

22303

23242

3 Hours / 70 Marks

Seat No.

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- 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****
- State Perpendicular axis theorem.
 - Define Elastic limit.
 - What is Poisson's ratio.
 - State the different types of beam with sketch.
 - State the flexural formula and write the meaning of symbols used in it.
 - Define slenderness ratio and effective length of column.
 - Calculate polar MI of solid circular shaft having diameter 'D'.

P.T.O.

2. Attempt any THREE of the following: 12

- a) A RCC column 450 mm dia. is reinforced with 6 bars of 16 mm diameter. Find the safe load if $\sigma_c = 5 \text{ N/mm}^2$ and $\sigma_s = 125 \text{ N/mm}^2$, modular ratio is 18.
- b) Define shear force and bending moment and give its sign convention.
- c) A timber beam 150 mm wide 300 mm deep simply supported having span 4 m, it carry UDL - 15 kN/m over entire span. Find maximum bending stress induced in section. Draw stress diagram.
- d) Calculate slenderness ratio for which Euler's crippling load and Rankine's failure load is of same magnitude if $E = 200 \text{ mpa}$, $\alpha = 1/7500$, $\sigma_c = 300 \text{ N/mm}^2$.

3. Attempt any THREE of the following: 12

- a) Calculate the radius of gyration of a steel pipe having external diameter 22 mm and internal diameter 16 mm.
- b) Determine the total elongation of the bar shown in Fig. No. 01. Take $E = 2 \times 10^5 \text{ N/mm}^2$.

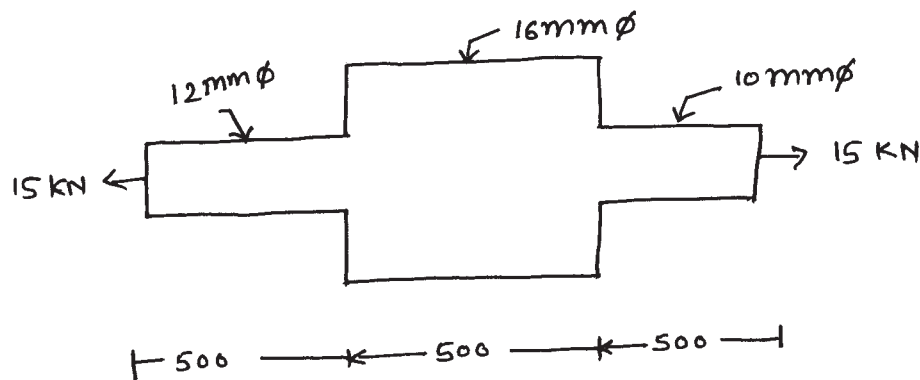


Fig. No. 01.

- c) For a given material, $E = 110 \text{ Gpa}$, $G = 43 \text{ Gpa}$, find bulk modulus and Poisson ratio.

- d) Determine bending moments at 1.5 m from fixed end for beam shown in Fig. No. 02.

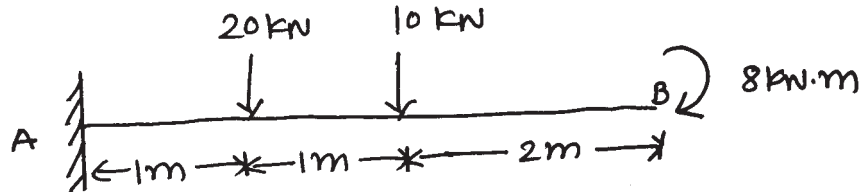


Fig. No. 02.

4. Attempt any THREE of the following: 12

- a) Calculate the bending moment at 1 m from the fixed end for cantilever beam loaded as shown in Fig. No. 03.

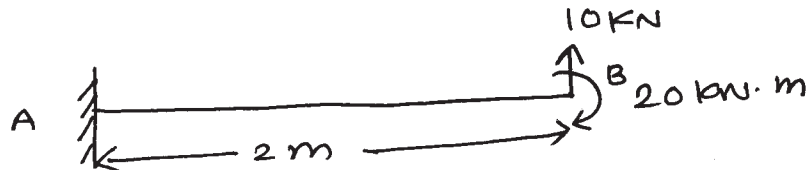


Fig. No. 03.

- b) A joist of 5 m span has planges 250 mm wide \times 20 mm thick and web 10 mm thick. The overall depth 500 mm. It carry UdL 20 kN/m over entire span. Calculate maximum bending stress induced. Sketch the stress distribution diagram
- c) A copper rod 20 mm ϕ is 500 mm long it subjected to axial pull of 2.4 kN applied suddenly calculate
- Stress induced in rod
 - Elongation
 - Energy stored in rod

- d) Calculate I_{XX} of inverted T-section as shown in Fig. No. 04.

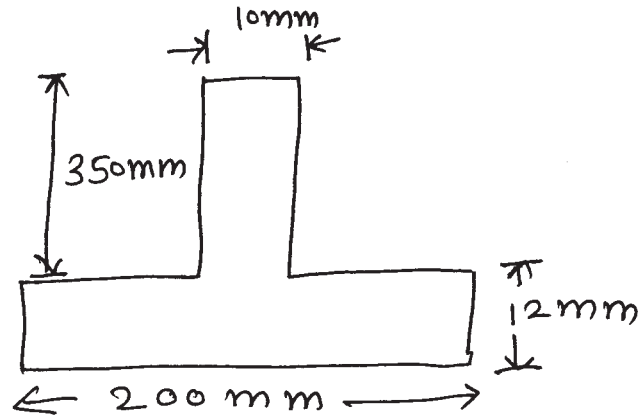


Fig. No. 04.

- e) A cube of 200 mm side is subjected to a compressive force 3.6 MN on each face. The change in volume found to be 5125 mm^3 , Find E and K if $1/m = 0.25$.

5. Attempt any TWO of the following:

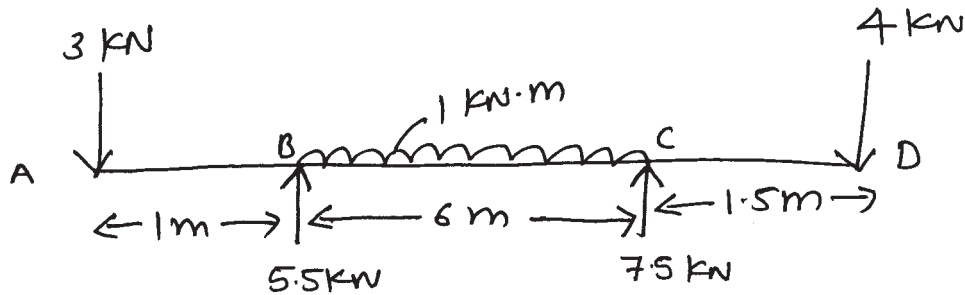
12

- a) A RCC column $400 \times 400 \text{ mm}$ is reinforced with 4 bar of 20 mm ϕ determine the stresses induced in steel and concrete if it is subjected to an axial load of 500 kN. Take modulus ratio $\frac{E_S}{E_C} = 13.33$
- b) In a biaxial stress system the stresses along the two direction are $\sigma_x = 50 \text{ N/mm}^2$ (T) $\sigma_y = 60 \text{ N/mm}^2$ (C), find changes in diamention and volume if $X = 200 \text{ mm}$, $y = 600 \text{ mm}$, $Z = 800 \text{ mm}$.
Take $E = 200 \text{ kN/mm}^2$ and $m = 4$.
- c) Draw S.F.D and B.M.D for a simply supported beam having length 5 m, it carry a point load 20 kN which is acting 3 m from left support, it also carry a moment anticlockwise on point load of 8 kN.m.

6. Attempt any TWO of the following:

12

- a) Draw SFD and BMD of a beam as shown in Fig. No. 05.

Fig. No. 05.

- b) A beam with a rectangular section of 200×300 mm is subjected to a shear force of 48 kN. Calculate the shear stress at the top layer and at distances of 50 mm, 100 mm, and 150 mm from the top layer. Draw the shear stress distribution.
- c) A column with a diameter of 200 mm and a length of 3 m has hinged ends at both ends. Find Euler's crippling load. Take $E = 2 \times 10^5$ MPa.
