CBCS SCHEME

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17MR34

Third Semester B.E. Degree Examination, Aug./Sept. 2020
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 : i) Elasticity ii) Plasticity. **(05 Marks)**

b. Derive the Expression of change in length for uniformly tapering circular bar. **(10 Marks)**

c. Calculate the Nature and magnitude of stress induce in the rod 2m long and 20mm diameter. Where its temperature raises by 70°C with both ends constrained. Take $E = 1 \times 10^5 N/mm^2$ and $\alpha = 1.2 \times 10^{-5} °C$ **(05 Marks)**

OR

2 a. Explain relationship between modulus of rigidity and modulus of elasticity. **(10 Marks)**

b. A steel wire of 10mm diameter is used for lifting a load of 1kN at its lowered, the length of the wire having vertically being 200m. Taking unit weight of steel = $78kN/m^3$ and $E = 2 \times 10^5 N/mm^2$. Calculate the total elongation of wire. **(10 Marks)**

Module-2

3 a. Find the expression of normal stress and tangential stress for member subjected to direct stresses on two mutually perpendicular directions. **(10 Marks)**

b. A point of at principal stress in a bar $200N/mm^2$ (Tensile) and $100N/mm^2$ (compressive). Determine the resultant stress in magnitude and direction a plane inclined at 60° to the axis of major principal stress. Also determine the maximum intensity of shear stress in material at the point. **(10 Marks)**

OR

4 a. Derive the Lame's equations for thick cylinder. **(10 Marks)**

b. Derive the expressions for circumferential stress and longitudinal stress in thin cylinder. **(10 Marks)**

Module-3

5 a. Draw SFD and BMD for the beam shown in Fig Q5(a). Locate the point of contra flexure if any.

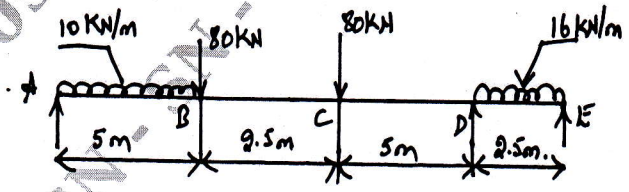

Fig Q5(a) **(15 Marks)**

b. Explain the terms :
i) Point of contra flexure
ii) Hogging bending moment. **(05 Marks)**

OR

6 a. List the different kinds of beams and loads? Explain with sketches. **(12 Marks)**

b. Draw shear force and bending moment diagram for a simply supported beam with a point load at mid-point. **(08 Marks)**

Module-4

7 a. Derive a Bending moment equation. **(10 Marks)**

b. A simply supported beam of 'I' section carries a uniformly distributed load of 40kN/m runs on entire span of beam of length 10m. If 'I' section is having dimensions of flange 200mm × 20mm and wed of 360mm × 10mm determine the maximum stress produced due to bending. Draw stress distribution. **(10 Marks)**

OR

8 a. Prove that in a rectangular cross section maximum shear stress at the natural surface 1.5 times the average shear stress. **(10 Marks)**

b. A beam of T section has flanges 100mm × 20mm and web 200mm × 12mm is subjected to a vertical shear force of 200kN. Find the shear stress at the flange, function and neutral axis. Sketch the stress distribution. **(10 Marks)**

Module-5

9 a. Write the Relation between torque and shear stress in a solid circular shaft. **(10 Marks)**

b. A solid shaft rotating at 1000rpm transmits 50kW. Maximum torque is 20% more than the mean torque. Material of the shaft has the allowable shear stress of 50MPa and modulus of rigidity 80GPa. Angle of twist in the shaft should not exceed 1° in one meter length. Determine the diameter of the shaft. **(10 Marks)**

OR

10 a. Derive the expression for Euler's crippling load for a column when both ends are fixed. **(10 Marks)**

b. A column of timber sections is 200mm×300mm and 5m long. One end of the column is fixed and the end is free. If E = 17.5kN/mm^2. Determine :

i) Crippling load ii) Safe load if FOS is 2.5. **(10 Marks)**

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