R18

Code No: 153BE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, March - 2022

MECHANICS OF SOLIDS

(Common to ME, MCT, MIE)

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

Answer any five questions

All questions carry equal marks

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1.a) What is composite section? Explain the procedure for finding the stresses developed when a composite section is subjected to an axial load?

b) A bar of 35mm diameter is subjected to a pull of 45kN. The measured extension on gauge length of 250 mm is 0.09 mm and the change in diameter is 0. 029mm. Calculate the value of Poisson's ratio and the three moduli. [8+7]

2.a) Derive total elongation expression for bars of varying cross section.

b) A copper bar of 15mm diameter gets stretched by 1 mm under a steady load of 5 kN. What stress would be produced in the bar by a weight 550 N, the weight falls through 80mm before striking the collar rigidly fixed to the lower end of the bar? Take Young's modulus for the bar material as 110 GPa. [7+8]

3.a) Draw the shear force and bending moment diagram for a cantilever beam of length l subjected to UDL along its total length and point load at the free end.

b) A beam 6m long and simply supported at each end has a uniformly distributed load of 800 N/m extending from the left end to a point 2 m away. There is also a clockwise couple of 100kN-m at the center of the beam. Draw SFD and BMD. [7+8]

4.a) Draw the shear force and bending moment diagram for a simply supported beam of length l subjected to UDL along its total length and point load at the center.

b) A cantilever of length 4m carries a of 3kN/m run over the whole length and two point loads of 4kN and 2.5kN are place 1m and 2m respectively from the fixed end. Draw the shear force and BM diagram. [7+8]

5.a) State the assumptions made in the theory of simple bending and derive the bending formula.

b) A rectangular beam 320 mm deep is simply supported over the span of 5 m. Determine the uniformly distributed load per meter which the beam may carry, if the bending stress should not exceed 120 N/mm^2. Take $I=8\times10^6$ mm^4. [8+7]

6.a) Derive the expression for shear stress in a beam. How it is distributed over the cross section of a rectangular beam?

b) A beam of rectangular cross section is 5m long. It is simply supported and carries UDL of 12 kN/m over the whole span. If the maximum bending stress is limited to 6 N/mm^2, find the width and depth of section if depth is twice the width. [7+8]

7.a) Obtain an expression for the major and minor principal stresses on a plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress.

b) In a material the principal stresses are 60 N/mm^2, 50 N/mm^2 and – 40 N/mm^2. Calculate the total strain energy, volumetric strain energy, shear strain energy and factor of safety on the total strain energy criterion if the material yields at 100 N/mm^2. [7+8]

8.a) Derive an expression for the angle of twist for a hollow circular shaft with external diameter D, internal diameter d, length l and rigidity modulus G.

b) A circular shaft of 1200mm diameter and 2.5 m length is subjected to a twisting moment which creates a shear stress of 30 N/mm^2 at 30mm from the axis of the shaft. Calculate the angle of twist and the strain energy stored in the shaft. Take $G=8\times10^4$ N/mm^2. [7+8]

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