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C20-M-305

**7260**

**BOARD DIPLOMA EXAMINATION, (C-20)**

**FEBRUARY/MARCH — 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. List six mechanical properties of materials.
2. Define (a) stress and (b) strain.
3. Draw stress-strain curve for ductile material and indicate salient points.
4. Define (a) resilience and (b) strain energy.
5. Calculate the modulus of resilience due to extension of steel bar having an elastic limit of 200 mPa. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ .
6. An axial pull of 150 kN is gradually applied on a circular steel rod 5 m long and 50 mm diameter. Find the strain energy that can be stored in the rod. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ .
7. Draw shear force diagram for a cantilever of length L, subjected to a point load (W) at its free end.
8. State three assumptions made in theory of simple bending.

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9. Find the maximum stress induced in a rectangular beam of width 60 mm and 160 mm, when bending moment is 600 N-m.
10. State the assumptions made in the deriving torsion equation.

### PART—B

8×5=40

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

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

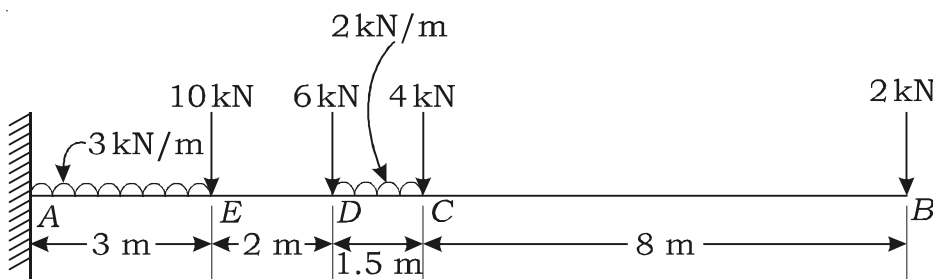
(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. (a) A compound bar consists of a circular rod of steel of diameter 20 mm rigidly fitted into a copper tube of internal diameter 20 mm and thickness 4 mm. If the bar is subjected to tensile load of 100 kN. Find the stresses in each material and elongation of the compound material. Take  $E$  for steel = 210 GN/mm<sup>2</sup>,  $E$  for copper = 100 GN/mm<sup>2</sup>. Assume length of bar is 3 m.

(OR)

- (b) A reinforced concrete column is 400 mm × 400 mm in section. The column is provided with 4 bars each of 40 mm diameter placed at each corner. If column carries a compressive load of 300 kN. Determine (i) load carried by steel and concrete and (ii) stresses in concrete and steel bars. Young's modulus of elasticity of steel is 14 times that of concrete.

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

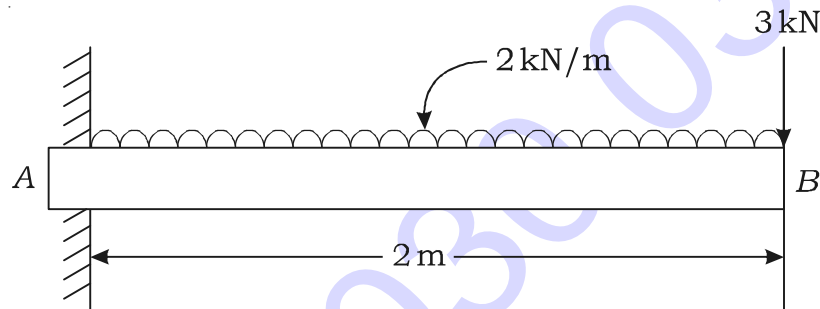


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**(OR)**

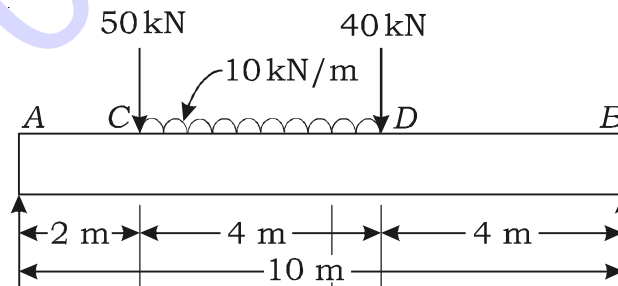
- (b) A simply supported beam 9 m long is carrying a uniformly distributed load of 10 kN/m over a length of 6 m from left end. Draw the S.F. and B.M. diagrams for the beam and also calculate the maximum B.M. on the section.

13. (a) A cantilever beam of 2 m span loaded shown in fig. Draw the shear force and bending moment diagrams.



**(OR)**

- (b) A simply supported beam of 10 m span is carrying loads as shown in fig. Draw shear force and bending moment diagrams for the beam :



14. (a) Simply supported beam of square cross section 20 mm × 20 mm is 2 m long. The beam fails when a point load of 400 N is applied at the centre of the beam. A cantilever beam of the same material having the rectangular cross section 40 mm × 60 mm over a span of 3 m. Calculate the uniformly distributed load per meter length will break the beam.

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(OR)

- (b) A timber beam 150 mm × 300 mm cross section supports a central point load on a span of 4 m. If the maximum bending stress is 8 N/mm<sup>2</sup>, what is the maximum deflection? Take  $E = 200 \text{ kN/mm}^2$ .

15. (a) A hollow circular shaft 120 mm external diameter; thickness of metal 15 mm is to transmit 300 kW power at 200 rpm. Determine the angle of twist in a length of 5 m. Take  $G = 0.8 \times 10^5 \text{ N/m}^2$ .

(OR)

- (b) A hollow shaft is to transmit 300 kW power at 80 rpm. Taking allowable shear stress of 60 N/mm<sup>2</sup> and the internal diameter is 0.6 of the external diameter. Determine the external and internal diameters of hollow shaft, if the maximum torque is 40% greater than the mean torque.

**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. Discuss the variation of stresses developed in copper rod and steel tube if the combination is heated through 30 °C as the composite member is formed by enclosing a copper rod in a steel tube.

Dia of copper rod	=	36 mm
Internal dia of steel tube	=	40 mm
External dia of steel tube	=	50 mm
E for steel = 200 GPa, E for copper	=	110 GPa
$\alpha$ for steel = $12 \times 10^{-6}/^\circ\text{C}$ , $\alpha$ for copper	=	$16 \times 10^{-6}/^\circ\text{C}$

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