C16-M–**302**

# 6243

## BOARD DIPLOMA EXAMINATION, (C-16)

## MARCH/APRIL—2021

## DME - THIRD SEMESTER EXAMINATION

## STRENGTH OF MATERIALS

*Time* : 3 hours ]                                                 [ *Total Marks* : 80

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**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 the following terms :

*(a)* Poisson's ratio

*(b)* Modulus of elasticity

*(c)* Modulus of rigidity

**2.** A MS bar carries an axial load of 75 kN. If the allowable tensile stress is 50 N/mm$^2$, find the diameter of the rod.

**3.** A mild steel specimen of 15 mm dia and 50 mm gauge length is subjected to an axial pull of 32 kN. Calculate the maximum stress and elongation. Assume $E = 2 \times 10^5$ N/mm$^2$.

**4.** Derive an expression for hoop stress of a thin cylindrical shell subjected to internal pressure.

**5.** List any three types of beams.

**6.** State simple bending equation with usual notations and write the units of the terms.

**7.** A cantilever beam of length 3 m carries a point load of 40 kN at free end. Find the deflection of the beam at the free end. Assume $I = 8 \times 10^7$ mm$^2$ and $E = 2 \cdot 1 \times 10^5$ N/mm$^2$.

**8.** A solid shaft is to transmit 350 kW power at 110 RPM. If the maximum shear stress induced must not exceed 90 N/mm$^2$, find the diameter of the shaft.

**9.** State the assumptions made in simple torsion equation.

**10.** Define the terms Spring Index and Stiffness related to coil springs.

## PART—B

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

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

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

**11.** Draw a stress-strain diagram for MS specimen and discuss the significance of salient points on it.                    4+6

**12.** A stepped bar is loaded by a pull of 200 kN. It has 30 mm diameter over a length of 160 mm and 40 mm diameter for the remaining 140 mm length. Find the strain energy stored in the bar. Also find the total extension in the bar. Assume $E = 2 \times 10^5$ N/mm$^2$.          6+4

**13.** *(a)* Define thin shell and write the causes of failure of thin shells.    4

*(b)* A thin cylindrical pressure vessel of 2 m diameter is subjected to an internal pressure of 2 N/mm$^2$. If the longitudinal stress and hoop stress for the material is 60 N/mm$^2$ and 90 N/mm$^2$ respectively. Calculate the thickness of the vessel.          6

**14.** A 6 m long cantilever beam carries loads of 2 kN and 3 kN at 2 m and 5 m respectively from fixed end and u.d.l of 10 kN/m over its entire length. Draw S.F and B.M diagram for the beam.          5+5

15. A simply supported beam of span 6 m has cross section 100 mm×250 mm. If the permissible stress is 8 N/mm², find     5+5

   (a)   the maximum intensity of the udl it can carry.

   (b)   the maximum concentrated load *w* applied at 2 m from one end it can carry.

16.  (a)   A cantilever beam of length 3 metres carries udl of 2 kN/m over a length of 2 m from the fixed end and a point load of 2 kN at the free end. Find the deflection at the free end. If $I = 14 \times 10^7$ mm⁴ and $E = 0.1 \times 10^5$ N/mm².     5

   (b)   A simply supported beam of span 3 metres is carrying uniformly distributed total load of 6000 N. The beam has a rectangular section 150 mm wide and 300 mm deep. Calculate the maximum deflection $E = 0.1 \times 10^5$ N/mm².     5

17. A solid steel shaft 100 mm diameter transmits 75 kW at 150 rpm. Calculate *(a)* Torque on the shaft ; *(b)* The maximum shear stress induced ; *(c)* The angle of twist in a length of 600 mm and *(d)* The shear stress at a radius of 30 mm. Take $G = 0.8 \times 10^5$ N/mm².     3+3+2+2

18. A close coiled spring is to have stiffness of 1 N/mm of compression under maximum load of 45 N and maximum shearing stress of 120 N/mm². The solid length of wire is to be 45 mm. Find the diameter of wire, the mean diameter of coils and number of coils required. Take $G = 0.5 \times 10^5$ N/mm².     4+3+3

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