Code: 15A01308 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 2017

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) What is the difference between elasticity and plasticity?

(b) Define strain energy.

(c) Derive a relation between shear force and bending moment.

(d) Define point of contraflexure.

(e) What is neutral axis?

(f) What is the difference between normal and shear stress?

(g) Define polar sectional modulus.

(h) What is moment area method?

(i) What is hoop stress?

(j) What is Lame's theorem?

PART – B

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

UNIT – I

2 (a) Explain the main aspects of stress strain diagram for mild steel.

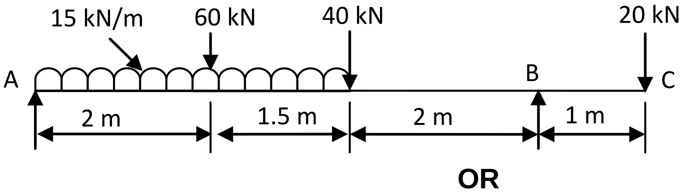
(b) The modulus of rigidity for a material is 0.5 x 10^5 N/mm. A 12 mm diameter rod of the material was subjected to an axial pull of 14 kN and change in diameter was observed to be 3.6 x 10^{-3} mm. Calculate Poisson's ratio and modulus of elasticity.

OR

3 A copper rod of 40 mm diameter is surrounded tightly by a cast iron tube of 80 mm external diameter, the ends being firmly fastened together. Calculate the sharing of load when subject to a compressive load of 30 kN. Also calculate the decrease in length of the composite system if it is 2 m long. Take E_{CU} = 75 GPa and E_{CI} = 175 GPa.

UNIT – II

4 Draw shear force and bending moment diagram for the beam below. Also determine its point of contraflexure.



OR

5 A beam of 8 m length is simply supported at its ends. It carries a uniformly distributed load of 20 kN/m run over the length of left half of its span, together with concentrated load of 20, 40 and 20 kN situated at 1, 2 and 3 m respectively from right hand support. Draw the shear force and bending moment diagrams for this beam and find out the magnitude arid position of the maximum bending moment taking place in this beam.

Contd. in page 2

UNIT – III

6 (a) What are the assumptions made in simple theory of bending?

(b) Derive relation between bending moment and bending stress.

OR

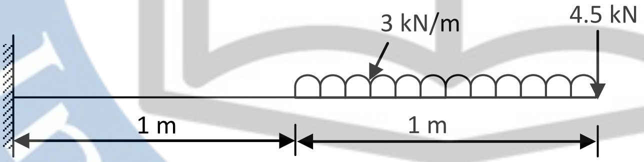
7 Derive an expression for shear stress distribution across a rectangular section.

UNIT – IV

8 A hollow shaft, having an internal diameter 40% of its external diameter, transmits a power of 500 kW at 100 r.p.m. Determine the external diameter of the shaft if the shear stress is not to exceed 60 N/mm^2 and the twist in a length of 3 m should not exceed 1.5 degrees. Assume maximum torque is equal to 1.25 times the mean torque and modulus of rigidity = 8 x 10^4 N/mm.

OR

9 A 2 meter long cantilever of rectangular section 150 mm wide and 300 mm deep is shown in figure. Calculate the deflection at the free end. E = 10.5 GN/m^2.



UNIT – V

10 (a) What is meant by thick cylinder? What is the important assumption made in the analysis of thick cylinders?

(b) A thick cylindrical pipe of outside diameter 340 mm and internal diameter of 220 mm is subjected to an internal fluid pressure of 28 MPa and external fluid pressure of 7 MPa. Determine the hoop stress developed and draw the variation of hoop stress and radial stress across the thickness.

OR

11 A compound steel cylinder has a bore of 80 mm and an outside diameter of 160 mm, the diameter at the common surface being 120 mm. Find the radial pressure at the common surface which must be provided by shrinkage if the resultant maximum hoop tension in the inner cylinder under a superimposed internal pressure of 60 N/mm^2 is to be half the value of the maximum hoop tension which would be produced in the inner cylinder if that cylinder alone were subjected to an internal pressure of 60 N/mm^2. Determine the final hoop tensions at the inner and outer surfaces of both cylinder under the internal pressure of 60 N/mm^2 and sketch a graph to show the hoop tension varies across the cylinder wall.

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