Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – SUMMER 2015

Subject Code: 140605 **Date: 08/06/2015**

Subject Name: Advanced Strength of Materials

Time: 10.30am-01.00pm **Total Marks: 70**

Instructions:

1. Attempt all questions.

2. Make suitable assumptions wherever necessary.

3. Figures to the right indicate full marks.

4. Draw neat and clean figures wherever required.

Q.1 (a) (i) Derive expressions for finding out strain energy stored in a member due to **04**
(a) Gradually loading (b) sudden loading.
(ii) Explain Castiglione's second theorem **03**

(b) A weight of 4 kN is dropped on to a collar at the lower end of vertical bar 3 m long and 30 mm in diameter. Calculate the maximum height of drop if the maximum instantaneous stress is not to exceed 140 Mpa elongations? Take E = 2 x 10^5 N/mm^2. **07**

Q.2 (a) Explain maximum shear stress theory and Distortion Energy theory **07**

(b) Find the diameter of a shaft. If it is subjected to a maximum torque of 25 kN.m and a maximum bending moment of 30 kN.m at a particular section. Take allowable equivalent stress in simple tension as 180 MPa. according to (i) maximum shear stress theory (ii) shear strain energy theory **07**

OR

(b) Steel plate has yield stresses in tension and compression as 300N/mm^2 and 400N/mm^2. Find (compressive) one principal stress if the other stress is 120 N/mm^2. Take f.o.s 2.0, Using, **07**

a. Shear stress theory
b. Distortion energy theory

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) A laminated steel spring simply supported at ends with span of 0.75 m is centrally loaded with a load of 8 kN. The central deflection under the above load is not to exceed 50mm and the maximum stress is to be 400 MPa, determine; (i) width of plate (ii) thickness of plate (iii) number of plates (iv) the radius to which plates should be bent so that the spring become straight under the given 7.5 kN load. Assume width= 10 x thickness and E= 210 GPa. **07**

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) Find the thickness of metal necessary for thick steel cylindrical shell having internal diameter 300 mm to with stand an internal pressure of 50 Mpa. The maximum hoop stress in the section is not to exceed 150 N/mm^2. **07**

Q.4 **(a)** A thick cylindrical shell having internal and external diameters of 200 mm and 400 mm respectively is subjected to internal fluid pressure of 10 MPa. Find the maximum and minimum hoop stresses in the cylinder material and sketch the stress distribution diagram. **07**

(b) A hook of circular section having 30 mm diameter with radius of curvature of its central axis 60 mm carries a load of 8kN. Calculate maximum stresses in hook material. **07**

OR

Q.4 **(a)** A ring made of 60 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**

(b) A cantilever beam loaded as shown in fig. 1 consists of rectangle (0.3mx 0.6 m) and circular 0.6m radius cross section; calculate magnitude and location of maximum shear stress at the point of maximum shear force for each cross section. **07**

Q.5 **(a)** Draw the shear stress distribution across the following section **07**

a. Rectangle
b. Circular
c. Hollow rectangle
d. H -section
e. T-section
f. Hollow circular
g. Angle section

(b) A rolled steel joist of I section as shown in fig 2, if permissible shear stress limited 100 Mpa. Find uniformly distributed load section carry over simply supported span 10 m. **07**

OR

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 1m diameter rotates at 3600 r.p.m. Determine the intensities of principal stresses. Take density of material is 7.85 x 10 $^{-5}$ N/mm^3 and Poisson's Ratio = 1/3. **07**

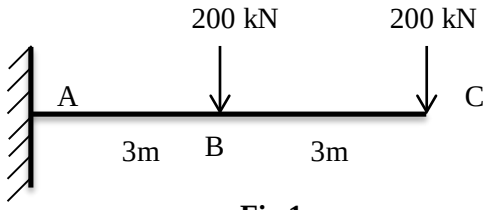

Fig 1

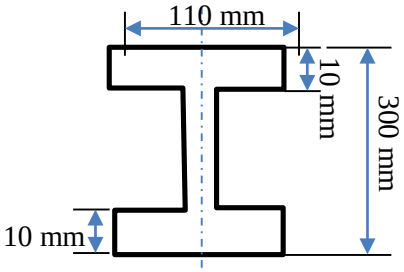

Fig 2

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