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Total number of printed pages = 4

19/4th Sem/DME 405

2022

STRENGTH OF MATERIALS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Define stress, strain and elasticity. Derive a relation between stress and strain of an elastic body. 6

   (b) State clearly the Hooke's law. 2

   (c) Write from fundamental, the relation for the deformation of a body, when it is subjected to : 4

   (i) a tensile force and

   (ii) its own weight.

   (d) What is Principle of the superposition ? Explain its uses. 2

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(e) Explain the differences between 'Primary strain' and 'Secondary strain'. 4

(f) Define Poisson's ratio. 2

2. (a) A straight bar of 500 mm length has its cross-sectional area of 500 mm^2. Find the magnitude of the compressive load under which it will decrease its length by 0.2mm. Take E for the bar material as 200 GPa. 6

(b) A hollow cylinder 4 m long has outside and inside diameters of 75 mm and 60 mm respectively. Find the stress and deformation of the cylinder, when it is carrying an axial tensile load of 50 kN. Take E = 100. GPa. 8

(c) A copper rod, circular in cross-section, uniformly tapers from 40 mm to 20 mm in a length of 11m. Find the magnitude of force, which will deform it by 0.8 mm. Take E = 100 GPa. 6

3. (a) Explain clearly the term 'Modulus of rigidity'. 3

(b) A metal bar 50 mm × 50 mm in section is subjected to an axial compressive load of 500 kN. If the contraction of a 200 mm gauge length was found to be 0.5 mm and the

increase in thickness 0.04 mm, find the values of Young's modulus and Poisson's ratio for the bar material. 8

(c) In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of the three moduli. 9

4. (a) The stresses at point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses by analytical method on a plane inclined at an angle of 55° with the axis of major tensile stress . Also find the magnitude of the maximum shear stress in the component. 10

(b) The stresses at a point in a component are 100 MPa (tensile) and 50 MPa (compressive). Determine the magnitude of the normal and shear stresses on a plane inclined at an angle of 25° with tensile stress. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress. by using 'MOHR'S CIRCLE'. 10

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5. (a) Define principal planes and principal stresses and explain their uses. 5

(b) Define the terms 'Shear force' and 'Bending moment'. 5

(c) Write the assumptions in the Theory of Simple bending. 5

(d) Classify the types of beam. 2

(e) What are springs ? Name the two important types of spring. 3

6. (a) Compare and contrast among torsion, bending and torque. 5

(b) List the assumptions made in the Theory of Torsion ? 4

(c) Write the expression for power transmitted by a shaft. 2

(d) What is meant by Stiffness ? Write the formula for stiffness of a close coiled helical spring subjected to axial load. 4

(e) State 'Triangle law' and 'Polygon Law of forces. 5

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