mm^2. 07

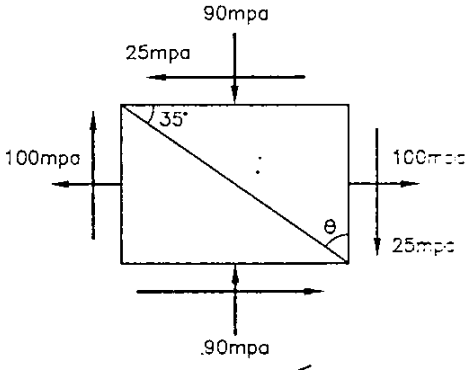

Figure 1

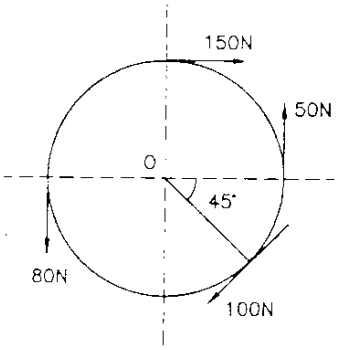

Figure 2

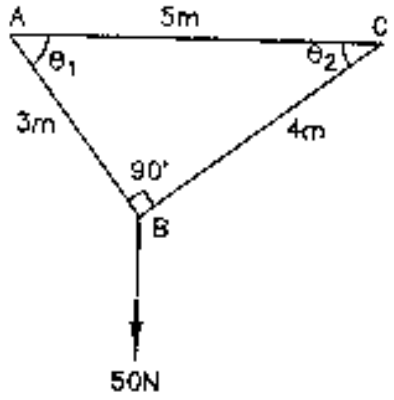

Figure 3

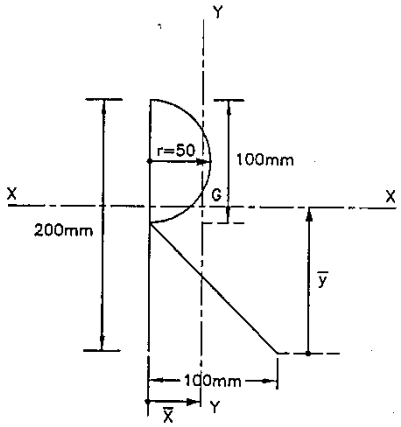

Figure 4

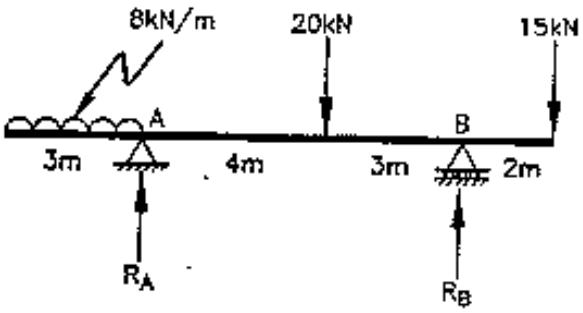

Figure 5

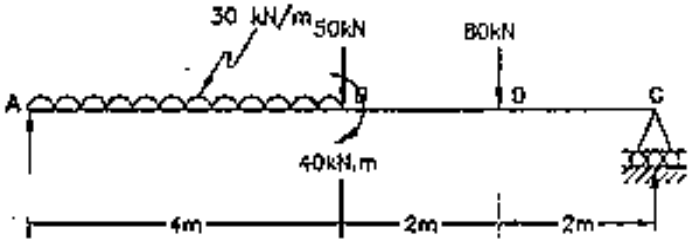

Figure 6

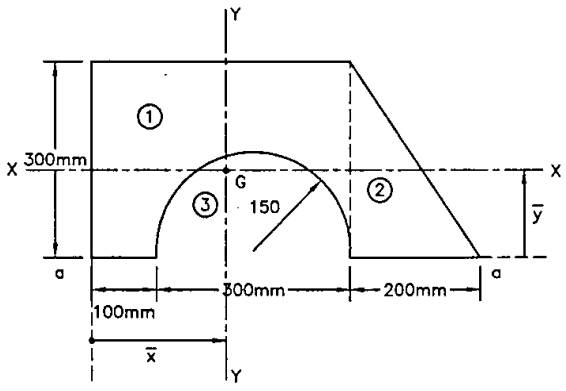

Figure 7

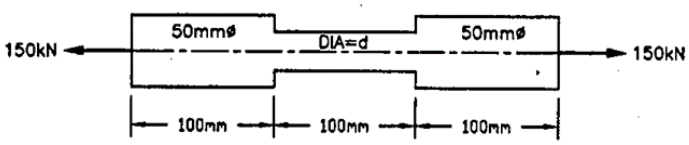

Figure 8

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