Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-IV Remedial Examination Nov/ Dec. 2010

Subject code: 140605 Subject Name: Advanced Strength of Materials

Date: 08 / 12 / 2010 **Time: 03.00 pm – 05.30 pm**

Total Marks: 70

Instructions:

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

Q.1 **(a)** (i) State and explain Castigliano's theorems and Mexwell's reciprocal theorem. **04**

(ii) Derive the formula for stress due to suddenly applied load. **03**

(b) (i) Find (a) energy of distortion (b) energy of dilation per unit volume at a point in a body, where the principal stresses are 50 MN/m^2 (tensile),70 MN/m^2(compressive) and 20 MN/m^2(compressive). Take E = 200 \ GN/m^2 and μ=0.25. **04**

(ii) A cantilever beam of length L is subjected to a point load 'P' at free end. Find the deflection at the free end using Castigliano's theorem. Take flexural rigidity EI as constant. **03**

Q.2 **(a)** Explain maximum shear stress theory, total strain energy theory and shear strain energy theory. **07**

(b) Find the diameter of a shaft according to (i) maximum shear stress theory (ii) shear strain energy theory, if the shaft is subjected to a maximum torque of 15 kNm and a maximum bending moment of 10 kNm at a particular section. Take allowable equivalent stress in simple tension as 180 MN/m^2. **07**

OR

(b) (i) Write short note on shear centre. **03**

(ii) Locate the shear centre 'O' and find out the value 'e' for thin unbalanced 'I' section as shown in fig.-1. **04**

Q.3 **(a)** Derive the formulae for open coiled helical springs for axial deflection and axial rotation under the action of combined axial load and axial couple. **07**

(b) (i) An open coiled helical spring having 12 coils and 250 mm mean coil diameter is made of 20 mm diameter steel rod. The helix angle is 30°. Find the deflection and angular twist of one of the ends of the spring relative to the other end, if it is subjected to an axial load of 230 N. Take E=200 GN/m^2 and G = 80 GN/m^2 . **04**

(ii) A flat spiral spring is 8 mm wide and 0.40 mm thick, the length of spring is 2.8 m. Assuming the maximum stress of 860 N/mm^2 to occur at the point of greatest bending moment, calculate the torque, strain energy and number of turns to wind up the spring. Take E = 210 GPa. **03**

OR

Q.3 **(a)** Write assumptions made in theory of Lame's equation. Derive Lame's equations to find longitudinal and hoop stresses for thick cylinder subjected to internal pressure. **07**

(b) A pipe 400 mm internal diameter and 100 mm thickness carries fluid at a pressure of 20 MPa. Calculate the maximum and minimum intensities of hoop stress across the section. Also find the intensity of longitudinal stress and sketch the radial stress distribution and hoop stress distribution across the section. **07**

Q.4 **(a)** A crane hook curved to an internal diameter of 70 mm carries a load of 90 kN. The cross section of crane is symmetrical trapezium with top width 80 mm (concave side), bottom width 30 mm and depth 70 mm. Determine the maximum stresses in cross section. **07**

(b) A ring made of 20 mm steel bar carries a pull of 20 kN. Calculate the maximum tensile stress and maximum compressive stress in the material of the ring, if the mean radius of the ring is 180 mm. **07**

OR

Q.4 **(a)** (i) Draw shear stress distribution diagrams for rectangular, circular, I, T and channel sections. **03**

(ii) Find ratio of maximum shear stress to average shear stress for circular cross-section. **04**

(b) A simply supported beam having span 4 m is subjected to a UDL of 30 kN/m over whole span. The cross-section of beam is T section. The dimensions of flange are 120mmx10mm and that of web are 200mmx15mm. Draw shear stress distribution across the depth of cross-section marking the values at salient points. **07**

Q.5 **(a)** Derive the formulae for hoop and radial stresses for a rotating disc with constant thickness. **07**

(b) A flat steel disc of uniform thickness and 1.5 m diameter rotates at 2000 r.p.m. Determine the intensities of radial and hoop stresses at centre and periphery. Take $\rho = 7.85 \times 10^{-5}$ N/mm^3, and m=3. **07**

OR

Q.5 **(a)** Using Castigliano's theorem, determine the reaction R_B at end B, for a propped cantilever beam as shown in fig.-2. Take EI = constant. **07**

(b) Derive the formulae for maximum bending stress and deflection of a semi-elliptical leaf-spring. **07**

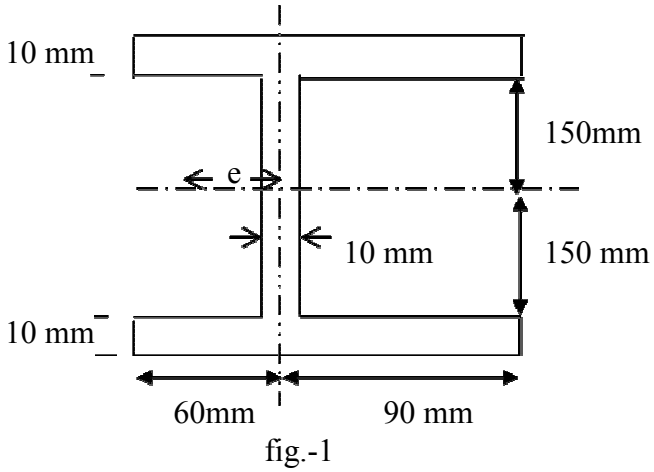

fig.-1

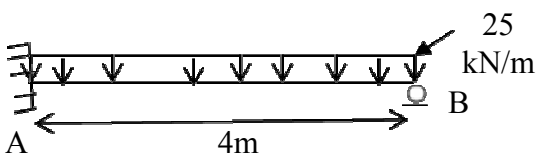

fig.-2

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