Seat No.: _____ Enrolment No._____

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. 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. **07**

(b) Equilibrium of block is maintained by a pull *P* as shown in **Fig.-1.** The co efficient of friction between block and surface is 0.2. Determine the values of *P* for which the block remains in equilibrium. **07**

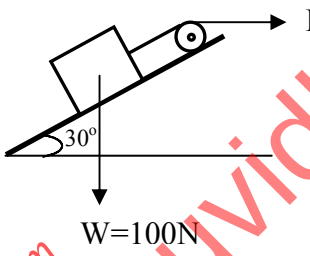

Fig.-1

Q.2 **(a)** Define the modulus of elasticity, Poisson's ratio, modulus of rigidity and bulk modulus. Explain homogeneous material, composite element and prismatic element. **07**

(b) Determine the centroid of wire; bent as shown in **Fig.-2.** **07**

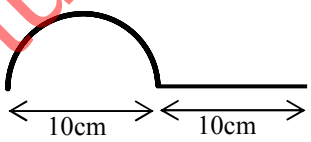

Fig.-2

Q.3 A beam is loaded as shown in **Fig.-3**.

(i) Determine the reactions at supports, **07**

(ii) draw shear force diagram for the beam, **03**

(iii) draw bending moment diagram for the beam and determine magnitude of maximum bending moment. **04**

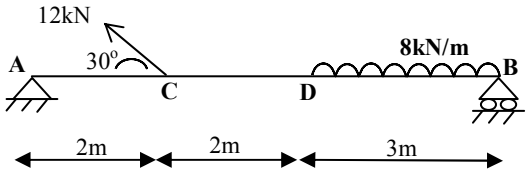

Fig.-3

Q.4 A truss is loaded as shown in **Fig.-4.** Determine
(i)the support reactions and **06**
(ii)internal forces in the members **08**

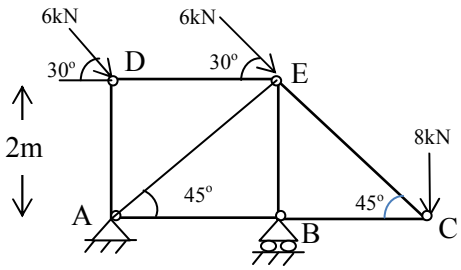

Fig.-4

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 $E_{steel}=2x10^5$MPa and $E_{aluminum}=0.7x10^5$MPa. **07**

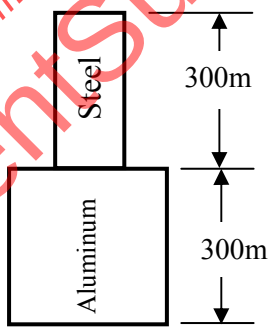

Fig.-5

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 $2x10^5$MPa and Poisson's ratio 0.3. **07**

(b) The normal stress on plane *AA* is 20N/mm^2 (tensile). If the principal stress in the material is limited to 60N/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 **03**
(iii)draw shear stress distribution across the section. **04**

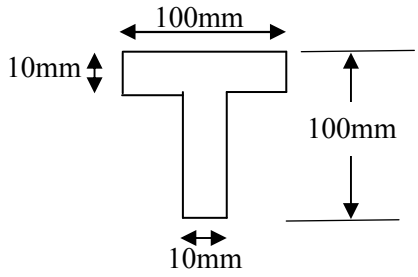

Fig.-6

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