Code No: 113AC

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June-2015

MECHANICS OF SOLIDS

(Common to ME, MCT, MMT, AE, AME, MSNT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

Part- A **(25 Marks)**

1.a) What is proof resilience? How to calculate it for gradual applied loading? [2M]
b) Draw the stress strain diagram for the mild steel and discuss. [3M]
c) Derive the relation between shear force and loading condition for the beams. [2M]
d) Explain the importance of point of contra flexure. [3M]
e) What is section modulus? Write the equation for circular section. [2M]
f) Draw the shear stress distribution across the triangular cross sectional beam. [3M]
g) Write the equations for principal stress and strain for biaxial loading. [2M]
h) What are the favourable conditions for applying the maximum principal stress theory? Explain the significance. [3M]
i) What is the amount of power transmitted by the shaft subjected to torque? [2M]
j) What is volumetric strain of thin spherical shell? Explain. [3M]

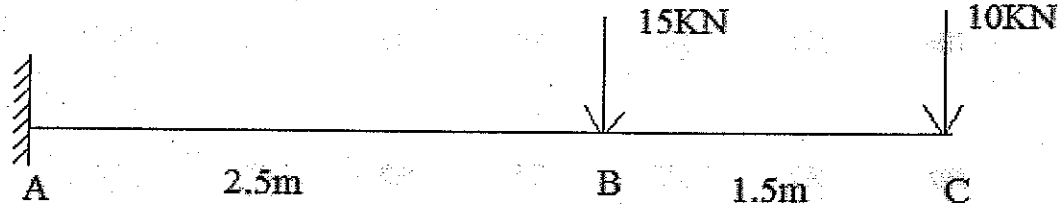
Part-B **(50 Marks)**

2.a) Determine the strain at a tensile stress of 200 MPa and the corresponding Youngs modulus of a bar is made of a material having the relationship given by $\sigma = 75000.00 \in (1.0 - 50.0 \in)$ and the ultimate strain of the material is 0.004.
b) Determine the constitutive relationship for a non – Hookean material with an ultimate strain of 0.0045, σ =180.0 MPa and an initial tangent modulus of 190.0GPa. Assume parabolic behavior. [4+6]

OR

3.a) Derive the relation between Bulk modulus and Modulus of rigidity.
b) A rigid bar AB 9 m long is suspended by two vertical rods at its ends A and B and hangs in horizontal position by its own weight. The rod at A is brass, 3 m long, 1000 mm^2 area and E is 10^5 N/mm^2. The rod at B is steel, 5 m long, 450 mm^2 area and E is 2×10^5 N/mm^2. At what distance `d' from A may a vertical load P = 5 kN be applied if the bar is to remain horizontal even after the load is applied. [3+7]

4. Sketch the shear force and bending moment diagrams showing the salient values for the loaded beam shown in the figure below. [10]



OR

5. A beam of length 6m is simply supported at its ends. It is loaded with a gradually varying load of 750 N/m from left end to 1500 N/m to the right end. Construct the SF and BM diagrams and find the magnitude and position of the maximum BM. [10]

6.a) A rectangular beam 300 mm wide and 460 mm deep is simply supported over a span of 8.5 m. What u.d.l the beam may carry if the bending stress is not to exceed 150 MPa?

b) Explain the design procedure for simple beam section of I cross section. [6+4]

OR

7.a) Prove that for a rectangular section the maximum shear stress is 1.5 times the average stress. Sketch the variation of shear stress.

b) A timber beam 120 mm wide and 185 mm deep supports a u.d.l. of intensity w kN/m length over a span of 2.7 m. If the safe stresses are 29 MPa in bending and 3 MPa in shear, calculate the safe intensity of the load which can be supported by the beam. [4+6]

8. At a point in an elastic material, a direct tensile stress of 60 N/mm^2 and a direct compressive stress of 40 N/mm^2 are applied on planes at right angles to each other. If the maximum principal stress in the material is to be limited to 65N/mm^2. Find out the shear stress that may be allowed on the planes. Also determine the magnitude and the direction of the minimum principal stress and the maximum shear stress. [10]

OR

9. A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on a plane at right angle, together with shear stresses of 63 N/mm^2 on the same planes Find: a) the direction of the principal planes; b) the magnitude of the principal stresses; c) the magnitude of the greatest shear stresses. [10]

10. Derive the formula for thickness of thin cylindrical shell and solve the following problem. A thin cylindrical shell of 1 m diameter is subjected to an internal pressure of 1 N/mm^2. Calculate the suitable thickness of the shell, if the tensile strength of the plate is 400 N/mm^2 and factor of safety is 4. [10]

OR

11. A torque of 3.3 kNm acts on the cross section of a solid circular shaft, 80 mm diameter. What is the bending moment which can act on this section in addition to the given torque so that the maximum shear stress is 60 MPa and maximum normal stress is 100 MPa? Calculate the maximum and minimum principal stresses for this combination of torque and bending moment. [10]

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