Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- Ist /IInd SEMESTER–EXAMINATION – MAY/JUNE - 2012

Subject code: 110010 Date: 07/06/2012

Subject Name: Mechanics of Solids

Time: 10:30 am – 01:00 pm Total Marks: 70

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Each question carry equal marks**

Q.1	(a)	State Varignon's theorem and prove it.	**03**
	(b)	Determine magnitude and direction of resultant force of the force system shown in **figure 1.**	**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**
Q.2	(a)	State Pappus Guldinus Theorem for volume of solid.	**03**
	(b)	Determine the magnitude direction and position of resultant force of the force system given in **figure 2** with reference to point A.	**04**
	(c)	Find the forces in all the members of the truss shown in **figure 3**. Indicate the magnitude and nature of forces on the diagram of the truss.	**07**
Q.3	(a)	Derive expression of moment of inertia of rectangular section by first principal.	**03**
	(b)	Determine the centroid of the wire shown in **figure 4**.	**04**
	(c)	What should be the value of θ in **figure 5** which will make the motion of 1000N block down the plane to impend? The coefficient of friction for all contact surfaces is 1/3.	**07**
Q.4	(a)	Find out centroid of the section shown in **figure 6**.	**03**
	(b)	Determine the moment of inertia of the section shown in **figure 6** about an axis passing through centroid and parallel to the base.	**04**
	(c)	Draw shear force and bending moment diagram for the beam shown in **figure 7**.	**07**
Q.5	(a)	Derive the relation between modulus of elasticity and modulus of rigidity.	**03**
	(b)	A circular rod of diameter 20 mm and 500 mm long is subjected to a tensile force 50kN. The modulus of elasticity for steel may be taken as 200 kN/mm^2. Find stress, strain and elongation of the bar due to applied load.	**04**
	(c)	A simply supported beam of span 4.0 m has a cross-section 200 mm × 300 mm. If the permissible stress in the material of the beam is 20N/mm^2, determine maximum udl it can carry.	**07**
Q. 6	(a)	For the pure bending, prove that the neutral axis coincides with the centroid of the cross-section.	**03**
	(b)	Calculate the support reactions of the beam shown in **figure 8**.	**04**

(c) The direct stresses at a point in the strained material are 150 N/mm^2 compressive and 100 N/mm^2 tensile as shown in **figure 9**. There is no shear stress. Find the normal and tangential stresses on the plane AC. Also find the resultant stress on AC. **07**

Q.7 (a) What are principal planes and principal stresses? **03**

(b) Prove that the maximum shear stress in a rectangular section of a beam is 1.5 times of average shear stress. **04**

(c) A circular rod of 25 mm diameter and 500 mm long is subjected to a tensile force of 50 kN. Determine modulus of rigidity, bulk modulus and change in volume if Poisson's ratio = 0.3 and Young's modulus E = 2 × 10^5 N/mm^2. **07**

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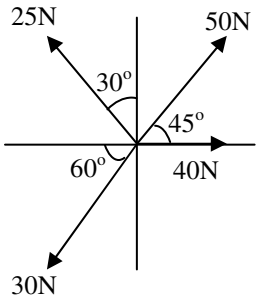

figure 1 [Q-1(b)]

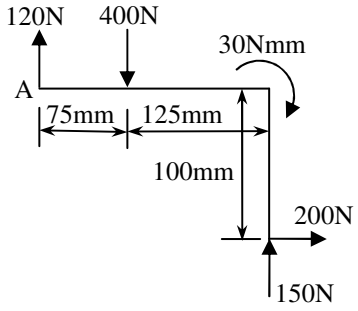

figure 2 [Q-2(b)]

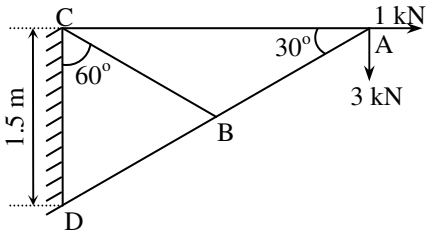

figure 3 [Q-2(c)]

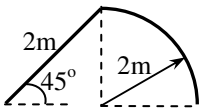

figure 4 [Q-3(b)]

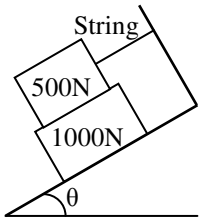

figure 5 [Q-3(c)]

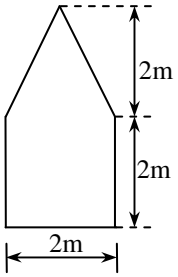

figure 6 [Q-4(a), Q-4(b)]

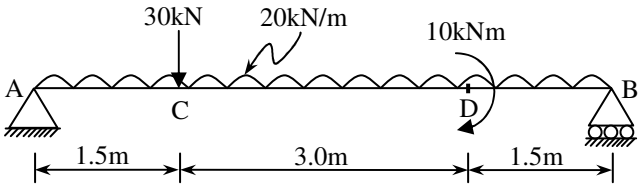

figure 7 [Q-4(c)]

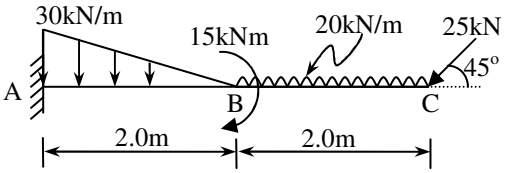

figure 8 [Q-6(b)]

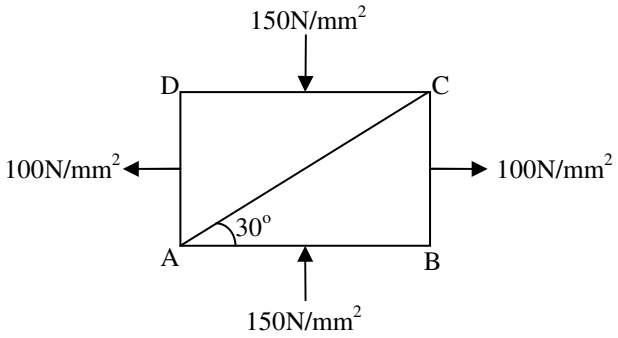

figure 9 [Q-6(c)]