22303

11819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : *(1)* ***All*** *questions are* ***compulsory****.*
(2) Answer ***each*** *next main question on a new page.*
(3) Illustrate your answers with ***neat*** *sketches* ***wherever*** *necessary.*
(4) Figures to the ***right*** *indicate* ***full*** *marks.*
(5) Assume suitable data, ***if necessary****.*
(6) ***Use*** *of Non-programmable Electronic Pocket Calculator is permissible.*
(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt **any five** of the following : **10**

a) Giving expression, define shear modulus.

b) Define resilience and proof resilience.

c) Define volumetric strain. Also give the relation between lateral stain and Poisson's ratio.

d) For a certain material, the modulus of elasticity is 200 N/mm^2. If Poisson's ratio is 0.35, calculate Bulk modulus.

e) Determine maximum shear force and maximum bending moment for a cantilever having 4 m span carrying udl of intensity 25 kN/m.

f) Give the expression for maximum bending stress with meaning of each term.

g) Along with expression, define slenderness ratio.

2. Attempt **any three** of the following : **12**

a) Along with the expression define radius of gyration and sectional modulus.

b) For a circular lamina of diameter 100 mm, calculate the moment of inertia and radius of gyration about any tangent.

c) Calculate the moment of inertia for an inverted T-section about its horizontal centroidal axis. Take the size of flange 100 mm × 30 mm and vertical web 120 mm × 30 mm, overall depth = 150 mm.

d) Determine the moment of inertia of an angle section 100 mm × 80 mm × 10 mm about vertical centroidal axis. Longer leg is vertical.

Marks

3. Attempt **any three** of the following : **12**

a) A load of 6 kN is to be raised with the help of steel cable. Determine the minimum diameter of steel cable if stress is not to exceed 110 N/mm^2.

b) A steel rod 15 m long is at a temperature of 15°C. Find the free expansion of the length when the temperature is raised to 65°C. Find the temperature stresses when the expansion of the rod is fully prevented.

Take, $\alpha = 12 \times 10^{-6}$ per °C.

$E = 2 \times 10^5$ N/mm^2.

c) A steel bar is 900 mm long; its two ends are 40 mm and 30 mm in diameter and the length of each part of rod is 200 mm. The middle portion of the bar is 15 mm in diameter and 500 mm long. If the bar is subjected to an axial tensile load of 15 kN, find its total extension.

d) A R.C.C. column is 300 mm × 300 mm in section. It is provided with 8 bars of 20 mm diameter. Determine the stresses induced in concrete and steel bars, if it carries a load of 180 kN. Take, E_s = 210 GPa, E_c = 14 GPa.

4. Attempt **any three** of the following : **12**

a) For a given material, Young's modulus is 110 GN/m^2 and shear modulus is 42 GN/m^2. Find the Bulk modulus and lateral contraction of a round bar of 37.5 mm diameter and 2.4 m length when stretched by 2.5 mm. when subjected to an axial load.

b) A cube of 100 mm size is subjected to a direct load of 50 kN (compressive) on all its faces. Find the change in volume if K = 1.3 GPa and μ = 0.30.

c) A beam ABCD is supported at 'A' and 'D'. AB = BC = CD = 2m. It is subjected to udl of 10 kN/m over AB and a point load of 20 kN at 'C'. Draw shear force and bending moment diagrams.

d) A solid circular column is 4m long with both ends fixed, carries a safe axial load 500 kN. Using Euler's equation, calculate the diameter of column. Take E = 100 kN/m^2 and Factor of safety 2.5.

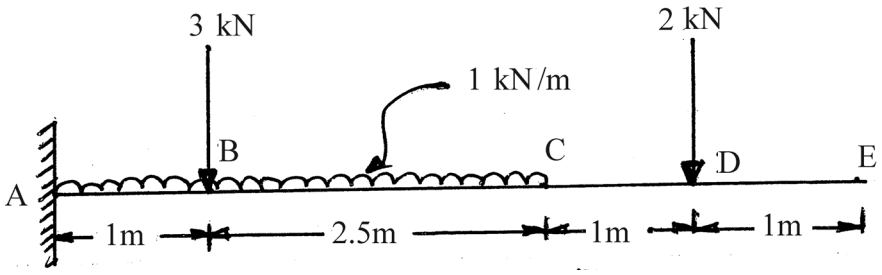
e) Determine the safe load on column of 6 m length, with both ends fixed.
The properties of section are :
$A = 1777\ mm^2$
$I_{xx} = 1.16 \times 10^7\ mm^4$
$I_{yy} = 0.84 \times 10^6\ mm^4$
$\sigma_C = 320\ MPa$

$$\alpha = \frac{1}{7500}$$

Take, factor of safety = 4. Use Rankine's formula.

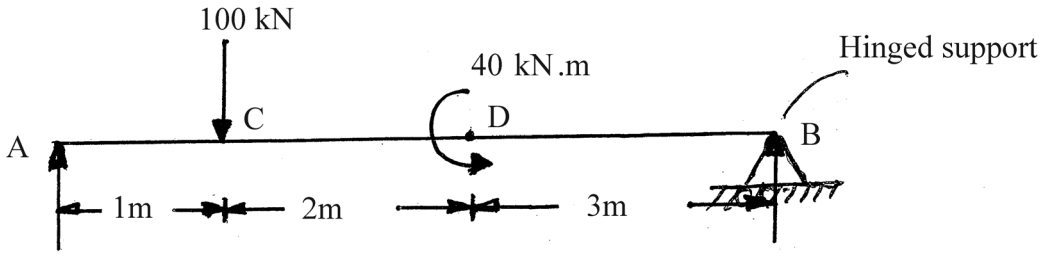
5. Attempt **any two** of the following : **12**

a) Draw shear force and bending moment diagrams for the cantilever beam loaded as shown in figure 1. Indicate all important values.



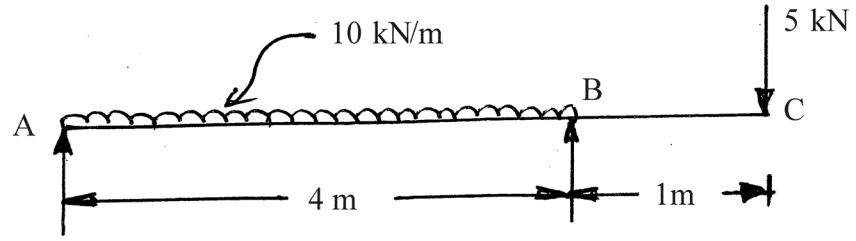
[Figure 1]

b) Draw shear force and bending moment diagrams for the beam as shown in fig. 2



[Figure 2]

c) Draw shear force and bending moment diagram for an overhang beam loaded as shown in fig. 3.



[Figure 3]

6. Attempt **any two** of the following : **12**

a) Attempt the following :

i) Find the bending stress at a distance of 25 mm below top edge of rectangular beam section 80 mm × 240 mm deep if maximum bending moment is 5 kN.m.

ii) A circular beam carries a maximum shear force of 10 kN. Find the necessary diameter of the beam if maximum shear stress is limited to 1.5 N/mm^2.

b) A symmetrical I section 500 mm deep is simply supported at ends having span 5 m and udl 20 kN/m over entire span. Size of flanges are 250 mm × 20 mm and web 10 mm thick. Calculate the magnitude of maximum bending stress induced. Draw stress distribution diagram.

c) A simply supported beam carries a udl of intensity 2.5 kN/m over entire span of 5m. The cross section of beam is a T-section having the dimensions given below.

flange : 125 mm × 25 mm

web : 175 mm × 25 mm, overall depth = 200 mm.

Calculate the maximum shear stress for the section of the beam. Construct shear distribution diagram.

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