Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New) EXAMINATION – SUMMER 2016

Subject Code:2130003 Date:13/06/2016

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	How will you differentiate scalar and vector quantities?	
	2	Explain the term free body diagram	
	3	What is the moment of inertia of a triangle about its base and horizontal centroidal axis?	
	4	Define Modulus of rigidity and Modulus of elasticity.	
	5	What is the relation between Load , Shear Force and Bending Moment.	
	6	Define section modulus.	
	7	What is the use of Mohr's circle?	
	8	_____ is equal and opposite to the resultant of several forces acting on a body. (Equilibrant, Resultant, Stress, Strain)	
	9	The process of finding components of a force is called _____ of forces. (Desolution, Resolution, Lami's theorem, Composition)	
	10	Angle of repose is equal to angle of static friction when _____. (motion is absent, system is in equilibrium, motion is impending, body is on a flat surface)	
	11	Ratio of maximum to average shear stress in a rectangular section is _____. (3/2, 1/2, 3/4, 5/2)	
	12	The difference of angle between two principal plane is _____ (180°, 90°,120°,45°)	
	13	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)	
	14	Twisting of an object due to applied torque is known as _____ (Bending, Shearing, Torsion, Rotation)	
Q.2	**(a)**	What is Polygon law of forces? Explain graphical procedure to find resultant of the forces using polygon law of forces.	**03**
	(b)	The line of action of the 2.6 kN force F runs through the points A and B shown in fig. 1. Determine the x and y components of F.	**04**
	(c)	A uniform wheel of 80 cm diameter and 1500 N weight rests against a rigid rectangular block of thickness 30 cm	**07**

as shown in fig. 2. Considering all surfaces smooth, determine
a) Least pull to be applied through the center of wheel to just turn it over the corner of the block,
b) Reaction of the block.

OR

	(c)	A reinforced concrete column of size 250 mm x 250 mm supports a load of 250 kN axially. The reinforcement consists of 4 steel roads each of 25 mm in diameter in each corner. Find how much load is carried by the rods and the concrete if Young's modulus of steel is 15 times that of concrete.	**07**
Q.3	**(a)**	Explain various types of statically determinant beams and their support system	**03**
	(b)	A bar 3m long and 20mm 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 2mm. Take $\alpha = 12 \times 10^{-6}$ /°C and $E = 2 \times 10^5$ N/mm^2	**04**
	(c)	Find centroid of the shaded area shown in fig.3 with reference to point 'O'	**07**

OR

Q.3	**(a)**	A solid steel shaft is to transmit a torque of 1 kN.m. If the shearing stress is not to exceed 45 N/mm^2. Find the minimum diameter of the shaft.	**03**
	(b)	Under what axial tensile load the diameter of a steel bar will be reduced from 50 mm to 49.899 cm? Take $E = 2.0 \times 10^5$ N/mm^2 and Poisson's ratio = 0.33.	**04**
	(c)	Find moment of inertia about horizontal centroidal axis of a shaded area shown in fig. 4	**07**
Q.4	**(a)**	Derive the formula for the elongation of a rectangular bar under the action of axial load.	**03**
	(b)	The shaded area shown in fig. 5 is revolved about Y axis. By means of a theorem of Pappus Gauldinus, determine the volume generated. Dimensions are in cm.	**04**
	(c)	Draw Shear Force and Bending Moment diagram for the beam shown in fig. 6	**07**

OR

Q.4	**(a)**	Draw representative shear stress distribution diagrams for a) hollow rectangle, b) I section, c) hollow circle	**03**
	(b)	Determine reaction at supports for the Beam as shown in Fig. 7	**04**
	(c)	Determine the horizontal force required to cause the motion of the block weighing 550N as shown in fig.8. Take $\mu = 0.55$. a. To impend the motion downward b. To impend up the plane	**07**
Q.5	**(a)**	What is ellipse of stress? What is the use of it?	**03**
	(b)	A material is subjected to tensile stresses 80 N/mm^2 and 40 N/mm^2 perpendiculars to each other. It is also subjected to shear stress of 60 N/mm^2. Find normal, tangential and resultant stress on a plane inclined at 45° with smaller tensile stress.	**04**
	(c)	A cast iron beam is of T section as shown in fig.9 The beam is simply supported on a span of 8m. The beam	**07**

carries a UDL of 25 kN/m on the entire span. Determine the maximum tensile and maximum compressive stresses. Also draw bending stress distribution diagram. Take I = 3.14 x 10^6 mm^4.

OR

Q.5	**(a)**	Explain theory of pure bending.	**03**
	(b)	Prove that for a rectangular cross section of a beam the value of maximum shear stress is 1.5 times average shear stress.	**04**
	(c)	A simply supported beam of length 5m and Its cross section as shown in fig.9. is uniformly loaded with 20kN/m. Find values of shear stress at critical points and draw shear stress distribution diagram across the c/s. Take I = 3.14 x 10^6 mm^4.	**07**

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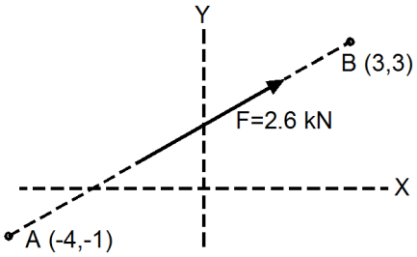

Fig. 1

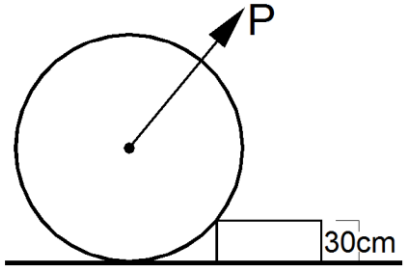

Fig. 2

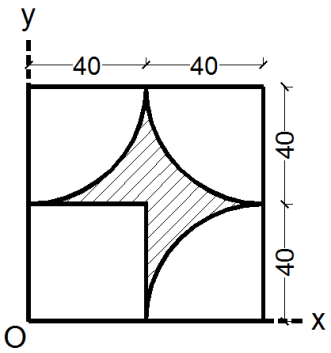

Fig. 3

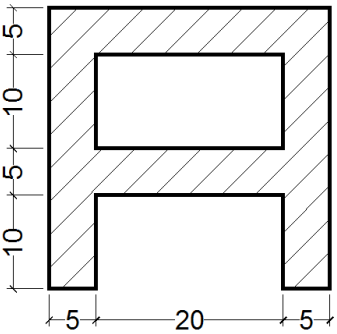

Fig. 4

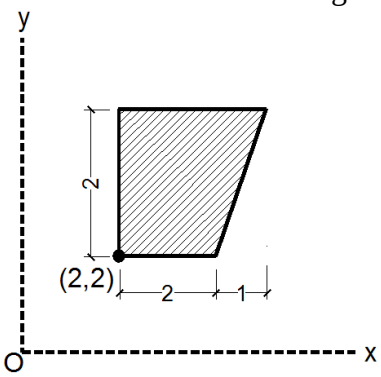

Fig. 5

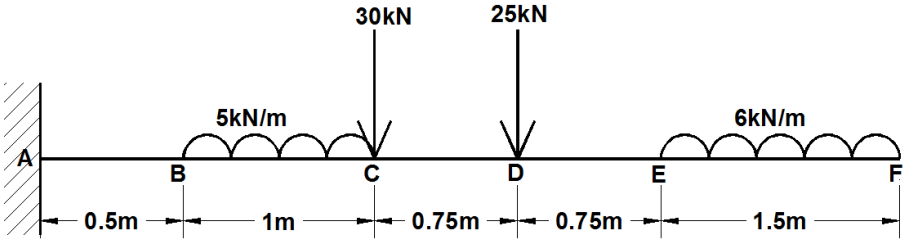

Fig. 6

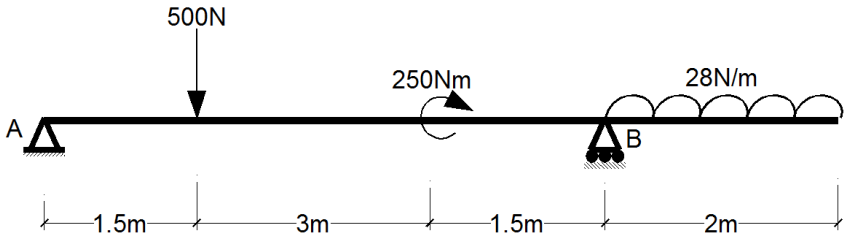

Fig. 7

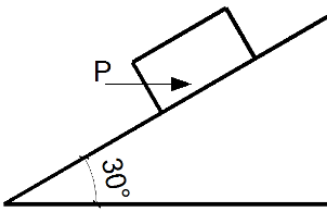

Fig. 8

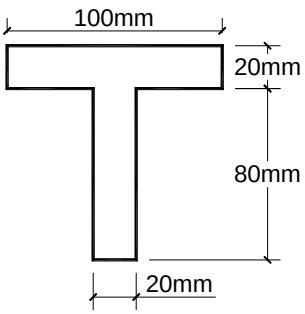

Fig. 9