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C16-M–302

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BOARD DIPLOMA EXAMINATION, (C-16)

AUGUST/SEPTEMBER—2021

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 the terms *(a)* ultimate strength and *(b)* factor of safety.

2. A mild steel bar carries an axial load of 75 kN. If the allowable tensile stress is 50 N/mm^2. Find the diameter of the rod.

3. Derive an expression for the strain energy.

4. A seamless pipe 800 mm diameter contains a fluid under a pressure of 2 N/mm^2. If the permissible tensile stress is 100 N/mm^2. Find the maximum thickness of the pipe.

5. What are the different types of loads acting on a beam?

6. State the bending moment equation and write the units of each term.

7. Define *(a)* deflection and *(b)* slope.

8. State the function of shaft. List suitable materials of shafts.

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

10. List out various types of 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 copper bar 300 mm long is 30 mm in diameter for 200 mm of length and 20 mm in diameter for remaining length. A tensile load is applied to the bar so that the maximum stress induced in the material is 50 N/mm^2. Determine the magnitude of load and calculate the total extension of the rod. Take E = $1{\cdot}03 \times 10^5$ N/mm^2.

12. A MS bar of length 2 m, has a diameter of 50 mm, hangs vertically. A load of 25 kN falls on a collar attached to the lower end. Find the maximum stress *(a)* height of fall is 100 mm, *(b)* load is applied suddenly without impact and *(c)* when the load is applied gradually. Take E = 2×10^5 N/mm^2.

13. A thin cylindrical shell 100 cm diameter, 1cm 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 × 10 N/mm^2 and Poisson's ratio = 0·3.

14. A 6 m long cantilever carries loads of 2 kN and 3 kN at 2 m and 5 m respectively from fixed end and a UDL of 10 kN/m over its entire length. Draw shear force and bending moment diagrams.

15. A cantilever 5 m long and of a rectangular cross-section carries a UDL of 25 kN/m. over its entire length. If the maximum stress induced is not to exceed 150 N/mm^2. Find the dimensions of the beam. Take depth of section is twice the width.

16. A simply supported beam of I section 4 m long, carries UDL of 10 kN/m over the entire span and a concentrated load of 70 kN at mid span. *(a)* Find the maximum deflection of the beam and *(b)* find the slope at the ends. Take E = $2{\cdot}1 \times 10^5$ N/mm^2 and I = $8{\cdot}98 \times 10^7$ N/mm^4.

17. Select suitable diameter of solid shaft to transmit 120 kW of power at 240 rpm. If the allowable shear stress is not to exceed 75 N/mm^2 and twist is not to exceeds 1° in a length of 4 m. Take $G = 0{\cdot}8 \times 10^5$ N/mm^2.

18. A helical spring 150 mm mean diameter is required to absorb 40 kJ of energy with maximum shear stress of 450 N/mm^2. Find the diameter of the steel rod and number of coils. If the maximum amount of compression is 160 mm. Assume $G = 0{\cdot}8 \times 10^5$ N/mm^2.

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