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C20-M–305

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—2023

DME – THIRD SEMESTER EXAMINATION

STRENGTH OF MATERIALS

Time : 3 Hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. Define and write the units of *(a)* stress and *(b)* strain.

2. Draw the stress-strain diagram for ductile material and locate salient points on it.

3. Write the relation between *(a)* E and C, *(b)* E and K and *(c)* E, C and K.

4. Define : *(a)* resilience and *(b)* modulus of resilience.

5. A circular rod of diameter 10 mm and length 1 m is subjected to a load of 500 N. Find the strain energy in the rod. Take $E = 2 \times 10^5$ N/mm^2.

6. Find the instantaneous stress in a rectangular bar of dimensions 20 × 40 mm when it is subjected to a load of 1 kN *(a)* gradually and *(b)* suddenly.

7. Draw line diagrams of any three types of beams.

8. List the assumptions made to derive the bending equation.

9. Define slope and deflection of a beam.

10. Find the torque transmitted by the circular shaft if it is transmitting a power of 25 kW at 450 rpm.

PART—B

8×5=40

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

11. *(a)* A steel bar, 600 mm long, is 28 mm in diameter for 240 mm of its length, 20 mm in diameter for 200 mm of its length and 16 mm in diameter for the remaining length. It is subjected to an axial pull of 20 kN. If $E = 210$ GN/m^2, calculate the extension of the bar and stress in each section.

(OR)

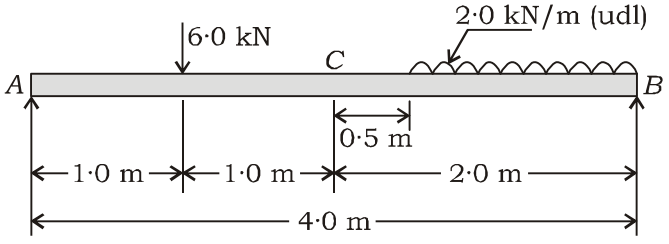
(b) A bar of steel 28 mm in diameter was subjected to a tensile load of 6 kN and the measured extension on a 200 mm gauge length was 0·09 mm and the change in diameter was 0·00375 mm. Calculate Poisson's ratio and the values of the three elastic constants.

12. *(a)* A cantilever beam is subjected to a UDL of 500 N/m over a length of 1·5 m from the free end. It is also subjected to a point load of 1500 N at a distance of 1 m from the fixed end. By taking the length of the beam as 4 m, draw the shear force and bending moment diagrams for the beam.

(OR)

(b) A cantilever beam of length 4 m is subjected to three point loads 1 kN, 2 kN and 3 kN at a distance of 1 m, 2 m and 3 m from the fixed end of the beam respectively. Draw the shear force and bending moment diagrams for the beam.

13. *(a)* Draw the shear force and bending moment diagrams for the beam shown in figure.



(OR)

(b) A simply supported beam of length 5 m is subjected to two point loads of 1000 N, 1500 N at a distance of 1 m, 2 m respectively from left support and a UDL of 600 N/m over a length of 2 m beginning from the right support. Draw the shear force and bending moment diagrams.

14. *(a)* A cnatilever beam of length 2 m is subjected to a UDL of intensity 1000 N/m throughout its length. Find the maximum bending stress in the beam if the cross-section of the beam is rectangle with dimensions 80 mm × 40 mm.

(OR)

(b) A simply supported beam of length 5 m carries a UDL of 1000 N/m throughout the length of the beam. The permissible stress due to bending is 120 N/mm^2. If the cross-section of the beam is rectangle and central deflection is not to exceed 10 mm calculate the width and depth of the beam. Take the depth of the beam as twice the width and E = 200 GN/mm^2.

15. *(a)* Derive the torsional equation by stating the assumptions.

(OR)

(b) A hollow steel shaft transmits 20 kW of power at 150 rpm. The angle of twist in a length of 5 m of the shaft is 3°. Find the inner and outer diameters of the shaft if the permissible shear stress is 60 N/mm^2. Take G = 80 GN/m^2. Ratio of outer and inner diameters is 1·6.

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. A mild steel bar 20 mm in diameter and 300 mm long is encased in a brass tube whose external diameter is 30 mm and internal diameter is 25 mm. The composite bar is heated through 60 °C. Calculate the stresses induced in each metal. The linear coefficient of thermal expansion for steel is $11{\cdot}2 \times 10^{-6}$/°C and for brass is $16{\cdot}5 \times 10^{-6}$/ °C. Young's modulus E for steel is 2×10^5 and for brass is 1×10^5 N/mm^2.

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