CBCS SCHEME

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17MN34

Third Semester B.E. Degree Examination, June/July 2019
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define the terms : Elasticity, Elastic limit , Young's modulus and Modulus of rigidity. **(04 Marks)**

b. A rod 150cm long and of diameter 2.0cm is subjected to an axial pull of 20kN. If the modulus of elasticity of the material of the rod is 2×10^5 N/mm^2. Determine
i) The stress ii) The stain and iii) The elongation of the rod. **(06 Marks)**

c. Prove that the total extension of a uniformly tapering rod of diameters D_1 and D_2 , when the rod is subjected to an axial load P is given by

$$dL = \frac{4PL}{\pi E D_1 D_2}.$$ **(10 Marks)**

OR

2 a. Find an expression for the total elongation of a uniformly tapering rectangular bar when it is subjected to an axial load P. **(10 Marks)**

b. A reinforced short concrete column 250mm × 250mm in section is reinforced with 8 steel bars. The total area of steel bars is 2500mm^2. The column carries a load of 390 kN. If the modulus of elasticity for steel is 15 times that of concrete, find the stresses in concrete and steel. **(10 Marks)**

Module-2

3 a. At a point within a body subjected to two mutually perpendicular directions, the stresses are 80N/mm^2 tensile and 40N/mm^2 tensile. Each of the above stresses is accompanied by a shear stress and resultant stress on an oblique plane inclined at an angle of 45^0 with the axis of minor tensile stress. **(10 Marks)**

b. The stresses at a point in a bar are 200N/mm^2 (tensile) and 100N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60^0 to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at the point. (Using Mohr's circle method). **(10 Marks)**

OR

4 a. Define and explain the terms : Longitudinal strain , lateral strain and Poisson's ratio. **(06 Marks)**

b. Determine the Poisson's ratio and bulk modulus of a material for which Young's modulus is 1.2×10^6N/mm^2 and modulus of rigidity is 4.8×10^4 N/mm^2. **(06 Marks)**

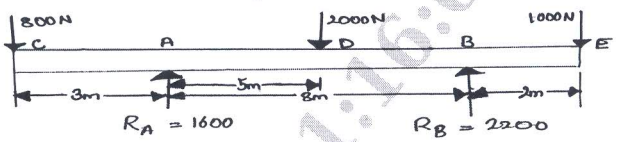
c. A metallic bar 300mm × 100mm × 40mm is subjected to a force of 5kN (tensile) , 6kN(tensile) and 4kN (tensile) along x, y and z directions respectively. Determine the change in the volume of the block. Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio = 0.25. **(08 Marks)**

Module-3

5 a. What are the different types of loads acting on a beam? Differentiate between a cantilever and a simply supported beam. **(06 Marks)**

b. Draw the S.F and B.M diagrams for the beam which is loaded as shown in Q5(b). Determine the points of contra flexural within the span AB. **(14 Marks)**

Fig.Q5(b)

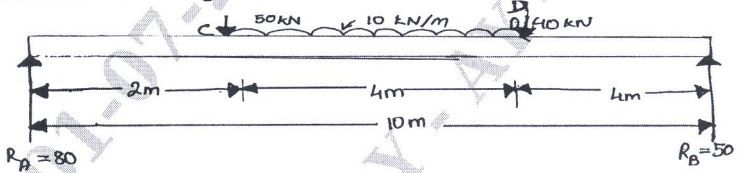


OR

6 a. Draw the S.F and B.M diagrams for a cantilever of length L carrying a point load W at the free end. **(06 Marks)**

b. A simply supported beam of length 10m, carries the uniformly distributed load and two point loads as shown in fig. Q6(b). Draw the SF and BM diagram for the beam. Also calculate the maximum bending moment. **(14 Marks)**

Fig.Q6(b)

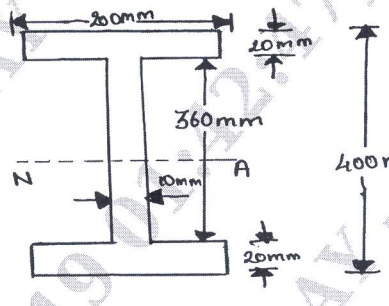


Module-4

7 a. Prove that relation $\frac{M}{I}=\frac{\sigma}{Y}=\frac{E}{R}$. **(10 Marks)**

b. A rolled steel foist of I section has the dimensions as shown in Q7(b). This beam of I section carries a udℓ of 40kN/m run on a span of 10m, calculate the maximum stress produced due to bending. **(10 Marks)**

Fig.Q7(b)



OR

8 a. Derive an expression for the slope and deflection of a beam subjected to uniform bending moment. **(10 Marks)**

b. A beam 3 m long, simply supported at its ends, is carrying a point load w at the center. If the slope at the ends of the beam should not exceed 1^0, find the deflection at the center of the beam. **(10 Marks)**

Module-5

9 a. Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion what are the assumptions made in the derivation. **(12 Marks)**

b. Find the maximum shear stress induced in a solid circular shaft of diameter 15 cm when the shaft transmits 150 kW power at 180 rpm. **(08 Marks)**

OR

10 a. Derive the relation for a circular shaft when subjected to torsion as given below :

$\frac{I}{J}=\frac{\tau}{R}=\frac{C\theta}{L}$. **(10 Marks)**

b. A solid shaft of 150mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is $45N/mm^2$. **(10 Marks)**