

**R13**

Code No: 114DP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, September/October - 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) Find the torque which a shaft of 50 mm diameter can transmit safely, if the allowable shear stress is  $75 \text{ N/mm}^2$ . [3]
- c) What are the assumptions made in finding stress distribution for a curved flexural member? [2]
- d) A steel column is of length 8 m and diameter 600 mm with both ends hinged. Determine the crippling load by Euler's formula. Take  $E = 2.1 \times 10^5 \text{ N/mm}^2$ . [3]
- e) Differentiate Direct and Bending Stresses. [2]
- f) Define beam column with example. [3]
- g) What do you mean by Shear Center? [2]
- h) Determine the product of inertia of rectangular section of a breadth of 3 cm and depth of 6 cm about the centroidal axis. [3]
- i) Explain briefly about Lamé's theory for thick cylinders. [2]
- j) What do you mean by longitudinal stress and hoop stress? [3]

**PART - B**

**(50 Marks)**

2. A helical spring of circular cross-section wire 18 mm in diameter is loaded by a force of 500 N. The mean coil diameter of the spring is 125mm. The modulus of rigidity is  $80 \text{ kN/mm}^2$ . Determine the maximum shear stress in the material of the spring. What number of coils must the spring have for its deflection to be 6 mm? [10]

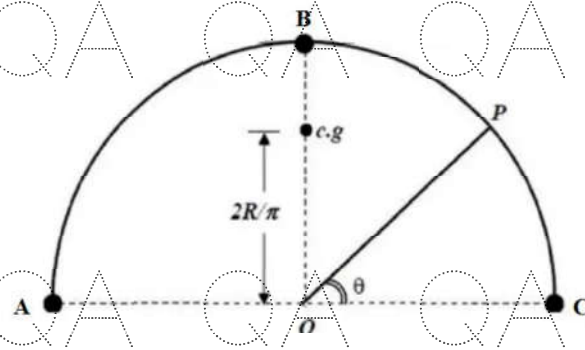
**OR**

3. A solid aluminum shaft 1m long and 100 mm diameter is to be replaced by hollow steel shaft of the same length and same external diameter. The angle of twist per unit torsional moment over total length is same for both the shafts. If the modulus of rigidity of steel is thrice that of aluminum, find the inner diameter of the steel shaft. [10]

4. Derive the expression for Euler's buckling load (or) Crippling load when one end of the long column is fixed and other end is hinged. [10]

**OR**

5. A semi-circular beam as shown in figure is supported on three equally spaced supports carrying uniformly distributed load 'w' N/m over its entire curved length, find Shear force and bending moment at a point P. [10]



6. A square chimney, 30 m high, has a flue opening of size 1.5 m × 1.5 m. Find the minimum width required at the base for no tension if the masonry weights 20kN/m<sup>3</sup> and the wind pressure is 1.5kN/m<sup>2</sup>. The permissible stress in the masonry is 1kN/m<sup>2</sup>. [10]

OR

7. Find the maximum bending moment in a beam –column with simply supported ends and is subjected to axial load 'P' N at two end supports also carrying a uniformly distributed load 'q' N/m at its entire span. [10]

8. A beam of rectangular section 80mm wide and 120mm deep is subjected to a bending moment of 120kN-m. The trace of the plane of loading is inclined at 45° to the y-y axis of the section. Locate the neutral axis of the section and calculate the maximum bending stress induced in the section. [10]

OR

- 9.a) Discuss the deflection of a beam under unsymmetrical bending.  
b) How will you find out the resultant stress in unsymmetrical bending? [5+5]

10. A closed cylindrical vessel made of steel plates 4mm thick with the plane ends, carries fluid under a pressure of 3N/mm<sup>2</sup>. The diameter of cylinder is 25cm and length is 75cm, calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take  $E = 2.1 \times 10^5 \text{ N/mm}^2$  and Poisson's ratio is 0.286. [10]

OR

11. A compound cylinder is made by shrinking a cylinder of external diameter 200 mm and an internal diameter 160 mm over another cylinder of external diameter 160 mm and internal diameter 120 mm. The radial pressure at the junction after shrinking is 8 N/mm<sup>2</sup>. Find the final stress set up across the section, when the compound cylinder is subjected to an internal fluid pressure of 60 N/mm<sup>2</sup>. [10]