C20-M–305

7260

BOARD DIPLOMA EXAMINATION, (C-20)

JUNE/JULY—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. Define *(a)* ductility and *(b)* brittleness.

2. Distinguish lateral and linear strain.

3. A tensile load of 60 kN is applied to a circular bar of 4 cm diameter and 5 m long. If the value of $E = 2\times10^5$ N/mm^2. Determine *(a)* stretch in rod and *(b)* stress in rod.

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

5. A MS bar of length 2 m and has a dia of 50 mm. A load of 20 kN falls from a height of 80 mm. Find the intensity of stress if $E = 2\times10^5$ N/mm^2.

6. A bar of 35 mm diameter and 2 m long is subjected to a sudden load of 50 kN. Calculate the maximum instantaneous stress, strain energy in the bar. Take $E = 2\times10^5$ N/mm^2.

7. Draw shear force diagram for a cantilever of length L, subjected to an UDL along with its entire length.

8. Define *(a)* neutral layer and *(b)* moment of resistance.

9. Find the cross-sectional dimensions of strongest rectangular which can cut out of the cylindrical log of wood whose diameter is 200 mm.

10. State any three requirements of materials used for 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 rod of length 250 mm is made with steel of diameter 20 mm for length 100 mm and remaining with copper of diameter 30 mm. A tensile force P is applied to the bar so that the maximum stress induced in the material is 50 N/mm^2. Determine :

(i) Magnitude of tensile force

(ii) Stress in copper rod

(iii) Stress in steel

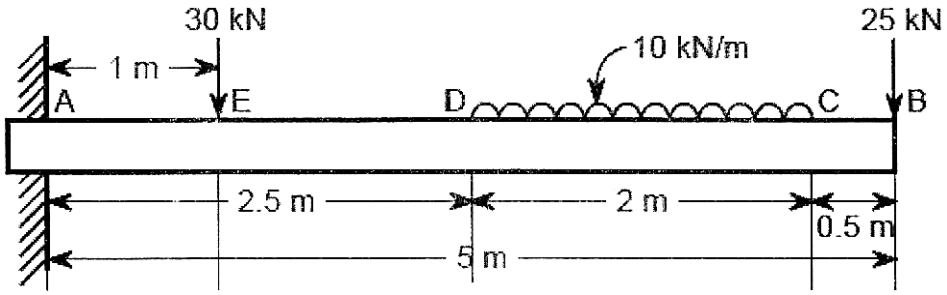
(iv) Total elongation

Take E for steel = 2×10^5 N/mm^2 and E for copper = 1×10^5 N/mm^2.

(OR)

(b) A reinforced concrete column 300 mm × 300 mm in section is provided with 8 bars of 20 mm diameter. The column carries a compressive load of 600 kN. Find the loads shared by each material. Modular ratio of steel to concrete is 18.

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



(OR)

(b) A beam of length 10 m has supports at its ends *A* and *B*. It carries a point loads of 4 kN at 3 m from *A* and a point load of 4 kN at 7 m from A and a uniformly distributed load of 2 kN/m between the point loads. Draw shear force and bending moment diagrams.

13. *(a)* A cantilever beam *AB*, 2 m long carries a uniformly distributed load of 1 kN/m over a length of 1·5 m from the free end. It also carries a point load of 2 kN at 0·5 m from its fixed end. Draw the shear force and bending moment diagrams for the beam.

(OR)

(b) A beam of 10 m length simply supported at its ends varies a UDL of 2 kN/m over the left hand half of the span and a point load of 3 kN at the mid span. Find the maximum bending moment and draw SF and BM diagrams for the beam.

14. *(a)* A cantilever beam of length 6 meters carries an 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.

(OR)

(b) 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 *(i)* bending stress is not to exceed 80 N/mm^2 and *(ii)* maximum deflection is limited to 8 mm. Take $E = 2 \times 10^5$ N/mm^2.

15. *(a)* A solid circular shaft is to transmit 500 kW at 300 r.p.m. Find the diameter of the shaft, if shear stress is not to exceed 75 N/mm^2. If this shaft was replaced by a hollow one whose internal diameter 2/3 of the external diameter. Find the dimensions of hollow shaft for the same stress limits.

(OR)

(b) A hollow shaft is required to transmit 2·5 MW when running at 150 rpm. Find the suitable diameter if the internal diameter is to be 0·75 of the external diameter and maximum permissible shear stress is 60 MPa. What will be the shear stress at the inner surface?

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. During a tensile test on a cylindrical bar of 25 mm diameter and 1·25 m long under an axial load of 50 kN, the following data is recorded : linear strain is 4 times its lateral strain; Elongation in the bar is 0·06 mm. Analyse the data and calculate three elastic constants.

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