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C09–M–403

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BOARD DIPLOMA EXAMINATION, (C–09)

APRIL/MAY—2015

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.

1. Define *(a)* yield stress, and *(b)* ultimate stress.

2. Define *(a)* modulus of rigidity, *(b)* bulk modulus, and *(c)* Young's modulus.

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

4. Define *(a)* shear force, *(b)* bending moment, and *(c)* point of contra-flexure.

5. Draw shear force diagram for a cantilever beam which is loaded with a point load W at its free end. Take length of the beam as L.

6. Find the maximum stress induced in a rectangular beam of width 60 mm and depth 160 mm when bending moment of 600 N-m is applied.

7. A simply supported beam of 2 m is subjected to a central load of 17 kN. Find the deflection of the beam if moment of inertia of the beam, I 13 10^6 mm^4 and E 200 GN/m^2.

8. Find the power transmitted by a circular shaft of 60 mm diameter at 150 r.p.m. The maximum shear stress in the shaft is not to exceed 65 N/mm^2.

9. A closed coiled helical spring is to carry a load of 180 N and mean coil diameter is 15 times the diameter of wire. Find the diameter of wire if the maximum shear stress is to be 100 N/mm^2.

10. A 12 mm thick cylindrical shell having 2·2 m diameter and 5 m length is subjected to fluid pressure of 2 N/mm^2. Calculate circumferential strain. Take Poisson's ratio as 0·3 and E $2{\cdot}1\times10^5$ N/mm^2.

PART—B

10×5=50

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

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

11. Two vertical rods are each fastened at their upper ends at a distance of 600 mm apart. Each rod is 3 m long and 12 mm in diameter. A horizontal rigid cross bar connects the lower ends of the rods and on it is placed a load of 4500 N so that the cross bar remains horizontal. Find the position of the load on the cross bar and the stress in each rod. One rod is of steel for which E_S 2 10^5 N/mm^2 and the other is of bronze for which E_B $0{\cdot}63\times10^5$ N/mm^2.

12. A 12 mm diameter steel rod passes centrally through a copper tube of 48 mm external diameter, 36 mm internal diameter and 2·5 m long. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened until length of the assembly is reduced in length by 0·508 mm. The whole assembly is then raised in temperature by 60 °C. Calculate the stresses developed in copper and steel before and after the raise of temperature. Take E_S $2{\cdot}1\times10^5$ N/mm^2, E_{Cu} $1{\cdot}05\times10^5$ N/mm^2, $_S$ 12×10^{-6} per °C, $_{Cu}$ $17{\cdot}5\times10^{-6}$ per °C.

13. A bar 2·5 m long and 50 mm diameter hangs vertically and has a collar securely attached to the lower end. Find the maximum stress induced when

(a) a body of weight 2000 N falls from 100 mm onto the collar;

(b) a body of weight 20000 N falls from 10 mm onto the collar.

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

14. A beam of length 12 m long is supported at its ends A and B. It carries point loads of 6 kN and 5 kN at 4 m and 8 m respectively from end A and a UDL of 1 kN/m between the point loads. Draw the shear force and bending moment diagrams.

15. A cantilever beam of length 9 m carries a point load of 10 kN at its free end, a point load 7 kN at 4 m from fixed end and a UDL of 3 kN/m for length of 2 m from its fixed end. Draw the shear force and bending moment diagrams.

16. Derive bending equation $\frac{M}{I} \quad \frac{}{y} \quad \frac{E}{R}$ and also state the assumptions made while deriving it.

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 0·82×10^5 MN/m^2.

18. *(a)* List any five applications of the spring.

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

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