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C14–M–305

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BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2017

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)* hardness and *(b)* ductility.

2. Young's modulus of steel is 2 10^5 N / mm^2. Find shear modulus and bulk modulus of steel if Poisson's ratio is 0·25.

3. Calculate modulus of resilience due to extension of steel bar having an elastic limit of 200 MPa. And E_s 2 10^5 N / mm^2.

4. Draw *(a)* cantilever beam and *(b)* simply supported beam.

5. Define *(a)* shear force and *(b)* bending moment.

6. Define *(a)* neutral layer and *(b)* neutral axis.

7. A simply supported beam of length 2 m is subjected to a central load of 15 kN. Find the maximum deflection of the beam if E 200 GN / m^2. Take MI of the beam is 12 10^6 mm^4.

8. The outer diameter of a hollow shaft is 150 mm and its thickness is 15 mm. Find polar section modulus of the shaft.

9. A closed coiled helical spring is to carry a load of 150 N and the mean coil diameter is 10 times the diameter of the wire. Find the diameter of the wire if the maximum shear stress is to be 100 MPa.

10. A thin cylindrical pressure vessel of 650 mm diameter is subjected to an internal pressure of 2·3 MPa. If the longitudinal stress for the material is 20 N / mm^2, calculate the thickness of the vessel.

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 short column of 500 mm square section is to consist of concrete reinforced with steel rods of 25 mm diameter. The compressive load on the column is 5 MN. How many reinforcing rods are required if the stress in the concrete is not to exceed 18 MPa? Take Young's modulus of steel as 10 times that for concrete.

12. A bar of 3 m long and 50 mm diameter hangs vertically has a collar securely attached at the lower end. Find the maximum streess induced when,

(a) a weight of 250 N falls from 120 mm on the collar;

(b) a weight of 2500 N falls from 10 mm on the collar.

13. A cantilever of 5 m long is subjected to a UDL of 10 KN/m over a length of 2 m commencing at 2·5 m from the fixed end. In addition, it also carries point loads of 25 kN and 30 kN at its free end and at 1 m from the fixed end respectively. Draw the loaded diagram, shear force and bending moment diagrams.

14. Derive bending equation and state the assumptions made in deriving it.

15. Determine the diameter of a solid shaft to transmit 450 kW of power at 100 r.p.m. The maximum torque is 15% greater than the mean torque. The allowable shear stress should not exceed 65 N/mm^2 and angle of twist in 3 m should not exceed 1°. Take G 80 GN/m^2.

16. A cylindrical boiler shell is to withstand an inter pressure of 1 MPa. The plate is 10 mm thick. The longitudinal efficiency of the joint is 90% while the circumferential joint 50%. Design the boiler shell diameter if the ultimate tensile stress is 350 N/mm^2 and factor of safety is 4.

17. *(a)* A steel rod of 2 m long is fixed rigidly at the ends and heated through a temperature of 100 °C. Find the stress induced in the rod if $_s$ 12 10^{-6} per °C, and E_s 2 10^5 N/mm^2. What is the expansion prevented.

(b) Draw shear force and bending moment diagrams for a simply supported beam of length L subjected to a point load W at centre.

18. *(a)* A cantilever beam of 1·3 m long has 100 mm wide × 150 mm deep carries a concentrated load of 50 KN at free end. Find the slope and deflection at free end. Take E 2 10^5 N/mm^2.

(b) A closed coiled helical spring of 100 mm mean diameter is made of 10 mm diameter rod and has 18 turns. The spring carries an axial load of 200 N. Determine *(a)* shear stress and *(b)* deflection when carrying this load. Assume G 0 8 10^5 MPa.

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