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C16-M–302

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BOARD DIPLOMA EXAMINATION, (C-16)

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. State Hooke's law and define Poisson's ratio.

2. A steel bar of 30 mm diameter is subjected to an axial load of 20 kN. Find the stress in the bar.

3. A tensile load of 60 kN is suddenly applied to a circular bar of 40 mm diameter and 5 m long. If the value of $E = 2 \times 10^5$ N/mm^2. Determine the strain energy absorbed by the rod.

4. A boiler shell of 1000 mm diameter and 10 mm thick plate having the efficiency of longitudinal joint is 70%. Determine the minimum tensile stress induced in the shaft, when the internal pressure of 2 N/mm^2.

5. List out the types of beams.

6. Write the assumptions made in theory of simple bending.

7. A cantilever beam of length 7 m is carrying a point load of 16 kN. Calculate the deflection at the free end if moment of inertia $I = 85 \times 10^7$ N/mm^4 and $E = 2 \times 10^5$ N/mm^2.

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8. Find the power transmitted by a circular shaft of 60 mm diameter at 150 rpm considering the maximum shear stress in the shaft is not to exceed 65 N/mm^2.

9. Write the assumptions made in deriving torsion equation.

10. Define the terms *(a)* spring index and *(b)* spring stiffness.

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.

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

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

11. A short column of 400 mm × 400 mm section is to consist of concrete reinforced with steel rods of 20 mm diameter with compressive load of 3 MN. How many reinforcing steel rods are required if stress in concrete is not to exceed 2 N/mm^2 and E_s = 12 times that of concrete.

12. A bar of 3 m long and 50 mm diameter hangs vertically has a collar securely attached at the lower end. Find the maximum stress induced. When *(a)* a weight of 250 N falls from 120 mm on to the collar and *(b)* a weight of 2500 N falls from 10 mm on to the collar. Take E = 2×10^5 N/mm^2.

13. Derive an expression for hoop stress on thin cylindrical shell.

14. A simply supported beam 9 m long is carrying a U.D.L of 10 kN/m over a length of 6 m from right end. Draw the S.F and B.M diagrams for the beam and also calculate the maximum B.M on the section. Take $G = 0{\cdot}85 \times 10^5$ N/mm^2.

15. A simply supported beam with a central point load on a span of 4 m and the maximum bending stress is 8 N/mm^2. What is the maximum deflection when the moment of resistance is 16 kN-m? Assume $I = 4 \times 10^8$ mm^4 and $E = 0{\cdot}2 \times 10^5$ N/mm^2.

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16. A closed coiled helical spring of 120 mm diameter is made up of 8 mm diameter wire is subjected to a load of 300 N. Determine the shear stress induced in the wire and energy stored, if the spring is wound for 20 turns. Take $G = 0{\cdot}8 \times 10^5$ N/mm^2.

17. A beam of length of 5 m it has an inverted T-section with 100 mm × 20 mm flange and 100 mm × 20 mm web. It is simply supported at the ends and carries a uniformly distributed load of 2 kN/m. Calculate the maximum tensile and compressive stress.

18. *(a)* State any five assumptions made in deriving torsion equation.

(b) A solid shaft of diameter 10 mm is subjected to a torque of 15 N-m. Calculate the angle of twist over a length of 250 mm. Take $G = 0{\cdot}8 \times 10^5$ N/mm2.

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