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C20-M–305

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—2024

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 the Hooke's law.

2. A steel rod of diameter 20 mm is subjected to an axial pull of 100 kN. Claculate the strain of the rod over a gauge length of 450 mm. Take E = 210 kN/mm^2.

3. A steel rod of 20 mm diameter and 500 mm length is subjected to an axial pull of 20 kN. Determine the stress and elongation. Take $E = 2 \times 10^5$ N/mm^2.

4. Define *(a)* Resilience, *(b)* Proof resilience and *(c)* Modulus of resilience.

5. Calculate the modulus of resilience due to extension of a steel bar having an elastic limit of 200 N/m^2. Take $E = 2 \times 10^5$ N/mm^2.

6. A 1000 N load falls from a height of 60 mm on a collar attached to a bar 30 mm diameter and 400 mm long. Find the instantaneous stress. Take $E = 2 \times 10^5$ N/mm^2.

7. Define beam and list three types of beams.

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

9. Find the section modulus of a hollow circular section of external dia 250 mm and thickness 25 mm.

10. State any three assumptions made in 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)* In a tensile test on a steel tube of external diameter 18 mm, 12 mm bore an axial load of 1·7 kN produced an elongation of 0·0045 mm in length of 75 mm while the outer diameter suffered a compression of 0·00032 mm. Calculate the values of 1/m , E, G and K.

(OR)

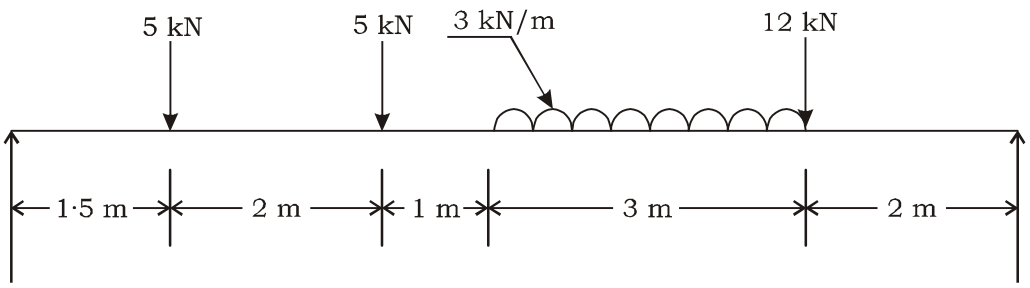
(b) A reinforced concrete column is 300 mm × 300 mm in section, the column is provided with 8 bars of 20 mm diameter. The column carries a load of 360 kN. Find the stresses in concrete and steel bars. Take $E_s = 2{\cdot}1 \times 10^5$ N/mm^2 and $E_c = 0{\cdot}14 \times 10^5$ N/mm^2.

12. *(a)* A cantilever of 3 m long carries two point loads one 60 N placed at 1 m from free end and another 80 N placed at 2 m from free end. Draw SF and BM diagrams.

(OR)

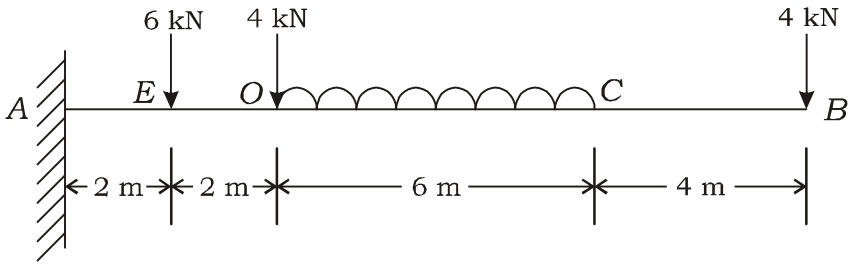
(b) A simply supported beam of length 3 m is subjected to a UDL of intensity 500 N/m over a length of 1 m starting from left support and a concentrated load of 1500 N at a distance of 1 m from the right support. Draw SF and BM diagrams for the beam.

13. *(a)* Draw SF and BM diagrams for the beam loaded as shown in figure below. All loads are in kN and lengths are in metres :



(OR)

(b) A cantilever beam is loaded with point loads and UDL as shown in the figure below. Draw SF and BM diagrams :



14. *(a)* A simply supported beam of 4 m span carries a UDL of 20 kN/m on the whole span. Calculate the slope at the ends and maximum deflection of the beam. Take $E = 2 \times 10^5$ N/mm^2 and $I = 5000$ cm^4.

(OR)

(b) A Cantilever is of circular section of diameter 100 mm. If the length of cantilever is 0·9 m. Find the point load which it can carry at its free end, the maximum bending stress is not to exceed 50 MPa.

15. *(a)* A hollow shaft is to transmit 300 kW at 90 r.p.m. If the shear stress must not exceed 60 N/mm^2, find the external and internal diameters of shaft. Internal diameter is 0·6 times of the external diameter.

(OR)

(b) A shaft transmits 280 kW of power at 160 r.p.m. Determine :

(i) The diameter of solid shaft to transmit the required power

(ii) The inner and outer diameters of hallow shaft if the ratio of inner and outer diameter is 2/3.

(iii) The percentage saving in the material on using a hallow shaft instead of solid shaft. Take the allowable shear stress as 80MPa and the weight density of the material as 78 kN/m^3.

PART—C

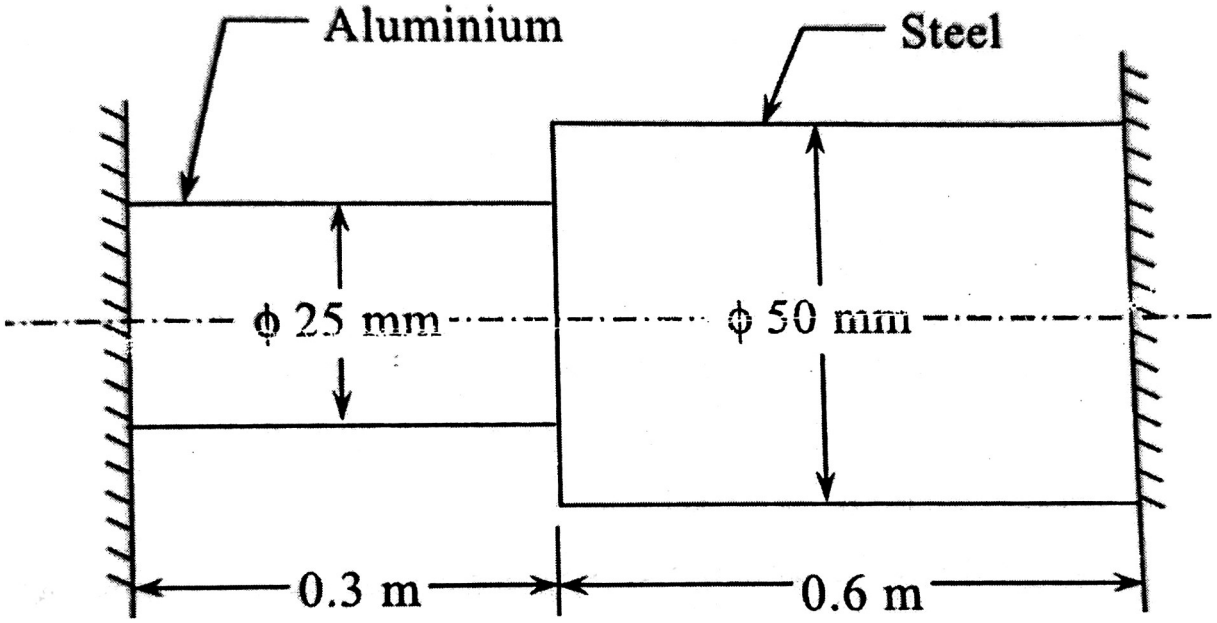
10×1=10

Instructions : (1) Answer the question.

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

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

16. A bar made of aluminium and steel is held between two supports as shown in figure. The bars are stress free at a temperature of 40 °C. What will be the stresses in the two bars when the temperature is 20 °C, if the supports are non yielding?



Take Es=210GPa, E_A=74GPa

α_s=11.7x10^{-6}/^{0}c, α_A=23.4x10^{-6}/^{0}c

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