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C16–M–302

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BOARD DIPLOMA EXAMINATION, (C–16)

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. List out the three elastic constants and write down the relation between them.

2. A load of 4000 N has to be raised at the end of a steel wire. If the unit stress in the wire must not exceed 80 N/mm^2, what is the minimum diameter required? What will be the extension of 3·5 m length of wire? Take E 2 10^5 N/mm^2.

3. Calculate the proof resilience and modulus of resilience due to extension of steel bar 20 mm diameter and 1500 mm length. The stress induced in elastic limit and modulus of elasticity for steel bar is 250 N/mm^2 and 200 GN/m^2 respectively.

4. A cylindrical shell of diameter 1·5 m and 15 mm thickness is subjected to an internal fluid pressure of 1·2 N/mm^2. Determine the longitudinal stress and circumferential stress setup in the shell.

5. Define *(a)* bending moment and *(b)* point of contraflexure.

6. Write the bending equation and mention the units of the terms.

7. Write the expression for slope and deflection on simply-supported beam with UDL over the entire beam.

8. Define polar modulus and write the equations for solid and hollow shafts.

9. A hollow circular shaft is having 110 mm outside diameter. The inner diameter is half of the outer diameter. Find polar moment of inertia of cross-section.

10. List out the 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 the criterion for valuation is the content but not the length of the answer.

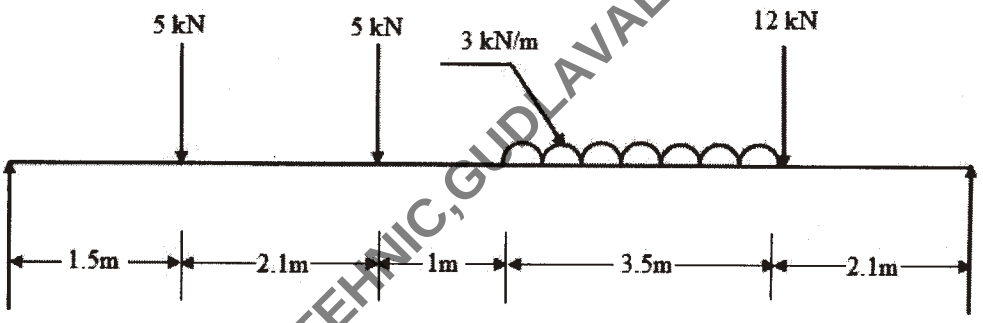
11. A 12 mm diameter steel rod passes centrally through a copper tube 48 mm external and 36 mm internal diameter and 2·5 m long. The tube is closed at each end by steel plates which are secured by nuts. The nuts are tightened until the copper tube is reduced in length by 0·508 mm. The whole assembly is then raised in temperature by 60 °C. Calculate the stresses in copper and steel before and after the rise of temperature, assuming that the thickness of the plates remains unchanged.

Take E_s 2 1 10^5 N/mm^2, E_c 1 05 10^5 N/mm^2, $_s$ 1 2 10^{-5} /°C, $_c$ 1 75 10^{-5} /°C.

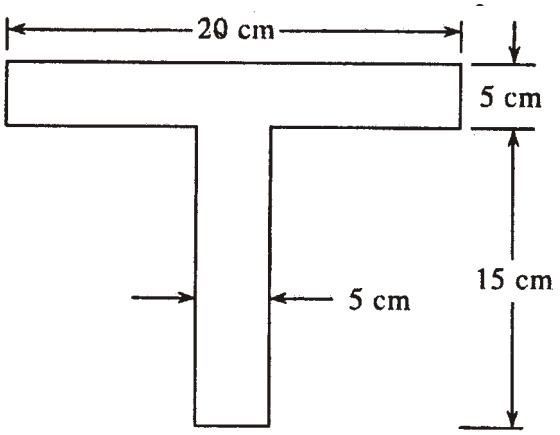
12. An MS bar of length 2 m has a diameter of 50 mm, hangs vertically. A load of 20 kN falls on a collar attached to the lower end. Find the maximum stress when *(a)* height of fall is 100 mm, *(b)* load is applied suddenly without impact and *(c)* load is applied gradually. Take E 2 10^5 N/mm^2.

13. A boiler shell is to be made of 10 mm thick plate having limiting tensile stress of 105 N/mm^2. If the efficiencies of the longitudinal and circumferential joints are 70% and 30% respectively, determine the permissible intensity of internal pressure when the shell diameter is 1·3 m.

14. Draw SF and BM diagrams for the beam loaded as shown in figure below. All loads are in kN and length are in metre :



15. A T-beam has the dimensions as shown in figure below. The beam is subjected to a bending moment of 500 N-m. Determine the maximum tensile and compressive stresses in the beam :



16. A simply-supported beam of 4 m span carries a UDL of 20 kN/m on the whole span and in addition carries a point load of 40 kN at the centre of span. Calculate the slope at the ends and maximum deflection of the beam. E 200 10^3 N/mm^2 and moment of inertia = 5000 cm^4.

17. A solid steel shaft 100 mm diameter 95 kW at 200 r.p.m., calculate—

(a) torque on shaft;

(b) the maximum shear stress induced;

(c) the angle of twist in a length of 800 mm;

(d) the shear stress at a radius of 45 mm;

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

18. A wagon weighing 30 kN moving at 7 kmph. How many springs each of 18 coils will be required in a buffer stop to absorb the energy of motion during a compression of 250 mm? The mean diameter of coil is 200 mm and the wire diameter is 25 mm.

Take G 0 9 10^5 N/mm^2.

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