# 7260

## BOARD DIPLOMA EXAMINATION, (C-20)

## MAY—2023

## 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.** List out any six mechanical properties of materials.

**2.** Define the terms *(a)* ultimate strength and *(b)* factor of safety.

**3.** A bar of 300 mm long and 30 mm diameter extends 0·17 mm under an axial load. Find the reduction in diameter, if the Poisson's ratio is 0·3.

**4.** Define the following terms :

*(a)* Resilience

*(b)* Strain energy

**5.** Calculate the strain energy stored in the body subjected to 60 $N/mm^2$ (Tensile stress). The volume of the body is $10^5$ $mm^3$. Assume $E = 2 \times 10^5$ $N/mm^2$.

**6.** Determine the maximum stress and elongation of a bar 2m long and 25 mm diameter when an axial pull of 50 KN is applied gradually on it. Take $E = 2 \times 10^5$ $N/mm^2$.

**7.** What are the different types of loads acting on a beam.

**8.** State any three assumptions made in the theory of simple bending.

**9.** Define the terms *(a)* deflection and *(b)* slope.

**10.** Write torsion equation. Specify each term in it.

## PART—B

8×5=40

**Instructions :** (1) Answer **all** questions.

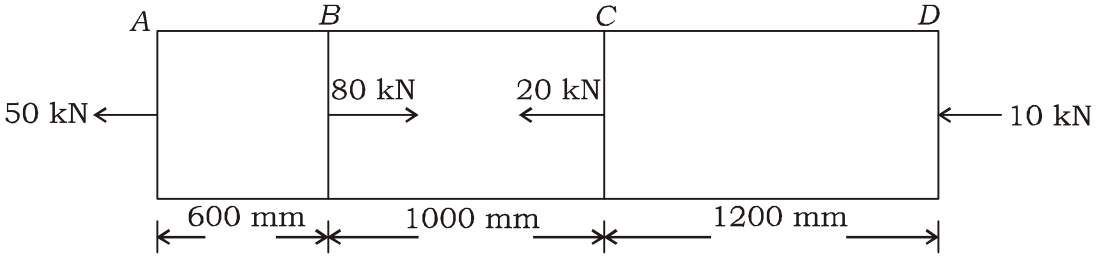
(2) Each question carries **eight** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

**11.** *(a)* A copper bar 40 mm diameter is surrounded by a steel tube of 50 mm external diameter and 5 mm thick, both the ends are rigidly attached. Find the stresses in each metal of composite section of length 1 meter, when it is subjected to an axial load of 200 kN. Take $E_s = 2 \times 10^5$ N/mm$^2$ and $E_c = 1 \times 10^5$ N/mm$^2$.

**(OR)**

*(b)* A bar having cross-sectional area of 1000 mm$^2$, is subjected to axial loads as shown in fig. Find the total elongation of the bar. Take $E = 1{\cdot}05 \times 10^5$ N/mm$^2$.




**12.** *(a)* A cantilever of 10 m span carries loads of 4 kN and 6 kN at 2 m and 6 m respectively from the fixed end, along with another load of 6 kN at the free end. Draw the shear force and bending moment diagrams.

**(OR)**

*(b)* A cantilever beam 2 m long carries concentrated loads of 20 kN at the free end and 30 kN at a distance of 0·5 m from the fixed end respectively. It also carries a u.d.l. of 20 kN/m for a length of 1 m at a distance of 0·75 m from the fixed end. Calculate the maximum SF and BM and draw SFD and BMD.

**13.** *(a)* A simply supported beam of 16 m effective span carries the concentrated loads of 4 kN, 5 kN and 3 kN at distances 3, 7 and 11 m respectively from the left support. Calculate maximum shear force and bending moment. Draw SFD and BMD for the beam.

**(OR)**

*(b)* A simply supported beam of span 8 m carries u.d.l. of 20 kN/m upto a distance of 4 m from left support and a concentrated load of 40 kN at a distance of 2 m from right support. Draw SF and BM diagrams.

**14.** *(a)* A rectangular beam of simply supported of span 5 m, is carrying uniformly distributed load of 45 kN/m. Depth of the beam is 2·5 times the width. Determine the dimensions of the beam if the maximum stress in the material should be 80 $N/mm^2$.

**(OR)**

*(b)* A simply supported beam of circular cross-section is 5 m long and is of 150 mm diameter. What will be the maximum value of the central load if the deflection of the beam does not exceed 12·45 mm? Also calculate the slope at the supports. Take $E = 2 \times 10^5$ $N/mm^2$.

**15.** *(a)* Select a suitable diameter of solid shaft to transmit 125 kW of power at 250 rpm. if the allowable shear stress is not to exceed 75 $N/mm^2$ and twist is not to exceed 1° in a length of 3 m. Take $G = 0{\cdot}84 \times 10^5$ $N/mm^2$.

**(OR)**

*(b)* A hollow shaft is to have outside diameter $D$ and inside diameter is $D/2$. Calculate the minimum value of $D$, if it transmits 147·2 kW at 150 rpm with working shear stress of 42 $N/mm^2$. Calculate the angle of twist in a length of 10 times that of external diameter. Take $G = 0{\cdot}8 \times 10^5$ $N/mm^2$.

## PART—C

10×1=10

**Instructions :** (1) Answer the following question.

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

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

**16.** A reinforced concrete column is 300 mm × 300 mm in section. The column is provided with 8 bars of 20 mm diameter. The column carries a load of 360 kN. Find the stresses in concrete and the steel bars. Take $E_s = 2{\cdot}1 \times 10^5$ $N/mm^2$ and $E_c = 0{\cdot}14 \times 10^5$ $N/mm^2$.

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