King Saud University
College of Engineering,
Department of Civil Engineering

CE 461 - Structural Analysis II
Second Semester, 1427-1428H
Thursday 21-5-1428 H
Time Allowed: 3 hrs

# FINAL EXAM

## CE 461 Structural Analysis II

**Student Name :**

**Student No. :**

**Section : 8-9 10-11 11-12**

**Answer ALL Questions**

| Question # | Grade | |
|---|---|---|
| **1** | | *Out of 10* |
| **2** | | *Out of 10* |
| **3** | | *Out of 10* |
| **4** | | *Out of 10* |
| **5** | | *Out of 10* |
| **TOTAL** | | ***Out of 50*** |

| Name | | No. |
| --- | --- | --- |
| | | Grade Q-1: / 10 |

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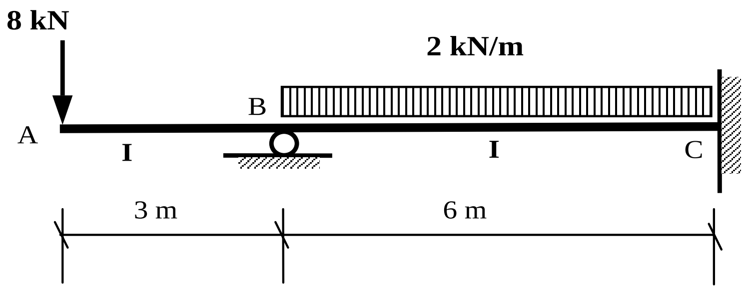
**Q-1 (10 Points)**

For the beam shown in the figure, use **the force method** *(consistent deformation)* to determine the reaction at support **B**.

Draw the shear force and bending moment diagrams.



| Name | | No. |
|---|---|---|
| | | Grade Q-2: / 10 |

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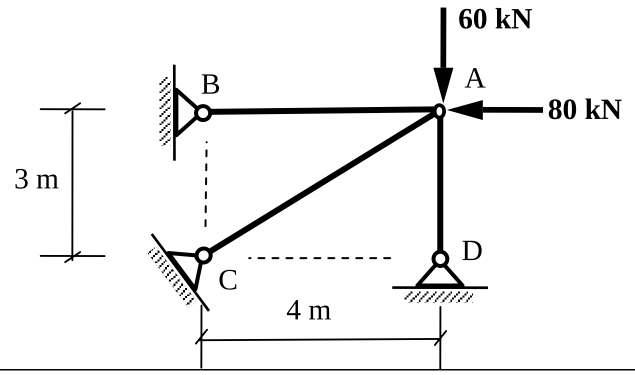
**Q-2 (10 Points)**

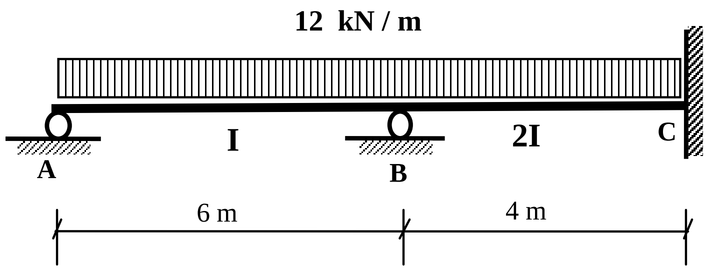
For the truss shown, use **the force method** *(consistent deformation)* to determine the force in each member. Take the force in member **AC** as a redundant. EA is constant



| Name | | No. |
|---|---|---|
| | | Grade Q-3: / 10 |

**Q-3 (10 Points)**

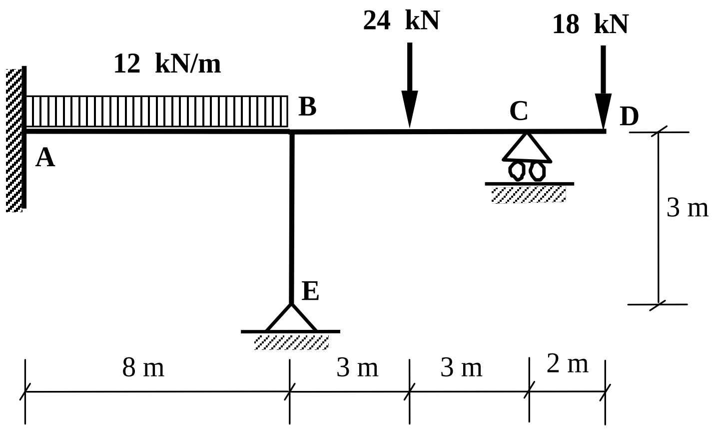
Use the **Slope-Deflection Method** to analyze the beam shown. The support at **B** settles **48/EI** downward. Draw the Shear Force and Bending Moment Diagrams. E is constant



| Name | | No. |
|---|---|---|
| | | Grade Q-4: / 10 |

**Q-4 (10 Points)**

Use the **Moment Distribution Method** to analyze the frame shown. Draw the Bending Moment Diagram. EI is constant.



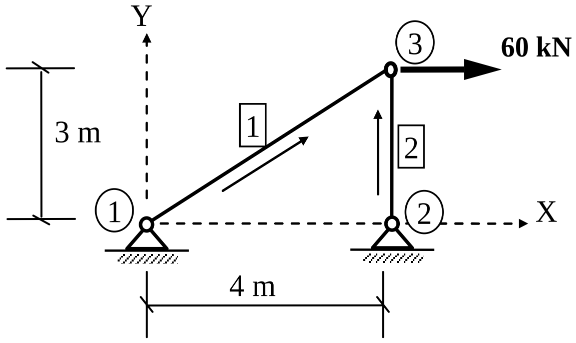
| Name | | No. |
|---|---|---|
| | | Grade Q-5: / 10 |

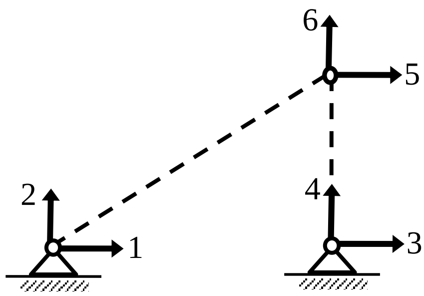
**Q-5 (10 Points)**

For the truss shown:

a) Write the stiffness matrix of <u>members 1 & 2</u> in **Local** axes.
b) Write the stiffness matrix of <u>members 1 & 2</u> in **Global** axes.
c) Write the stiffness matrix of <u>the truss</u> in **Global** axes.
d) Write the displacement vector of <u>the truss</u> in **Global** axes. Show the unknown and known displacements.
e) Write the force vector of <u>the truss</u> in **Global** axes. Show the unknown and known forces.

EA is Constant



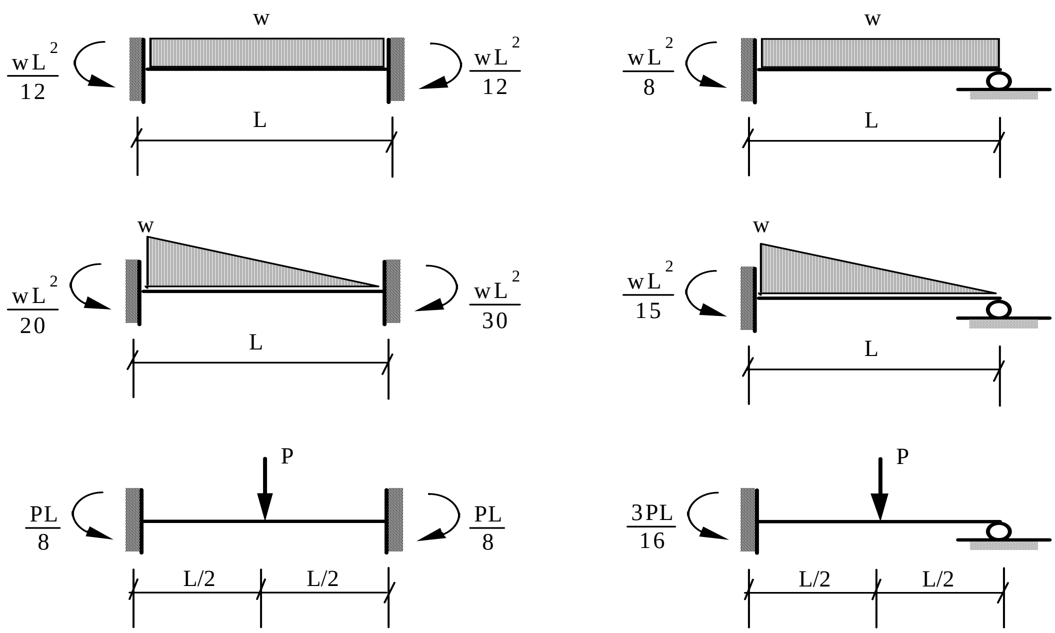



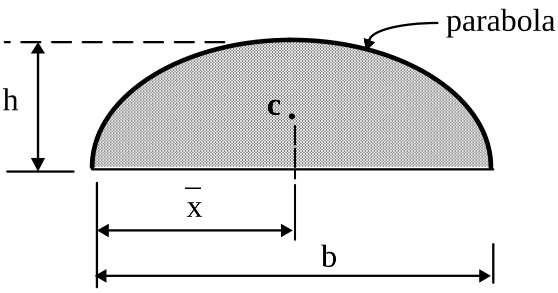

Degrees of Freedom

| Name | | No. |
|---|---|---|

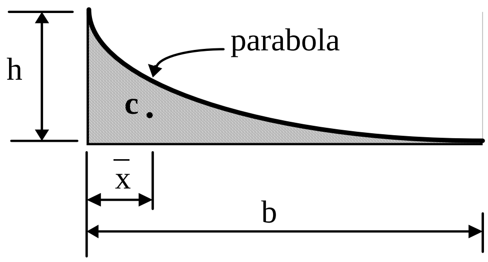
| | | |
|---|---|---|
| Name | | No. |

## USEFUL INFORMATION




$A = \frac{2}{3}\,b\,h \qquad \bar{x} = \frac{b}{2}$




$A = \frac{1}{3}\,b\,h \qquad \bar{x} = \frac{b}{4}$

The truss element stiffness matrix in global coordinate system is:

$$[k] = \frac{EA}{L}\begin{bmatrix} \lambda_x^2 & \lambda_x\lambda_y & -\lambda_x^2 & -\lambda_x\lambda_y \\ \lambda_x\lambda_y & \lambda_y^2 & -\lambda_x\lambda_y & -\lambda_y^2 \\ -\lambda_x^2 & -\lambda_x\lambda_y & \lambda_x^2 & \lambda_x\lambda_y \\ -\lambda_x\lambda_y & -\lambda_y^2 & \lambda_x\lambda_y & \lambda_y^2 \end{bmatrix}$$

where $\lambda_x = Cos\,\theta_x$ *and* $\lambda_y = Cos\,\theta_y$

OR

$$[k] = \frac{EA}{L}\begin{bmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{bmatrix}$$

where $C = Cos\,\theta$ *and* $S = Sin\,\theta$