SANKALCHAND PATEL COLLEGE OF ENGINEERING, VISNAGAR.

GTU Mid-term examination, March -2009

B.E. Semester - II (EC/CE/IT/ME/EE/Civil)

Subject: Mechanics of Solids **Time:10:30 to 12:00**

Date : 24 / 03 /2009 **Total marks: 40**

Q-1 a) Enlist and Describe in brief Fundamental principles and laws of Mechanics. **4**

b) 1. Write Hooke's Law **1**

2. _____ is the unit of Young's Modulus.(N.m , N/mm^2 , N/mm) **1**

3. Define Poisson's Ratio. **1**

4. What do you mean by Compound and Composite bars. **1**

Q-2 a) Find magnitude and direction of resultant for a concurrent force system shown in **Fig.1.** **4**

b) Forces are transmitted by two members as shown in **Fig. 2** to pin A. If the resultant of these forces is 700 N directed vertically upward, what are angles α 1 and α 2 **4**

c) Find the moment of 1000 N force about point A as shown in **Fig. 3.** **4**

OR

Q-2 a) A Uniform wheel of 600 mm diameter and weight 1000 N rest against rectangular obstacle 150 mm high. Find the least force required which when acting through the centre of wheel will just turn the wheel over the corner of the block. Refer **Fig. 4** **4**

b) Four forces are acting tangentially to a circle of radius 3 mt. as shown in **Fig. 5.** Determine the resultant in magnitude and its direction and location with respect to centre of the circle. **4**

c) Two forces P and Q are acting at a point O as shown in **Fig.6.** Determine magnitude and direction of the resultant using Triangle Law of forces. **4**

Q-3 a) Define **2**

1. Mechanics 2.Rigid body 3.Equilibrant force 4.Equivalent couples

b) Differentiate moment and couple. **2**

c) 1. What do you mean by Linear and Lateral Strain? **2**

2. Define: Thermal Stress and Complimentary Shear Stress **2**

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OR

Q-3 a) State and Explain Lami's Theorem. **4**

b) Derive the equation $\delta l = \frac{4pl}{\pi E d_1 d_2}$ (Bar of uniformly tapering circular section) **4**

Q-4 a) A short timber post of rectangular section has one side twice the other. It contracts by 0.005 cm/m when loaded axially by 10 kN. Calculate the sectional dimensions of the post. Take E= 0.1 x 10^5 N/mm^2. Refer **Fig. 7.** **4**

b) A steel bar 1600mm long is acted up on by forces as shown in **Fig. 8**. Find the elongation of the bar. Take E= 210 GN/m^2 **4**

c) A bar PQRS is supported as shown in **Fig. 9.** Calculate **4**

1. Maximum temperature up to which no temperature stress will develop.

2. Temperature stresses in each part of the bar if the temperature of the bar is raised to 75^0 C.

Take E= 200 GPa and α = 12 x 10^{-6} per ^{0}C

OR

Q-4 a) A rectangular bar made of steel is 2.8 mt long and 15 mm thick. It is subjected to an axial tensile load of 40 kN. The width of the bar varies from 75 mm at one end to 30 mm at the other. Find extension of the bar if E= 200 GPa. **4**

b) A bar XYZ is rigidly fixed at X & Z and subjected to an axial force as shown in **Fig. 10.** Calculate the stresses in each part of the bar. Also calculate the displacement of point Y. Take E_{steel} = 200 GPa , E_{brass} = 100 GPa. **4**

c) A Square prism of metal 60mm x 60mm in cross section and 300 mm long is subjected to a tensile stress of 450 MPa along its longitudinal axis, lateral compression of 240 MPa and lateral tension 120 MPa along the pair of sides. If E=150 GPa , calculate the changes in dimensions , change in volume for metal. μ = 0.36. Refer **Fig. 11.** **4**

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