Code No: 154CA **R18**

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) Define the term 'Polar modulus'. [2]
b) Determine the maximum shear stress induced in a solid circular shaft of diameter 100 mm when the shaft transmits 100 kW power at 90 r.p.m. [3]
c) What is beam column? [2]
d) Discuss the limitations of Euler's theory. [3]
e) Name the stability conditions that are checked for dams. [2]
f) A rectangular column (cross-section as shown in Figure. 1) is subjected to 90 kN. Determine the maximum and minimum stresses on the section [3]

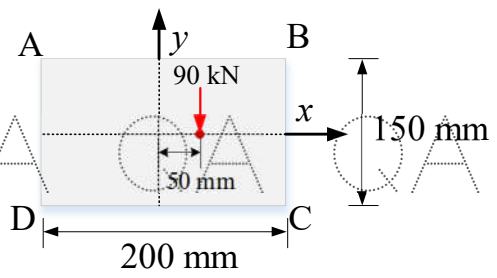


Figure. 1

g) What is Lame's theory? [2]
h) A cylindrical pipe of diameter 1 m and thickness 1 cm is subjected to an internal fluid pressure of 1 MPa. Determine the longitudinal stress. [3]
i) What is the rationale behind the shear centre being referred to as the "centre of twist"? [2]
j) What are the conditions for unsymmetrical bending to occur? [3]

PART – B

(50 Marks)

2. Derive torsion equation, highlighting the assumptions made in the theory of pure torsion. [10]

OR

3. Determine the diameter of wire, mean diameter of the coils, and the number of coils required for a close-coiled helical spring with a stiffness of 2 N/mm, subjected to a maximum load of 90 N. The maximum shearing stress in the wire is 150 N/mm², and the spring has a solid length of 60 mm. Assume $C = 4.5 \times 10^4$ N/mm². [10]

4. Determine the crippling/crushing load for a T-section, as shown in Figure. 2, and of length 5 m when used as a strut with both ends hinged. Consider Young's modulus, E = 200 GPa. [10]

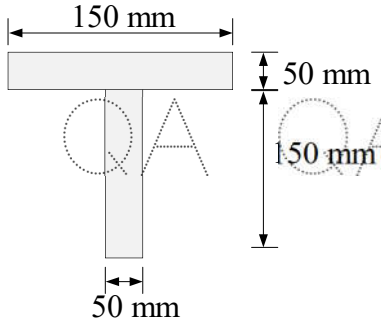


Figure. 2

OR

5. Determine the maximum stress developed in a steel strut with a length of 1.5 m and a diameter of 25 mm. The strut is pinned at both ends and experiences an axial thrust of 15 kN along with a transverse point load of 2.0 kN at the center. Consider E = 200 GN/m². [10]

6. A 20 m high cylindrical chimney having an outer diameter of 4 m and inside diameter 2.5 m is subjected to a wind pressure of 1.8 kPa. Determine the maximum and minimum stresses induced at the base of the chimney. Assume the unit of masonry is 22 kN/m³, and coefficient of wind pressure is 0.7. [10]

OR

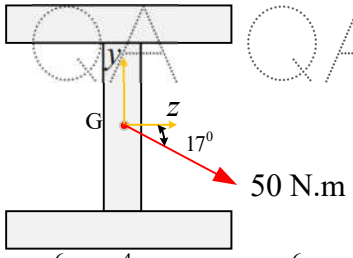
7. A 6 m high masonry retaining wall, trapezoidal in section, is 1 m wide at top. Its earth retaining face is vertical and smooth. The retained earth having unit weight of 15 kN/ m³ and angle of shearing resistance of 30^0 is level with the top of the wall. Determine the minimum bottom width of the wall so that no tension is induced at the base and also find the maximum pressure at this width. Assume unit weight of masonry is 22 kN/m³. [10]

8. Determine the thickness of a cylindrical shell with an internal diameter of 180 mm to resist an internal pressure of 40 N/mm². Ensure that the maximum hoop stress in the section does not exceed 120 N/mm². [10]

OR

9. Derive expressions for hoop stress and longitudinal stress in a thin cylinder with ends closed by rigid flanges and exposed to an internal fluid pressure '*p*', considering the internal diameter and shell thickness as '*d*' and '*t*' respectively. [10]

10. An I-section beam shown in Figure.3 carries a bending moment of 50 kN.m inclined at 17° to the z-axis. Determine the following parameters using the data given below. Determine the angle between the neutral axis & the z-axis and the largest bending stress acting on the section. [10]



$I_z = 71 \times 10^6$ mm^4 $I_y = 7 \times 10^6$ mm^4
$S_z = 534 \times 10^3$ mm^3 $S_y = 95 \times 10^3$ mm^3
I - Moment of Intertia & S- Section Modulus

Figure. 3

OR

11. Determine the shear centre of the channel section shown in Figure.4. [10]

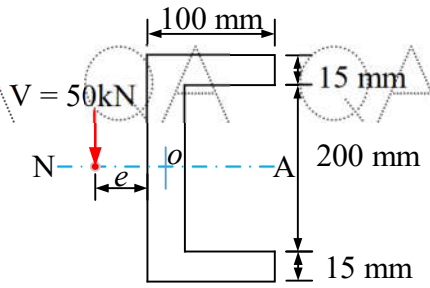


Figure 4

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