R13

Code No: 114DP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February - 2024

STRENGTH OF MATERIALS – II

(Civil Engineering)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART- A

(25 Marks)

1.a)	State maximum shear strain energy theory of failure.	[2]
b)	What are the differences between closely coiled and open coiled helical spring?	[3]
c)	How eccentric loads affect the design of columns?	[2]
d)	Differentiate between a long column and a short column in terms of its mode of failure.	[3]
e)	How will you interpret the resultant stress in a curved bar subjected to direct stress and bending stress?	[2]
f)	Show the core of the following column sections (i) Rectangular (ii) Circular.	[3]
g)	What are the causes of Unsymmetrical bending?	[2]
h)	Distinguish between shear flow and shear centre.	[3]
i)	Define thick and thin cylinders.	[2]
j)	Discuss briefly on "shrinkage allowance of a compound cylinder".	[3]

PART-B

(50 Marks)

2.a) Deduce the torsion equation stating the assumptions made.
b) Derive the expressions for maximum shear stresses in solid and hollow shafts. [5+5]

OR

3.a) A cylindrical shaft made of steel of yield strength 700 MPa is subjected to a bending moment of 12 kN-m and a torsional moment of 28 kN-m. Determine the diameter of shaft based on the maximum Principal stress theory of failure. Assume factor of safety as 2 and Poisson's ratio (υ) as 0.30.
b) Determine the mean coil radius, wire diameter and number of turns of a closed coiled spring of 1 kN/m stiffness and solid length 45 mm. The shear stress in the spring under the axial load of 75 N should not exceed 180 MPa, modulus of rigidity for the spring material = 82 GPa. [5+5]

4.a) What are the assumptions made in Euler's column theory?
b) Derive expression for Euler's crippling load of a column with both ends fixed from first principles. [5+5]

OR

5.a) A 4 m long hollow cylindrical cast iron column with both ends fixed carries an axial load of 1000 kN. The external diameter of the column is 200 mm. Determine the thickness of the column using Rankine's formula by taking the Rankine's constant as 1/6400 and working crushing strength of material as 78 N/mm^2.

b) A curved bar of rectangular section of 30 mm width, 40 mm depth and mean radius of curvature of 60 mm is initially unstressed. If a bending moment of 400 Nm is applied to the bar which tends to straighten it, determine the stresses at the inner and outer surfaces. [5+5]

6.a) A steel strut, 1 m long, is 30 mm in diameter. It is subjected to an axial thrust of 18kN. In addition, a lateral load W acts at the centre of the strut. If the strut fails at a maximum stress of 350 MN/m^2, determine the magnitude of W. Take E=201 GN/m^2.

b) What are the effects of eccentric loaded column and draw the stress distribution in case of an eccentrically loaded column. [5+5]

OR

7.a) A strut 30mm diameter and 2.2m long is hinged at both ends. It carries a central point load of 150 N in addition to an axial thrust of 8000N. Calculate the maximum stress. E=200 GPa.

b) Explain the effects of wind pressure on chimneys of different cross-sections. [5+5]

8.a) Locate the shear centre for a channel section which has 100 mm wide flanges and 220 mm overall depth. Take the thickness of flanges and web as 2 mm.

b) A 40 mm × 40 mm × 5 mm angle is used as a simply supported beam over a span of 2.4 meters. It carries a load of 200N along the vertical axis passing through the centroid of the section. Determine the resulting bending stresses on the outer corners of the section, along the middle section of the beam. [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) A cantilever of rectangular section 40mm (width) × 60 mm (depth) is subjected to an inclined load P at the free end. The inclination of the load is 25^0 to the vertical. If the length of the cantilever is 2 m and maximum stress due to bending is not to exceed 200 MN/m^2, determine the value of P. [5+5]

10.a) Explain and derive formulae for various stresses developed in cylinders subjected to internal fluid pressures.

b) A steel tube having a bore of 150mm, wall thickness 2.25 mm is plugged at each end to form a closed cylinder with external length of 450mm. If the tube is filled with oil and is subjected to a compressive load of 90kN. Determine the pressure produced on oil. For oil: K (bulk modulus) = 2800 MN/m^2, for steel: E = 210 GN/m^2 and poison's ratio=0.28. [5+5]

OR

11.a) Derive Lame's equations stating assumptions made.

b) A steel tube of 300 mm external diameter is to be shrunk on to another steel tube of 90 mm internal diameter, after shrinking the diameter at the junction is 180 mm, before shrinking on the difference of diameter at the junction is 0.12 mm. Rewrite the:
i) The radial pressure at the junction.
ii) The circumferential stress developed in the two tubes after shrinking on. Take E= 200 GN/mm^2. [5+5]

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