Code: 15A01308 **R15**

B.Tech II Year I Semester (R15) Regular Examinations November/December 2016

MECHANICS OF SOLIDS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define tensile stress and tensile strain.

(b) State Hooke's law.

(c) Define shear force at a section of a beam.

(d) Mention the different types of supports.

(e) State the theory of simple bending.

(f) Write the expression for maximum shear stress in case of rectangular section.

(g) Define polar modulus.

(h) What are the boundary conditions for a simply supported end?

(i) Define hoop and longitudinal stress.

(j) What do you mean by thick cylinders?

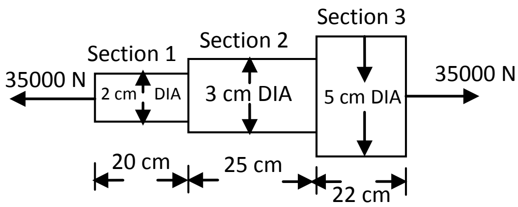
PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 An axial pull of 35000 N is acting on a bar consisting of three lengths as shown in figure below. If the Young's modulus = 2.1×10^5 N/mm^2, determine:

(a) Stresses in each section. (b) Total extension of the bar.

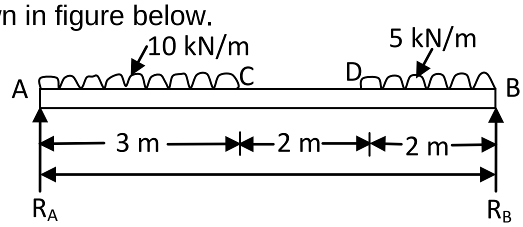


OR

3 A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If, at a temperature of 10℃ there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised to 200℃. Take E for steel and copper as 2.1×10^5 N/mm^2 and 1×10^5 N/mm^2 respectively. The value of co-efficient of linear expansion for steel and copper is given as 11×10^{-6} per ℃ and 18×10^{-6} per ℃ respectively.

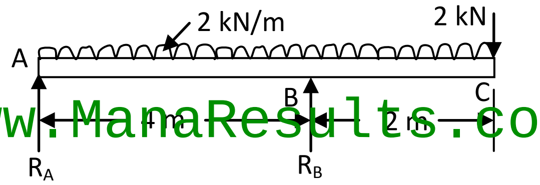
UNIT - II

4 Draw the S.F. and B.M. diagrams of a simply supported beam of length 7 m carrying uniformly distributed loads as shown in figure below.



OR

5 Draw the S.F. and B.M. diagrams for the overhanging beam carrying uniformly distributed load of 2 kN/m over the entire length and a point load of 2 kN as shown in figure. Locate the point of contraflexure.



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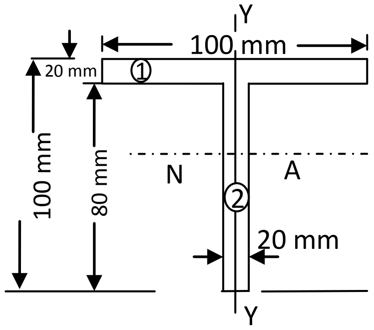
UNIT - III

6 A timber beam of rectangular section is to support a load of 20 kN uniformly distributed over a span of 3.6 m when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed 7 N/mm^2, find the dimensions of the cross-section. How would you modify the cross-section of the beam, if it carries a concentrated load of 20 kN placed at the centre with the same ratio of breadth to depth.

OR

7 The shear force acting on a section of a beam is 50 kN. The section of the beam is of T-shaped of dimensions 100 mm x 100 mm x 20 mm as shown in figure. The moment of inertia about the horizontal neutral axis is 314.221×10^4 mm^4. Calculate the shear stress at the neutral axis and at the junction of the web and the flange.



UNIT - IV

8 Determine the diameter of a solid shaft which will transmit 300 kW at 250 r.p.m. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1° in a shaft length of 2 m. Take modulus of rigidity = 1×10^5 N/mm^2.

OR

9 A beam of length 5 m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length. Calculate the depth of the section if the maximum permissible bending stress is 8 N/mm^2 and central deflection is not to exceed 10 mm. Take the value of E = 1.2×10^4 N/mm^2.

UNIT - V

10 A cylindrical vessel is 1.5 m diameter and 4 m long is closed at ends by rigid plates. It is subjected to an internal pressure of 3 N/mm^2. If the maximum principal stress is not to exceed 150 N/mm^2, find the thickness of the shell. Assume E = 2×10^5 N/mm^2 and Poisson's ratio = 0.25. Find the changes in diameter, length and volume of the shell.

OR

11 A steel cylinder of 300 mm external diameter is to be shrunk to another steel cylinder of 150 mm internal diameter. After shrinking the diameter at the junction is 250 mm and radial pressure at the common junction is 28 N/mm^2. Find the original difference in radii at the junction. Take E = 2×10^5 N/mm^2.

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