Code No: 134CD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, April/May - 2023
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 polar modulus. [2]
b) Why is the shear stress greater at the outer surface of the shaft than at the inner core? [3]
c) Define beam column and give suitable examples for practical application. [2]
d) What are the assumptions of Euler's theorem? [3]
e) Define core (or) Kernel of a section. [2]
f) What do you mean by the following terms?
i) Middle third rule for rectangular sections,
ii) Middle quarter rule for circular sections. [3]
g) How hoop stress in thick cylinders can be effectively reduced? [2]
h) What do you mean by hoop stress and longitudinal stress in thin cylinders? [3]
i) Write the shear center equation for unsymmetrical 'I' section. [2]
j) A rectangular section of breadth 4cm and depth 6cm.What is the product of inertia about the co-ordinate axis passing at one corner of the section and parallel to the sides? [3]

PART – B

(50 Marks)

2. Calculate the maximum torque and the mean power being transmitted by a hollow shaft, outer diameter of which is 0.2m and inner 0.1m, if the shear stress is not to exceed 60MN/m^2 and the shaft speed is 300r.p.m. assume the maximum torque to be 25% more than the mean. [10]

OR

3. Derive the torsion equation from fundamentals, with usual notations.

$$\frac{T}{J}=\frac{q}{r}=\frac{C\,\theta}{L}$$

C or G= modulus of rigidity; q=shear stress, J= polar MI, T= Torsion, Θ=angle of twist [10]

4. Find the Maximum bending moment in a beam-column subjected point load W at midpoint and axial thrust P shown in Figure 1. [10]

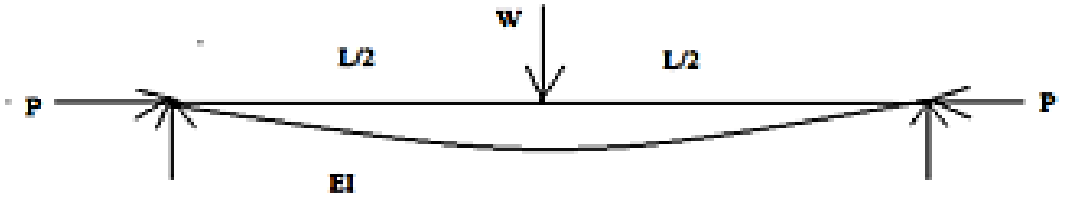

Figure 1

OR

5. Find Euler's critical load for a hollow cylindrical cast iron column 200mm external diameter and 25mm thick, if it is 6m long and hinged at both ends. Take $E=8\times10^4$ N/mm^2. Compare uler's critical load with the Rankine's critical load taking $\sigma_c=550$ N/mm^2 and $\alpha=1/1600$. For what length of the column would the critical loads by Euler's and Rankine's formula be equal? [10]

6.a) A hollow circular section having external diameter 300mm and internal diameter 250mm carries a load of 100KN at an eccentricity of 125mm calculate the max and min intensities of the stress in the section.

b) How will you find the maximum and minimum stresses at the base of a symmetrical column, when it is subjected to load which is eccentric to both axes? [6+4]

OR

7. A curved beam, semicircular in plan and supported on three equally spaced supports. The beam carries a uniformly distributed load of w/unit circular length. Determine and sketch the bending moment and twisting moment's diagrams. [10]

8.a) A thin cylindrical shell 3 m long has 1m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm ^{2}. Take $E = 2\times10^5$ N/mm^2 and poison's ratio =0.3. Also calculate change in volume.

b) A storage tank of internal diameter 280 mm is subjected to an internal pressure of 2.56 MPa. Find the thickness of the tank to resist the hoop and longitudinal stress are 75 MPa and 45 MPa respectively. [7+3]

OR

9. A closed cylindrical vessel made of steel plates 5 mm thick with plane ends, carries fluid under pressure of 6 N/mm ^{2} The diameter of the cylinder is 35cm and length is 85 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and Volume of the cylinder. Take $E=2.1\times10^5$ N/mm^2 and 1/m = 0.286. [10]

10.a) Explain the stresses induced due to unsymmetrical bending.

b) A rectangular-section beam 80 mm × 50 mm is arranged as a cantilever 1.3 m long and loaded at its free end with a load of 5 kN inclined at an angle of 30 ^{0} to the vertical as shown in figure 2. Determine the position and magnitude of the greatest tensile stress in the section. Take E = 210 GN/m^2. [4+6]

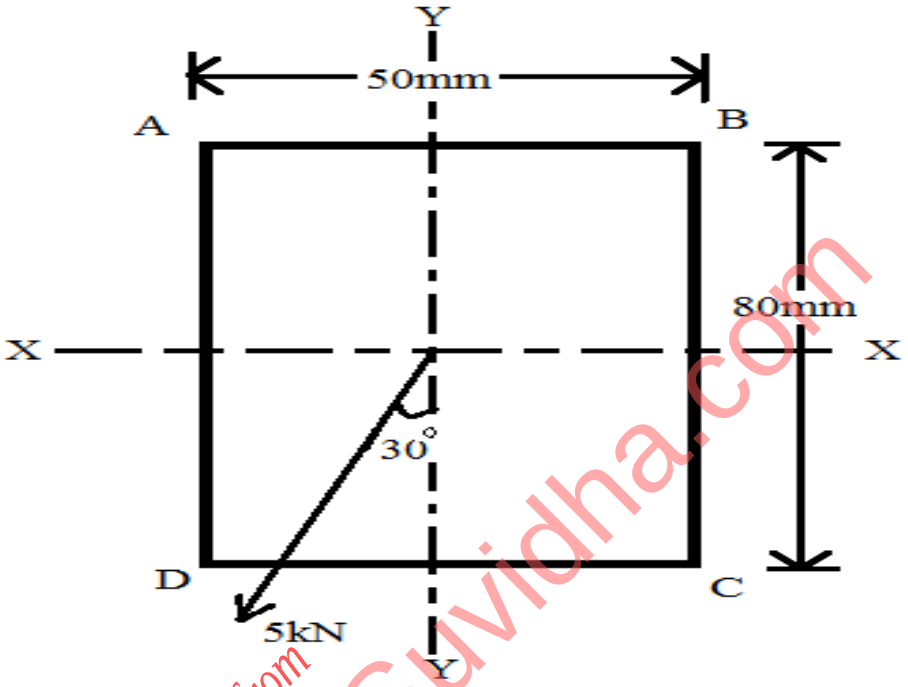

Figure 2

OR

11.a) Explain the concept of un-symmetrical bending. What are the conditions that should be satisfied for a beam to bend with- out twisting?

b) Derive the equation of Shear center for a symmetrical channel section. [5+5]

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