C16-M–302

6243

BOARD DIPLOMA EXAMINATION, (C-16)

MAY/JUNE—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. Draw the stress-strain diagram for ductile materials and label its important features.

2. A tensile load of 50 kN is gradually applied to a circular bar of 30 mm diameter and 5 m long. If the value of $E = 2 \times 10^5$ N/mm^2. Determine *(a)* elongation in rod and *(b)* stress in rod.

3. Define the terms *(a)* resilience, *(b)* proof resilience and *(c)* modulus of resilience.

4. Calculate the hoop and longitudinal stresses in the material of a thin cylindrical shell of 3 m diameter and 30 mm thick subjected to an internal pressure of 1 N/mm^2.

5. Draw shear force and bending diagrams for a cantilever of length L, subjected to an UDL w N/m along its entire length.

6. State any three assumptions made in theory of simple bending.

7. Define the terms *(a)* deflection and *(b)* slope of beam.

8. State any three requirements of materials used for shafts.

9. A solid circular shaft of diameter 40 mm. Transmits 1500 N-m torque. Find the shear stress induced in it.

10. Define the terms spring index and stiffness related to coil springs.

PART—B

10×5=50

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

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

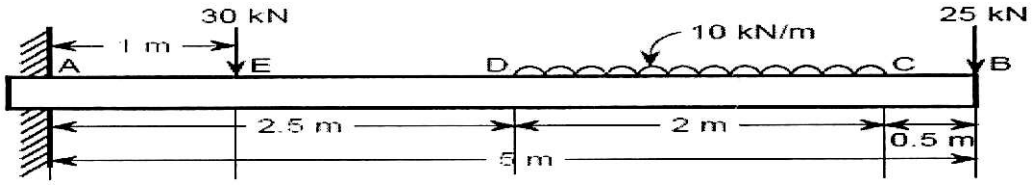
(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. A compound bar consists of a circular steel rod of diameter 20 mm rigidly fitted into a copper tube of internal diameter 20 mm and thickness 5 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 = 200 GN/mm^2, E for copper =100 GN/mm^2. Assume length of bar is 2 m.

12. A stepped bar is loaded by a pull of 200 kN. It has 30 mm diameter over a length of 160 mm and 40 mm diameter for the remaining 140 mm length. Find the strain energy stored in the bar. Also find the total extension in the bar. Assume $E = 2 \times 10^5$ N/mm^2.

13. A thin cylindrical shell 100 cm diameter, 1 cm thick and 5 m long is subjected to an internal fluid pressure of 5 N/mm^2. Calculate *(a)* hoop stress and longitudinal stress, *(b)* circumferential strain, *(c)* longitudinal strain and *(d)* volumetric strain. Assume $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio = 0·3.

14. Draw shear force and bending moment diagram of the given cantilever beam



15. A cantilever beam of length 6 meters carries a uniformly distributed load of 20 kN/m over the entire span. Calculate the dimensions of the beam, if the maximum stress induced is not to exceed 80 N/mm^2. The ratio of depth to width is 2.

16. A 150 mm × 300 mm cross-section is simply supported over a span of 5 meters. Determine the maximum central point load that can be placed if the *(a)* bending stress is not to exceed 80 N/mm^2 and *(b)* maximum deflection is limited to 8 mm. Take $E = 2 \times 10^5$ N/mm^2.

17. 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 $G = 0.82 \times 10^5$ MN/m^2.

18. A close coiled spring is to have stiffness of 1 N/mm of compression under maximum load of 45 N and maximum shearing stress of 120 N/mm^2. The solid length of wire is to be 45 mm. Find the diameter of wire, the mean diameter of coils and number of coils required. Take $G = 0{\cdot}5 \times 10^5$ N/mm^2.

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