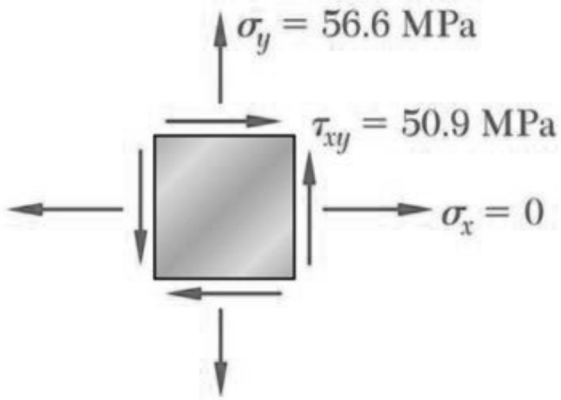
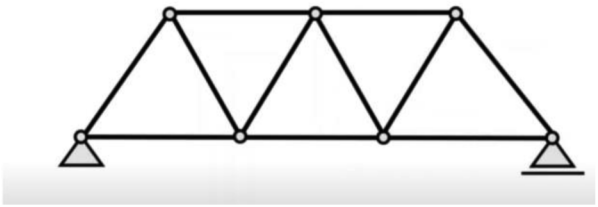
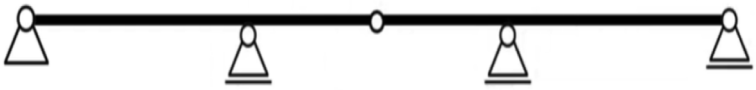
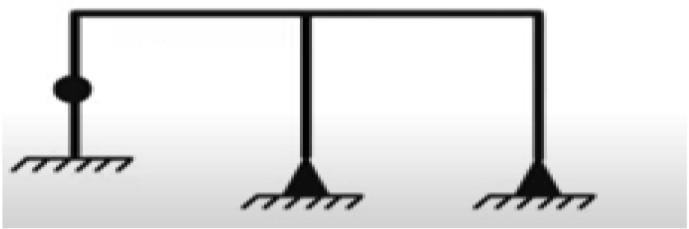
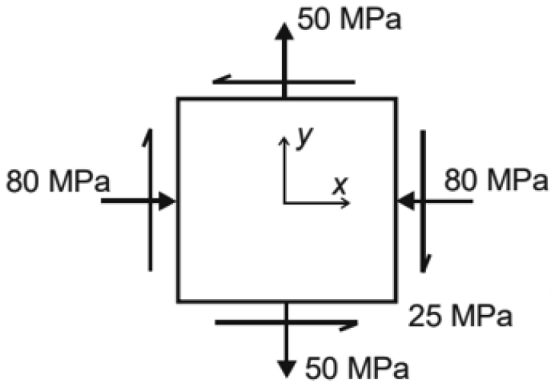
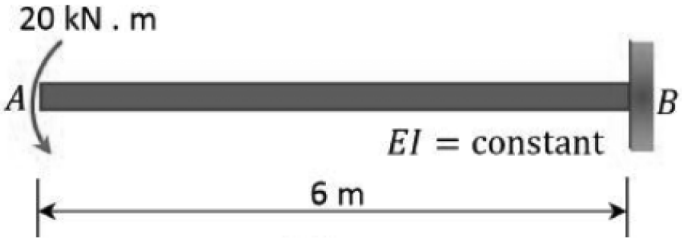
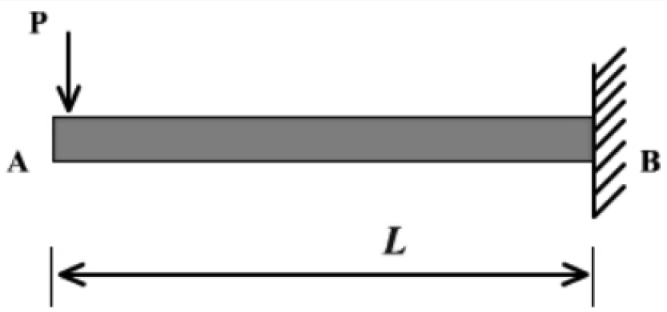
Bachelor of Architecture
Second Year First Semester -2025
Subject: Theory of Structures-I

Time: Three hours | Full Marks: 100

Answer any five questions

| No. of Qs | | |
|---|---|---|
| | 1) Illustrate your answers with neat sketches wherever necessary.<br>2) All notations represent their standard relevant meaning.<br>3) Assume suitable data, if necessary. | |
| **1.a)** | What do you mean by Principal Stresses ?<br>Find principal stresses acting on the principal planes :<br>  <br> | **2**<br>**6** |
| **b)** | Classify each of the figures as statically determinate or indeterminate? If statically indeterminate, state the degrees of indeterminacy. | **4 x3** |
| i) |  | |
| ii) |  | |
| iii) |  | |

| No. of Qs | | |
|---|---|---|
| 2a) | What is Mohr's Circle, and why it is used.? | 4 |
| b) | The state of plane stress at a point is represented by the stress element below. Draw the Mohr's circle, determine the principal stresses and the maximum shear stresses.   | 10 |
| c) | Also find the stresses on an element inclined at 30° clockwise | 6 |
| 3a) | Mentions the theorems of Moment Area method for calculating deflection. | 4 |
| b) | A cantilever beam shown in figure is subjected to a concentrated moment at its free end. Using the moment-area method, determine the slope at the free end of the beam and the deflection at the free end of the beam. EI = constant.   | 10 |
| c) | Determine the deflection and the slope at the free end A of the cantilever beam AB loaded as shown in the fig. EI= constant   | 6 |

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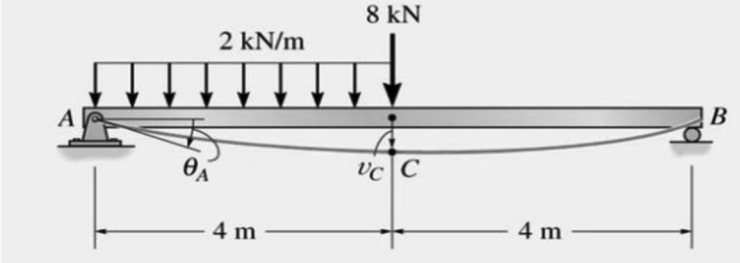
|---|---|---|
| **4 a)** | Explain the assumptions made during analysing deflection and slope of a beam using "Principle of Superposition ". | **6** |
| **b)** | Determine the displacement at point C and the slope at the support A of the beam as shown in figure. EI is constant.   [ provided : For concentrated load , slope = : $\pm\frac{PL^2}{16EI}$ , deflection= $-\frac{PL^3}{48EI}$ For distributed loading , slope = $\frac{3wL^3}{128EI}$ deflection = $\frac{5wL^4}{768EI}$ ] | **12** |
| **c)** | If we allow a beam to deflect too much, what will be the effect to other parts of the structure? | **2** |
| **5a)** | Differentiate between column and strut. How do you define slenderness ratio of a compression member? | **3+3** |
| **b)** | In the event of eccentric loading, explain the stresses experienced by a compression member. | **4** |

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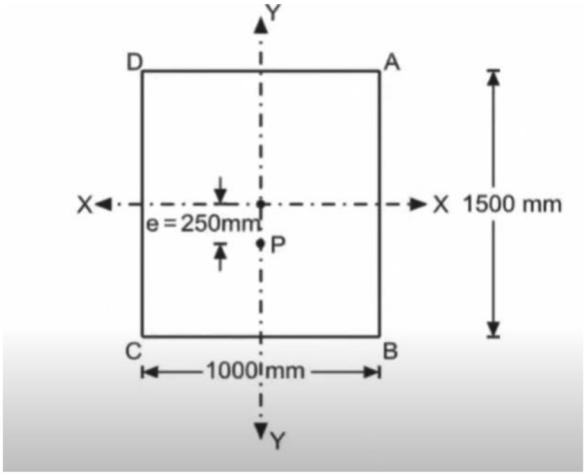
|---|---|---|
| c) | A rectangular column 1000 mm x 1500 mm is subjected to a compressive load of 500 KN with an eccentricity of 250 mm along the axis bisecting 1000 mm side. Find the maximum and minimum intensities of stress.<br>  | 10 |
| 6a) | Find the Euler's crushing load for a hollow cylindrical cast iron column, 15 cm external diameter and 2 cm thick, if it is 6m long and hinged at both ends. E= 80 GPa. Compare this load with the crushing load as given by the Rankine's formula, using constants 550 MPa and 1/1600. | 12 |
| b) | A strut 3.50 meters long is having 6 cm. diameter. One end of the strut is fixed while its other end is hinged. Find the safe compressive load for the member using Euler's formula, allowing a factor of safety of 3.5.<br>Take E=2. 1x $10^6$ kg./cm³. | 8 |

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