C20-M–305

7260

BOARD DIPLOMA EXAMINATION, (C-20)

NOVEMBER/DECEMBER—2022

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. State Hooke's law.

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

3. Define *(a)* stress and *(b)* strain.

4. Derive an expression for strain energy of a uniform bar subjected to tension.

5. A bar of 35 mm diameter and 2 m long is subjected to a sudden load of 50 kN. Calculate the maximum instantaneous stress and strain energy in the bar. Assume $E = 2 \times 10^5$ N/mm^2.

6. A 12 mm dia m.s. bar of length 1·25 m is stressed by a weight of 150 N dropping freely through 15 mm height. Find the max instantaneous stress produced in the bar. Take $E = 2{\cdot}1 \times 10^5$ N/mm^2.

7. Define *(a)* Shear force and *(b)* Bending moment related to beams.

8. State simple bending equation and write the units of each term.

9. Write the expression for slope and deflection for a simply supported beam with UDL over the entire span.

10. List three advantages of using hollow shafts in the place of solid shafts.

PART—B

8×5=40

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

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

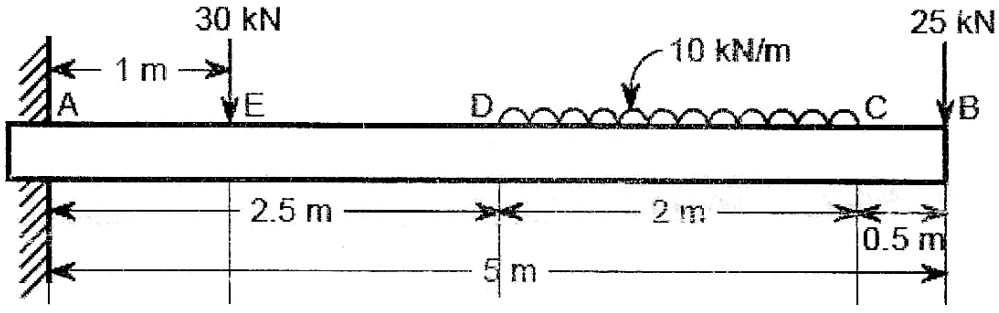
(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* A mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The ends of the rod and tube are brazed together and composite bar is subjected to an axial pull of 40 kN. If E for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively. Find the stress developed in the rod and the tube. Also find extension of the rod.

(OR)

(b) A test bar of certain material 40 mm dia is subjected to an axial pull of 600 kN recorded an extension of 0·35 mm on a gauge length of 160 mm and decrease of 0·022 mm in diameter. Find Poisson's ratio and three elastic constants.

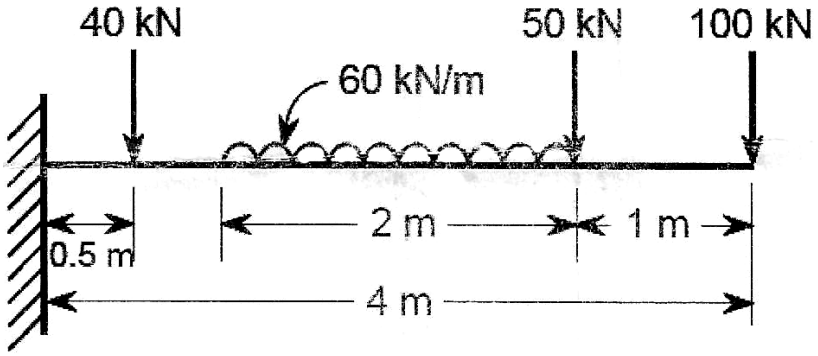
12. *(a)* Draw shear force and bending moment diagram of the given cantilever beam :



(OR)

(b) A beam of 12 m length simply supported at its ends varies a UDL of 5 kN/m over the left hand half of the span and a point load of 2 kN at the mid span. Find the maximum bending moment and draw SF and BM diagrams for the beam.

13. *(a)* A cantilever beam is loaded as shown in the figure. Draw shear force and bending moment diagrams :



(OR)

(b) A simply supported beam having span of 6 m carries u.d.l. of 2 kN/ m over left half of the span and also a point load of 10 kN at 1 m from right support. Draw shear force and bending moment diagrams.

14. *(a)* Calculate the cross-sectional dimensions of the strongest rectangular beam that can be cut out of a cylindrical log of wood whose diameter is 300 mm.

(OR)

(b) A beam of rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run-over the entire span of 5 m. $E = 1 \times 10^4$ N/mm^2. Find *(a)* The slope at the supports and *(b)* maximum deflection.

15. *(a)* A solid circular shaft of diameter 80 mm, has permissible shear stress of 50 N/mm^2. If the twist in the shaft is not to exceed 1° in 2 metres length of shaft, determine the maximum torque that can be applied to solid shaft. Take $G = 0{\cdot}8 \times 10^5$ N/mm^2.

(OR)

(b) Find the diameter of a solid circular shaft to transmit 450 kW power at 100 r.p.m. The maximum torque is 15% greater than the mean torque. The allowable shear stress must not exceed 65 N/mm^2 and the angle of twist must not exceed one degree in a length of 3 m. Take G = 0·82 × 10^5 MN/m^2.

PART—C

10×1=10

Instructions : (1) Answer the following question.

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

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

16. A rectangular beam of 300 mm deep is simply supported over a span of 4 metres. Evaluate the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 120 N/mm^2. Take I = 225 × 10^6 mm^4.

★ ★ ★