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C09–M–403

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BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2016

DME—FOURTH 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) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Define the following :

(a) Lateral strain

(b) Volumetric strain

(c) Strength

2. A material has a Young's modulus of 1 25 10^5 N/mm^2 and a Poisson's ratio of 0·25. Calculate *(a)* modulus of rigidity and *(b)* bulk modulus.

3. An axial pull of 150 kN is gradually applied on a circular steel rod 5 m long and 50 mm diameter. Find the strain energy that can be stored in the rod. Take E 2 10^5 N/mm^2.

4. What are meant by *(a)* shear force diagram and *(b)* bending moment diagram?

5. Draw shear force and bending moment diagrams for a simply supported beam which is loaded with a point load W at its mid-point. Take length of the beam L.

6. A steel wire 8 mm diameter is bent into a circular shape of 9 m radius. Determine the maximum stress induced in the wire. Take $E = 2 \quad 10^5$ N/mm^2.

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

8. A circular shaft is required to transmit a torque of 6 kN-m. If the permissible angle of twist is 2 degrees over the length of 4 m, find the diameter of the shaft. Take $G \quad 8 \quad 10^4$ N/mm^2.

9. Define *(a)* spring index and *(b)* spring stiffness.

10. A gas cylinder 2 m internal diameter is 15 mm thick. Find the allowable pressure of the gas if the tensile stress in the metal is not to exceed 120 N/mm^2 and efficiency of the joint is 80%.

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.
(2) Each question carries **ten** marks.
(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. A rectangular block 250 mm 100 mm 75 mm is subjected to axial loads as follows :

(a) 480 kN tensile load on the 100 mm 75 mm face

(b) 1000 kN compressive load on the 250 mm 100 mm face

(c) 900 kN tensile load on the 250 mm 75 mm face

Assuming Poisson's ratio as 0·25 and $E \quad 2 \quad 10^5$ N/mm^2, calculate the change in volume of the block due to application of loading specified above.

12. A steel bar is placed between two copper bars each having same area and length as the steel bar is at 15 °C. At this stage, they are rigidly connected together at both ends. When temperature is raised to 315 °C, the length of the bars increases by 1·5 mm. Determine the original length and final stresses in the bars. Take E_s 2 1 10^5 N/mm^2, E_{cu} 1 10^5 N/mm^2, $_s$ 12 10^{-6} per °C, $_{cu}$ 17 5 10^{-6} per °C.

13. A mild steel bar of length 2·5 m has a diameter of 55 mm, hangs vertically. A load of 25 kN falls on a collar attached to the lower end. Find the maximum stress when—

(a) height of fall is 150 mm;

(b) the load is applied suddenly without impact;

(c) the load is applied gradually.

Take E 2 10^5 N/mm^2.

14. A beam 5 m long supported at the ends carries point loads of 140 kN, 60 kN and 80 kN at a distance of 0·5 m, 2·5 m and 3·5 m respectively from the left end. Draw the shear force and bending moment diagrams.

15. A simply supported beam of span (length between supports) 4 m has an overhanging of 1 m on right-hand support. Point loads of 2 kN and 1 kN act at 5 m and 2 m respectively from the left-hand support and UDL of 2 kN/m over a length of 2 m from the left hand support. Draw the shear force and bending moment diagrams.

16. A wooden beam of rectangular cross section 125 mm wide 200 mm depth is simply supported at its ends and has a span of 5 m. If the maximum allowable bending stress is 7·5 N/mm^2, what is the maximum deflection? Take E 0 1 10^5 N / mm^2.

17. Find the diameter of a solid circular shaft to transmit 750 kW at 250 r.p.m. It is specified that the maximum shear stress must not exceed 40 N/mm^2 and the angle of twist must not exceed one degree in a length of 20 times the diameter. Take G 0 82 10^5 MN/m^2.

18. *(a)* A closed coiled helical spring is required to exert a force of 3·5 kN and to have stiffness of 75 kN/m. If the mean diameter of the coil is to be 100 mm and the working stress 200 N/mm^2, find the number of turns and diameter of spring wire with which it is made. Take G 0 8 10^5 N/mm^2.

(b) Derive the expression for hoop stress of a thin cylinder subjected to internal pressure.

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