Code No: 114DP

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2016
STRENGTH OF MATERIALS-II
(Common to CE, CEE)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (25 Marks)

1.a) A shaft of 20 mm diameter and length 1000 mm is subjected to twisting moment such that θ=0.1 rad. What is the shear strain in the shaft at outer surface? [2]

b) A shaft is subjected to twisting moment, show how shear strain varies along the radius of the shaft. [3]

c) What do you mean by Equivalent length of column? Mention its value for different end conditions of the column. [2]

d) A hollow circular column with D=100 mm and d=80 mm, what is its radius of gyration? [3]

e) What is the kernel of a section? What is its importance? [2]

f) What is the difference between beam and beam column? [3]

g) What do you understand about term Unsymmetrical bending? [2]

h) Define shear center. What is the importance of shear center? [3]

i) In a thick cylinder subjected to internal pressure, explain the assumption that plane section remains plane after the application of internal pressure. [2]

j) Take a small element of a thin spherical shell and show the stresses acting on this element. [3]

PART - B (50 Marks)

2.a) Derive the equation of torsion from fundamentals.

b) Find the power that can be transmitted by a 60 mm diameter shaft at 160 rpm, if the permissible shear stress is 80 N/mm^2 and the maximum torque 30% greater than the mean torque. [5+5]

OR

3. A solid circular steel shaft is required to transmit 60 HP at 200 rpm. Determine the diameter of the shaft, if the maximum shear stress is not to exceed 60 N/mm^2 in shaft. The solid shaft is now replaced by a hollow steel shaft with the internal diameter equal to 75% of the external diameter. Determine the external diameter of the shaft if it is required to transmit the same horse power at same rpm and the maximum shear stress produced is also the same. Find the % saving of the material by using hollow shaft in place of solid shaft. [10]

4. A cast iron column of a hollow circular section with an external diameter of 250 mm and a wall thickness of 45 mm is subjected to an axial compressive load. The column is 7 m long with both ends hinged. Taking factor of safety as 8, determine the safe value of 'P'.

Rankine's constants are, σ_c =560 N/mm, a = 1/1600 [where $a=\sigma_c/\pi^2 E$] [10]

OR

5.a) What are the merits of Rankine's load over Euler's load in buckling?

b) A column of a circular section, diameter 'd' and length L, buckles at a load of 25 KN, when the column is fixed at one end and free at the other end. If both the ends of the column are now fixed, what will be its buckling load? [5+5]

6. A cast iron column of section 200×250 mm is subjected to a vertical load of 300 kN acting at a point 40 mm away (along the diagonal) from the center. Determine the resulting stress at the corners a, b, c and d of the section. (Figure 1) [10]

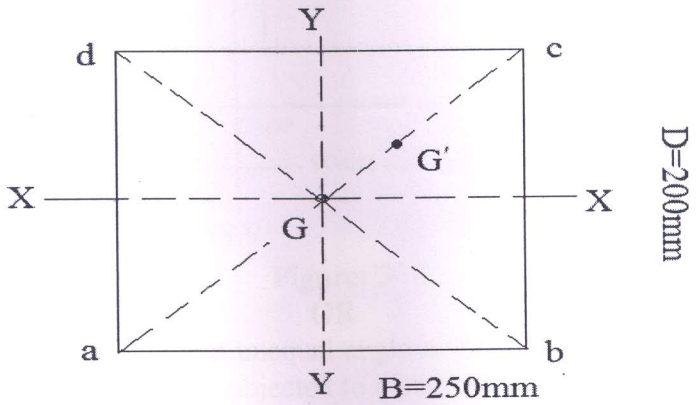

Figure: 1

OR

7. The cross-section of a short column is shown in figure 2. Load of 160 kN is applied at P, 75 mm from edge AD. Section is symmetrical about x-x axis. Determine the stresses at corners A, B, C and D. [10]

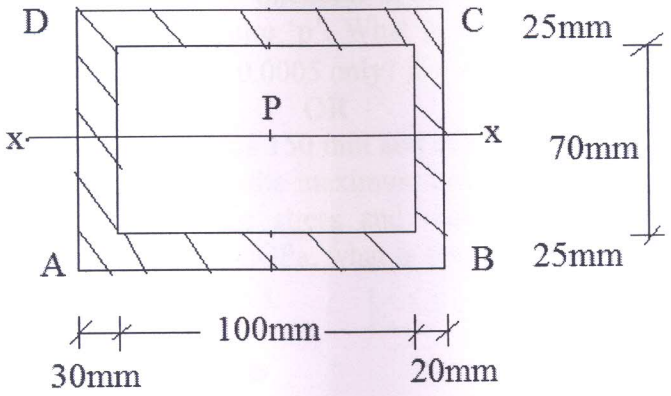

Figure: 2

Calculate the max. tensile stress in the I-section of a simply supported beam of span 3.0 m which carries a load of 7.5 kN at the center of the beam. The load line is inclined at an angle of 30^0 with the vertical as shown in figure 3 and passes through the centroid of the section. The dimensions of the I-section is shown in figure 3. Where U,V, X and Y are principal axes. [10]

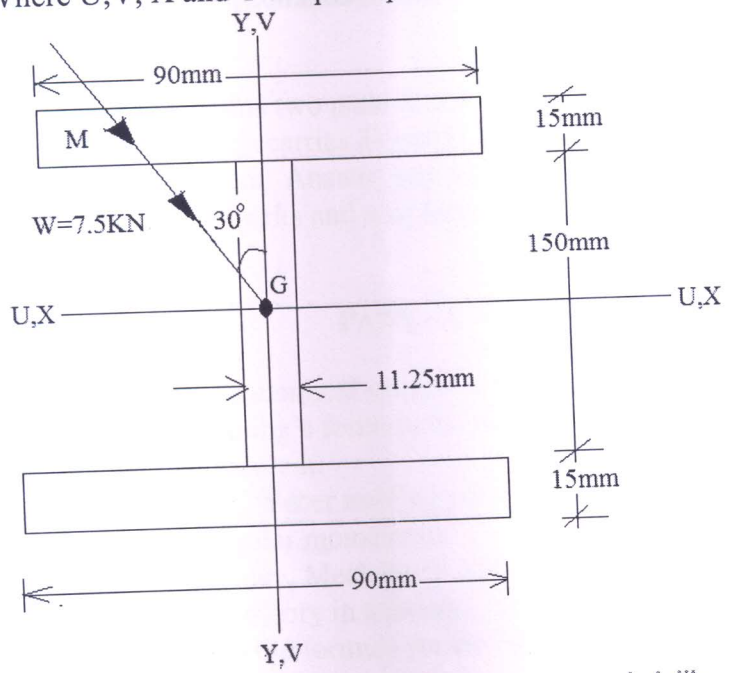

Figure: 3

OR

9. A 60 mm × 40 mm × 6 mm unequal angle is placed with the longer leg vertical, and is used as a beam. It is subjected to a bending moment of 12 kN-cm acting in the vertical plane through the centroid of the section. Determine the maximum bending stress induced in the section. [10]

10.a) Derive the expression for the volumetric strain of a thin spherical shell subjected to internal pressure 'p'.

b) A thin spherical shell of a wall thickness of 2.5 mm and a diameter of 500 mm is subjected to an internal pressure 'p'. What is the magnitude of 'p' if diametral strain in the shell is limited to 0.0005 only? E = 200 GPa, υ =0.3. [6+4]

OR

11. A thick cylinder of inner radius 150 mm and outer radius 210 mm is subjected to internal pressure 'p' such that the maximum hoop stress developed in cylinder is 154.16 Mpa. Draw the hoop stress and radial stress distribution along the thickness of cylinder. If E=200GPa, what is the circumferential strain in cylinder at the outer surface? Take υ =0.3. [10]

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