Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– 1st / 2nd • EXAMINATION – SUMMER 2013

Subject Code: 110010 **Date: 19-06-2013**

Subject Name: Mechanics of Solids

Time: 02:30 pm – 05:00 pm **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	Define: (i) Space (ii) Particle (iii) Equilibrant	**03**
	(b)	Locate the centroid of composite line ABCD as shown in **figure 1**.	**04**
	(c)	A cord supported at A and B carries a load of 20kN at D and a load of W at C as shown in **figure 2**. Find the value of W so that CD remains horizontal.	**07**
Q.2	**(a)**	State: (i) Law of Parallelogram of Forces (ii) Law of Triangle of Forces	**03**
	(b)	A wooden beam 2m long, simply supported at ends, has rectangular section 150mm × 600mm and carries a point load of 20kN at center of the beam. Calculate the bending stress at a layer 200mm above the bottom of the beam, the layer being of the section distant 0.8m from left support.	**04**
	(c)	Find forces in members CD, FG and FD. The truss is shown in **figure 3**.	**07**
Q.3	**(a)**	Enlist various type of loads and type of supports.	**03**
	(b)	A beam of rectangular section 100mm × 300mm is subjected to a shear force of 10kN. Find shear stress at the top layer, at neutral layer and the average value of shear stress. Show the stress distribution diagram.	**04**
	(c)	Some forces are acting on a rigid body as shown in **figure 4**. Find the resultant of the given force system, in terms of magnitude and direction. Find the location of the Resultant with respect to point O.	**07**
Q.4	**(a)**	Distinguish between perfect, unstable and redundant trusses. Illustrate with sketches.	**03**
	(b)	Find reaction at support A and B for the beam shown in **figure 5**.	**04**
	(c)	Calculate shear force and bending moment at salient points of the beam shown in **figure 6**. Draw shear force diagram and bending moment diagram for the beam.	**07**
Q.5	**(a)**	State Pappus-Guldinus first theorem and prove it.	**03**
	(b)	A force is acting at an angle of 45^{o}. Find the components along the axes m-m and n-n as shown in **figure 7**.	**04**
	(c)	Find the moment of inertia of the area about *x-x* axis as shown in **figure 8**.	**07**
Q.6	**(a)**	Define: (i) Coefficient of friction (ii) Angle of friction (iii) Stress	**03**
	(b)	Refer **figure 9**. The coefficient of frictions between the block and the inclined plane is 0.2. Determine the least value of the force P required just to move the block up along the inclined plane.	**04**
	(c)	A steel rod of 30mm diameter is placed inside a copper tube of external diameter 50mm and internal diameter 40mm, having length equal to 500mm and connected rigidly at the ends as shown in **figure 10**. The bar is subjected to axial pull of 150kN. Find the stresses in each material and elongation of the composite bar. Take E_{steel} = 200 GPa and E_{copper} = 100GPa.	**07**
Q.7	**(a)**	A uniform ladder of weight 250N and length 5m is placed against a vertical wall in a position where its inclination to the vertical is 30^{o}. A person weighing 700N climbs the ladder. At what position of the person the ladder	**07**

will start to slip? Take coefficient of friction μ = 0.2 at both the contact surfaces of the ladder.

(b) For the state of stress as shown in **figure 11** determine location of principal planes, principal stresses and maximum shear stress. **07**

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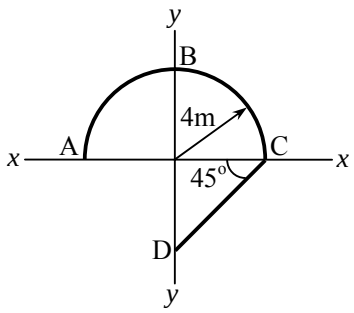

Fig. 1 [Q-1(b)]

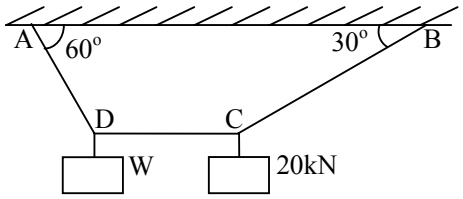

Fig. 2 [Q-1(c)]

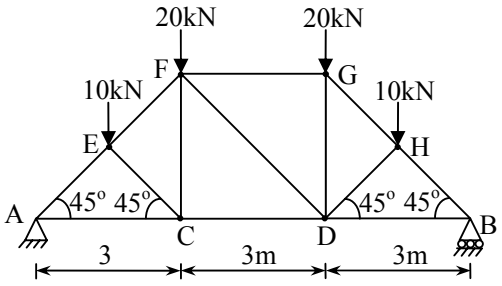

Fig. 3 [Q-2(c)]

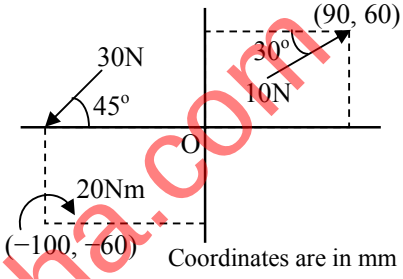

Fig. 4 [Q-3(c)]

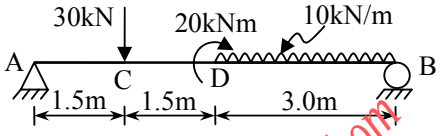

Fig. 5 [Q-4(b)]

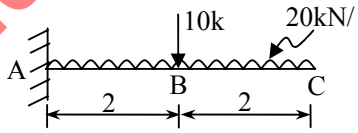

Fig. 6 [Q-4(c)]

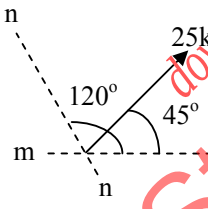

Fig. 7 [Q-5(b)]

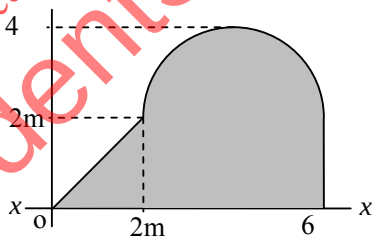

Fig. 8 [Q-5(c)]

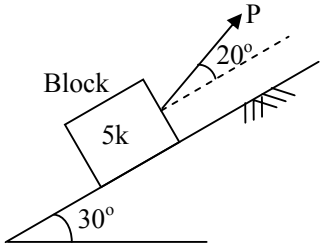

Fig. 9 [Q-6(b)]

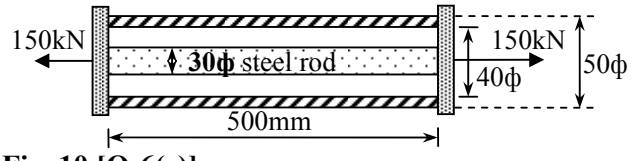

Fig. 10 [Q-6(c)]

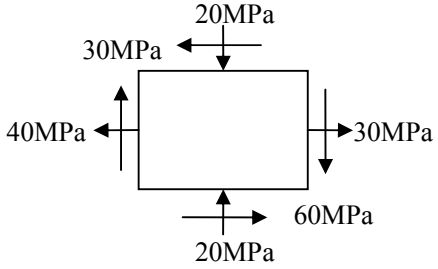

Fig. 11 [Q-7(b)]