Code No: 114DP

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, November/December - 2015
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.

PART- A

(25 Marks)

1.a) State the assumptions made in the theory of pure torsion. [2M]

b) A rigid weightless bar is supported by two springs of stiffnesses 200 kN/m and 150 kN/m respectively. Determine the point of action of the load 50 kN on the rigid bar so that the rigid bar remains horizontal. Also find the deformation in each spring. The distance between the two springs is 3 m. [3M]

c) A steel column of solid circular section of radius equal to 75 mm is to be replaced by a column of square section of same material and same end conditions. Determine the size of the square section if the length of both the columns is the same. [2M]

d) Define Euler's critical load and write down the limitations of the Euler's formula. [3M]

e) What are the conditions for stability of a dam? [2M]

f) Define "Core" of a section and obtain the core of a circular section of diameter 300 mm. [3M]

g) Define the shear centre and the principal axes of a cross-section. [2M]

h) Determine the moments of inertia of a rectangular section 150 mm × 300 mm with respect to a set of rectangular axes passing through the centroid and making an angle 30^0 with respect to horizontal and vertical centroidal axes. [3M]

i) A thin cylinder of 1.6 m diameter is made of a material whose allowable tensile stress is 165 N/mm^2. Determine the thickness of the wall if the cylinder is subjected to an internal fluid pressure of 3 N/mm^2. [2M]

j) A thin spherical shell of internal diameter 1.5 m and wall thickness 10 mm is subjected to an internal fluid pressure of 2 N/mm^2. Find the change in volume. Adopt E = 2× 10^5 N/mm^2 and Poisson's ratio is 0.3. [3M]

PART-B

(50 Marks)

2. A solid circular shaft is subjected to a bending moment of 60 kNm and a torque of 25 kNm. Design the shaft according to maximum shear stress theory and maximum distortion theory. Adopt the stress at elastic limit is 250 N/mm^2, Poisson's ratio is 0.3 and the factor of safety is 2. [10]

OR

3.a) A steel close coiled helical spring is subjected to an axial couple of 60 kNmm. The mean coil diameter of the spring is 75 mm and the diameter of the spring wire is 8 mm. If the number of coils of the spring is 15, find the bending stress induced in the wire and the increase in the number of turns.

b) Design a steel leaf spring of span 1.2 m subjected to a central concentrated load of 10 kN. The central deflection is not to exceed 25 mm and the bending stress is limited to 175 N/mm^2. Adopt the width of the plate as 15 times the thickness. [5+5]

4. Design a hollow circular Cast Iron column of length 5 m with both ends fixed subjected to a safe axial load of 250 kN. Adopt the factor of safety as 5 and the internal diameter is 0.85 times the external diameter. The Rankine's constants are $f_c = 550\ MPa$ and $\alpha = \frac{1}{1600}$. [10]

OR

5. A beam, semi-circular in plan of radius equal to 5 m, is simply supported on three equally spaced supports. The beam is subjected to uniformly distributed load of 20 kN/m of curved length. Draw the bending moment diagram and indicate location and magnitude of maximum bending moment. [10]

6. A steel fixed beam-column of I-section, 150 mm × 200 mm × 8 mm, is 3.6 m long. It is subjected to an axial load of 250 kN and a vertical lateral load of 50 kN at its mid-span. Determine the maximum bending moment and maximum stress. [10]

OR

7. A chimney of uniform thickness is 45 m high with external diameter tapers from 4 m at the base to 2.5 m at the top. The internal diameter at the base is 2.5 m. The chimney is subjected to horizontal wind pressure of 2 kN/m^2. The self-weight of the chimney is 2500 kN. Determine the maximum and minimum stresses. [10]

8. A simply supported beam of span 4.5 m has I-section 150 mm × 250 mm × 10 mm. The beam is subjected to a concentrate load of 125 kN at the mid-span in a plane making an angle 30^0 with respect to the vertical and passing through the centroid of the section. Determine the maximum stress developed at the section. [10]

OR

9. An unequal angle section, 150 mm × 115 mm × 12 mm, is placed with the long leg vertical and used as a simply supported beam of span 3 m. What central concentrated load can be placed on the beam in order that the maximum stress due to bending is not to exceed 100 N/mm^2? Also determine the maximum deflection. [10]

10. A thin steel cylindrical shell of thickness 10 mm, 1.5 m diameter and 4.5 m long is carrying a fluid at a pressure of 3.5 N/mm^2. Find the change in diameter, length and volume of the cylinder. Assume E = 2×10^5 N/mm^2 and Poisson's ratio = 0.25. [10]

OR

11. A steel compound cylinder is made by shrinking a cylinder of external diameter 300 mm and internal diameter 250 mm over another cylinder of external diameter 250 mm and internal diameter 200 mm. The radial pressure at the junction after shrinkage is 10 N/mm^2. Find the hoop and radial stresses if the cylinder is subjected to an internal fluid pressure of 100 N/mm^2. [10]

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