

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE SEM- I / II Winter Examination-Dec.-2011**

Subject code: 110010

Date: 26/12/2011

Subject Name: Mechanics of Solids

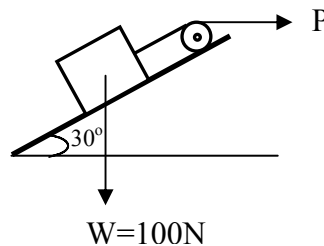
Time: 10.30 am -1.00 pm

Total marks: 70

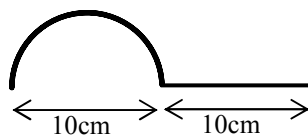
**Instructions:**

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

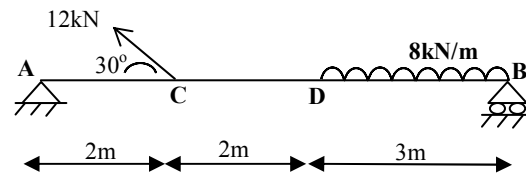
- Q.1** (a) A system of forces is made of two forces of equal magnitude. **07**  
 Determine, using the triangle law of forces, the angle between two forces if magnitude of resultant force is equal to the magnitude of one of the forces.
- (b) Equilibrium of block is maintained by a pull  $P$  as shown in **Fig.-1**. The **07**  
 co efficient of friction between block and surface is 0.2. Determine the values of  $P$  for which the block remains in equilibrium.

**Fig.-1**

- Q.2** (a) Define the modulus of elasticity, Poisson's ratio, modulus of rigidity **07**  
 and bulk modulus. Explain homogeneous material, composite element and prismatic element.
- (b) Determine the centroid of wire; bent as shown in **Fig.-2**. **07**

**Fig.-2**

- Q.3** A beam is loaded as shown in **Fig.-3**. **07**
- (i) Determine the reactions at supports, **03**
  - (ii) draw shear force diagram for the beam, **03**
  - (iii) draw bending moment diagram for the beam and **04**  
 determine magnitude of maximum bending moment.



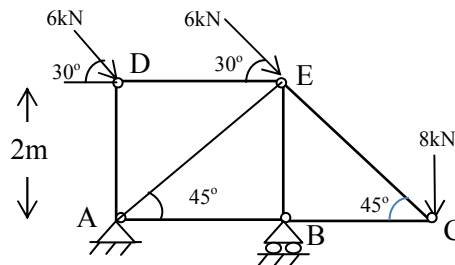
**Fig.-3**

**Q.4** A truss is loaded as shown in **Fig.-4**. Determine

- (i) the support reactions and
- (ii) internal forces in the members

**06**

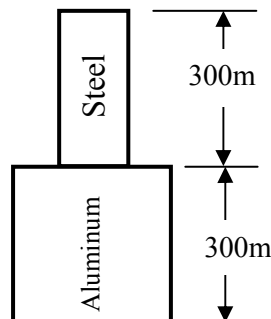
**08**



**Fig.-4**

**Q.5 (a)** Determine the compressive stress developed in a punch of 10mm diameter, used to make a hole of 10mm diameter in 8mm thick mild steel plate. The shear strength of mild steel is 300MPa. **07**

**(b)** A member is formed by connecting end to end a 300mm long steel bar of 50mmx50mm square section with 300mm long aluminum bar of 100mmx100mm square section as shown in **Fig.-5**. Determine the axial push required to produce the total decrease in length of 0.2mm. Take  $E_{\text{steel}} = 2 \times 10^5 \text{ MPa}$  and  $E_{\text{aluminum}} = 0.7 \times 10^5 \text{ MPa}$ . **07**



**Fig.-5**

**Q.6 (a)** A Steel bar 16mm diameter and 3m long is subjected to an axial pull of 80kN. Determine the changed dimensions and volume of the bar. Take Young's Modulus as  $2 \times 10^5 \text{ MPa}$  and Poisson's ratio 0.3. **07**

**(b)** The normal stress on plane AA is  $20 \text{ N/mm}^2$  (tensile). If the principal stress in the material is limited to  $60 \text{ N/mm}^2$  (compressive), determine the allowable shear stress on plane AA. The normal stress on the planes perpendicular to plane AA is zero. **07**

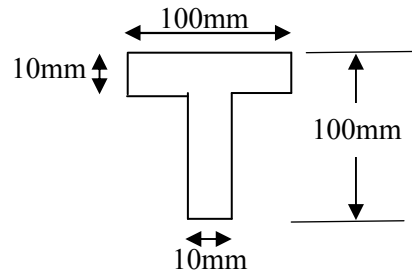
**Q.7** A section of beam as shown in **Fig.-6** is subjected to a bending moment of 10kN.m about the major axis and a shear force of 20kN.

- (i) Determine the moment of inertia of the section about both the centroidal axis,

**07**

- (ii) draw bending stress distribution across the section and  
(iii) draw shear stress distribution across the section.

03  
04



**Fig.-6**

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