R15

Code No: 124DP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2017
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) State the fundamental assumptions made in the theory of torsion. [2]
b) Write an expression for strain energy stored in a shaft of uniform section subjected to torsion. [3]
c) What are the limitations of Euler's column theory? [2]
d) State the assumptions made in Winkler Bach theory for curved beams? [3]
e) What is a beam column? Give an example. [2]
f) What do you mean by core of a column section? [3]
g) What are the causes for unsymmetrical bending of beams? [2]
h) Define shear centre. [3]
i) Outline qualitative stress and pressure diagram across the cross section of a thick cylinder subjected to internal pressure. [2]
j) State the assumptions made in Lame's theory for the analysis of thick cylinders. [3]

PART-B

(50 Marks)

2.a) Compare the weight of a solid shaft with that of a hollow one having same length to transmit a given power at a given speed, if the material used for the shafts is the same. Take the inside diameter of the hollow shaft as 0:6 times the outer diameter.
b) A hollow shaft is to transmit 300 kW at 80 rpm. The internal diameter is 0.6 of the external diameter. The maximum torque is 40% more than the mean torque. If the shear stress is not to exceed 60 N/mm^2, find the external and internal diameters of the shaft. [5+5]

OR

3.a) A hollow shaft with external and internal diameters of 120mm and 80 mm respectively is to be replaced by a solid shaft of the same weight. Find the torques transmitted by the shafts if the permissible shear stress is 100 MPa. If the solid shaft is replaced by a hollow shaft of 160 mm external diameter, what is the torque transmitted for the same weight of the shafts?
b) For a close-coiled helical spring subjected to an axial load of 300 N having 12 coils of wire diameter of 16mm, and made with coil diameter of 250 mm, find: (i) Axial deflection (ii) Strain energy stored (iii) Maximum torsional shear stress in the wire. Take modulus of rigidity as 80 GN/m^2. [5+5]

4.a) A 4 m long hollow circular cast iron column with fixed ends has 200 mm external diameter and 20 mm thickness. The column carries a load of 130 kN at an eccentricity of 30 mm from the axis of the column. Determine (i) the extreme stresses on the cross-section and (ii) the maximum eccentricity when there is no tension anywhere on the cross-section. The elastic modulus-of the material of the column is 60 GPa.

b) Derive the Winkler- Bach formula to calculate the stress in a curved beam subjected to bending. [5+5]

OR

5.a) Derive an expression for Euler's critical load of a column with one end fixed and the other end hinged from first principles.

b) Determine the section of a cast iron hollow cylindrical column 3 m long with both ends fixed, if it carries an axial load of 800 kN. The ratio of internal to external diameter of the column is 5/8. Use Rankine's formula by taking the Rankine's constant as 1/1600 and working crushing strength of material as 550 N/mm^2. [5+5]

6.a) A strut 30mm diameter and 2.2 m long is hinged at both ends. It carries a uniformly distributed load of 60 N/m in addition to an axial thrust of 8000N. Calculate the maximum stress. E=200 GPa.

b) Explain and draw in detail about possible stress distributions in case of an eccentrically loaded column. [5+5]

OR

7.a) Illustrate with suitable examples about Middle-third rule and one-fourth diameter rule.

b) A rod, 2m in length and of rectangular cross-section 88 mm × 44 mm is supported horizontally through pin joints. It carries a vertical load of 3.3 kN/m length and an axial thrust of 110 kN. If E = 208 kN/mm^2, calculate the maximum stress induced. [5+5]

8.a) Analyze the shear center of a channel section of 400 mm × 200 mm outside and 5 mm thick.

b) Explain the concept of unsymmetrical bending. What are the conditions that should be satisfied for a beam to bend without twisting? [5+5]

OR

9.a) Derive general equations for Unsymmetrical bending and also state the assumptions made in analyzing a beam for unsymmetrical bending.

b) Explain the concept of shear centre with a suitable example. [5+5]

10.a) In case of cylindrical shells, what is done to enhance their pressure-bearing capacity? Explain how the shell behaves when such steps are taken.

b) A thick spherical shell, of 250 mm internal diameter is subjected to an internal pressure of 8 N/mm^2. If the maximum permissible tensile stress is 10MPa, find the minimum thickness required. Find the stresses in the interior and exterior of the shell. [5+5]

OR

11.a) Estimate the maximum and minimum hoop stress across the sections of pipe of 400 mm internal diameter and 100 mm thick, the pipe contains a fluid at a pressure of 8N/mm^2. Also sketch the radial pressure distribution and hoop stress distribution across the section.

b) Which shell is more efficient in resisting pressure-the cylindrical or the spherical shell? Why? [5+5]

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