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C14–M–305

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BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2018

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)* bulk modulus and *(b)* Poisson's ratio.

2. A steel bar of 25 mm diameter is subjected to an axial load of 10 kN. Find the stress in the bar.

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

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

5. Draw shear force diagram for a simply-supported beam which is loaded with a point load W at its midpoint. Take length of the beam L.

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

7. A cantilever of length 7 metres is carrying a UDL of 16 kN/m. Calculate the deflection at the free end, if moment of inertia I 85 10^7 mm^4 and E 2 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 metres, find the diameter of the shaft. Take G 8 10^4 N/mm^2.

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

10. A gas cylinder 2 metres 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 2 10^5 N/mm^2, calculate the change in volume of the block due to application of loading specified above.

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12. A mild steel bar of length 2·5 metres 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.

13. A beam 5 metres long supported at the ends carries point loads of 14 kN, 6 kN and 8 kN at a distance of 0·5 metre, 2·5 metres and 3·5 metres respectively from the left end. Draw the shear force and bending moment diagrams.

14. A beam of 5 m long, simply-supported at its ends is to carry a central point load of 8 kN. The beam is to be a rectangular section, the depth being twice of the width. Determine the dimensions of the beam, if the maximum stress in the material is to be 60 N/mm^2.

15. 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.

16. Derive the equation for hoop stress and longitudinal stress of a thin cylinder subjected to an internal pressure with usual notations.

17. *(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 steel rod which it is made.

Take G 0 8 10^5 N/mm^2.

(b) Draw SFD and BMD for a simply-supported beam of length L when it is subjected to a UDL of W N/m throughout its length.

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18. *(a)* Young's modulus of steel is 2 10^5 N/mm^2. Find the shear modulus and bulk modulus of steel, if Poisson's ratio is 0·3.

(b) A cantilever beam of 1·5 m long has 110 mm wide 160 mm deep carries a concentrated load of 60 kN at free end. Find the slope and deflection at free end.

Take E 2 12 10^5 N/mm^2.

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