CBCS SCHEME

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17MN34

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

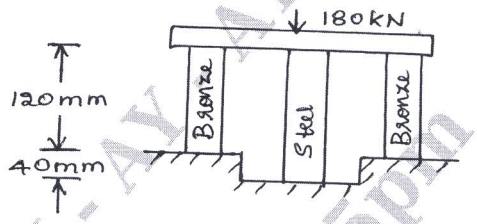
Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain the stress – strain curve for ductile material explaining all the salient points on the curve. **(10 Marks)**

b. Determine the stresses and deformation induced in the bronze and steel compound bars shown in the fig.Q1(b). The particulars of bronze and steel bars are :
Area of bronze bar , $A_B = 600\ mm^2$; Area of steel bars, $A_{St} = 1000\ mm^2$.
Young's modulus of bronze bar , $E_B = 0.83 \times 10^5 MPa$
Young's modulus of steel bar , $E_{St} = 2 \times 10^5\ MPa$. **(10 Marks)**

Fig.Q1(b)

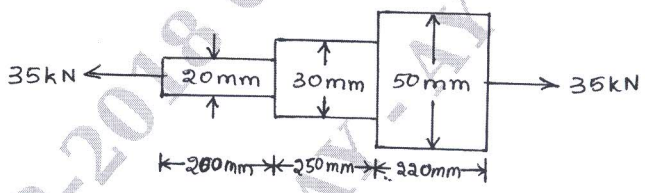


OR

2 a. Derive the expression for the deformation of a uniformly tapered bar with circular cross – section subjected to tensile load. **(10 Marks)**

b. An axial pull of 35kN is acting on a circular bar consisting of three lengths as shown in the fig. Q2(b). If the Young's Modulus is 2×10^5 MPa, determine the stresses in each section and the total extension in the bar. **(10 Marks)**

Fig.Q2(b)



Module-2

3 a. Derive an expression to obtain the relationship between Young's Modulus (E) , Bulk Modulus (K) and Rigidity Modulus (G). **(10 Marks)**

b. At a point in a strained material, the principle tensile stresses across two perpendicular planes are $80N/mm^2$ and $40N/mm^2$. Determine the normal stress, shear stress and resultant stress on a plane inclined at 20^0 with the major principle plane by using Mohr's circle method. **(10 Marks)**

OR

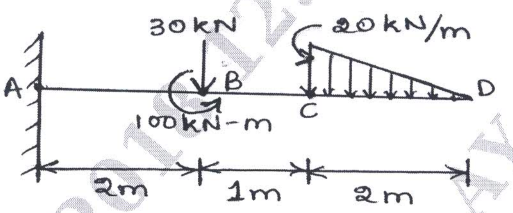
4 a. Derive an expression for circumferential stress and longitudinal stress of a thin cylinder. **(10 Marks)**

b. A thin cylindrical shell of 0.6m diameter and 0.9m long is subjected to an internal pressure of $1.2N/mm^2$. Thickness of cylinder wall is 15mm. Determine i) Longitudinal stress, circumferential stress and maximum shear stress induced ii) Change in diameter, length and volume. Take $E = 2 \times 10^5 N/mm^2$ and $\gamma = 0.3$. **(10 Marks)**

Module-3

5 Draw the shear force and bending moment diagram for a cantilever subjected to forces as shown in the fig. Q5. Locate the point of contraflexure. **(20 Marks)**

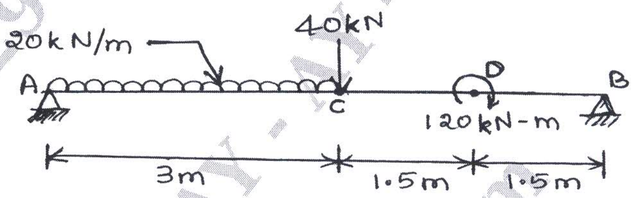
Fig.Q5



OR

6 Draw the shear force and bending moment diagram for the beam as shown in the fig. Q6. Find the maximum bending moment where the shear force is zero. **(20 Marks)**

Fig.Q6

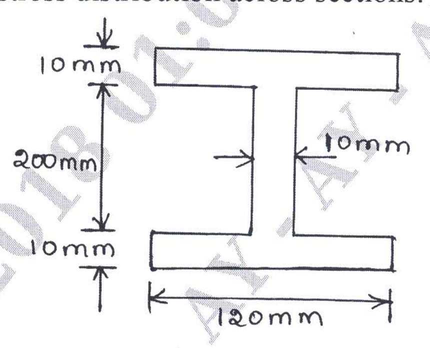


Module-4

7 a. State the assumptions made in the theory of simple bending. Derive the expression for relation between moment and Radius of curvature. **(10 Marks)**

b. The cross – section of a beam which is subjected to a shear force of 50kN is shown in the fig.Q7(b). Sketch the shear stress distribution across sections. **(10 Marks)**

Fig.Q7(b)



Symmetric I - Section

OR

8 a. Derive an expression for deflection, $EI\frac{d^2y}{dx^2} = M$ with usual notations. **(10 Marks)**

b. A cantilever beam of 2m length is subjected to a uniformly distributed load of 10kN/m over its full length and a vertically downward point load of 20kN at its free end.
Taking $E = 2 \times 10^5$ N/mm^2 and maximum deflection as 0.3mm, determine the moment of Inertia (I) and hence the width and depth of the rectangular cross – section beam.
Note : Depth of the section is twice the width. **(10 Marks)**

Module-5

9 a. State the assumptions made in the theory of pure tension. Derive an expression for relation between Angle of twist and shear stress. **(10 Marks)**

b. A solid shaft rotating at 500 rpm transmits 30 kW power. Maximum torque is 20% more than the mean torque. Material of shaft has the allowable shear stress of 65 MPa and a Modulus of rigidity of 81 GPa. Angle of twist in the shaft should not exceed 1^0 in 1m length. Determine the diameter of shaft. **(10 Marks)**

OR

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

b. A 2m long column has a square cross section of side 40mm. Taking the factor of safety as 4, determine the safe load for the end conditions when,

i) One end is fixed and other end is free.
ii) Both the ends are fixed.
iii) One end is fixed and other end is hinged. **(10 Marks)**

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