

Final Exam

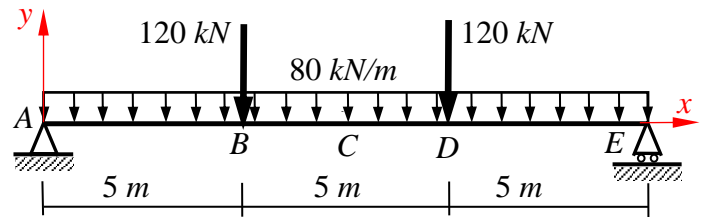
Total Marks: **70**

No. of Questions: **50** (Attempt all questions)

Choose the nearest answer.

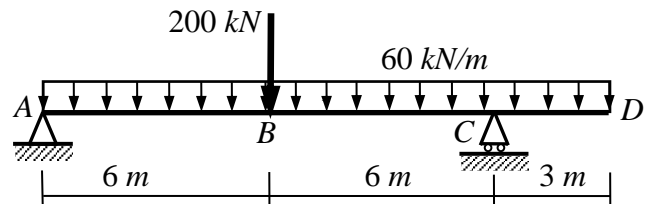
For the shown beam, it is required to determine the deflections at **B** and **C** and the slope at **A** by using the **double integration method**.

$EI = 1.0 \times 10^6 \text{ kN.m}^2$

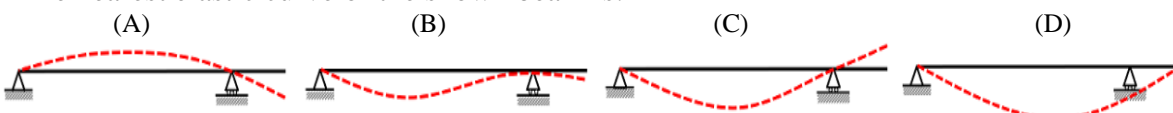


- The vertical reaction at the hinged support **A** is:
 (A) 600 kN ↑ (B) 1200 kN ↑ (C) 120 kN ↑ (D) 720 kN ↑
- The bending moment equation (M) in the last part **DE** is:
 (A) $600x - 40x^2 - 120(x-15)$ (B) $720x - 40x^2 - 120(x-5) - 120(x-10)$ (C) $120x - 40x^2 - 120(x-5) - 120(x-10)$
- $EIy' = \dots$
 (A) $300x^2 - 40x^3/3 - 60(x-15)^2 + C_1$ (B) $60x^2 - 40x^3/3 - 60(x-10)^2 + C_1$ (C) $360x^2 - 40x^3/3 - 60(x-5)^2 - 60(x-10)^2 + C_1$
- $EIy = \dots$
 (A) $100x^3 - 10x^4/3 - 20(x-15)^3 + C_1x + C_2$ (B) $20x^3 - 10x^4/3 - 20(x-10)^3 + C_1x + C_2$ (C) $120x^3 - 10x^4/3 - 20(x-5)^3 - 20(x-10)^3 + C_1x + C_2$
- Boundary Conditions are:
 (A) At $x = 0, y = 0$ & at $x = 15, y = 0$ (B) At $x = 0, y' = 0$ & at $x = 15, y' = 0$ (C) At $x = 5, y = 0$ & at $x = 10, y = 0$
- C_2 is:
 (A) 160 (B) 50 (C) -560 (D) zero
- C_1 is:
 (A) -14250 (B) -2450 (C) -1600 (D) zero
- The deflection at **B**, y_B is:
 (A) 101.2 mm ↓ (B) 8.8 mm ↓ (C) 58.3 mm ↓ (D) 91.7 mm ↓
- The deflection at **C** (at $x=7.5$ m), y_C is:
 (A) 120.1 mm ↓ (B) 13.7 mm ↓ (C) 97.11 mm ↓ (D) 67.1 mm ↓
- The slope at **A**, $\theta_A = y'_A$ is:
 (A) 0.0143 rad ⤴ (B) 0.124 rad ⤴ (C) 0.0325 rad ⤴ (D) 0.0005 rad ⤴

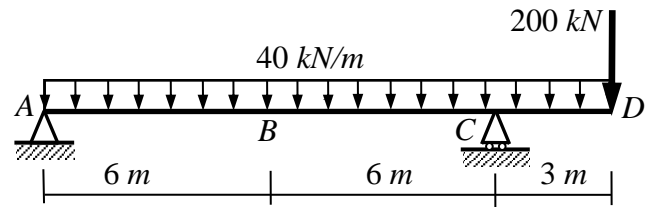
For the shown beam, it is required to determine the slope at **A** and the deflections at **B** & **D** by using the **moment-area method**. $EI = 1.0 \times 10^6 \text{ kN.m}^2$



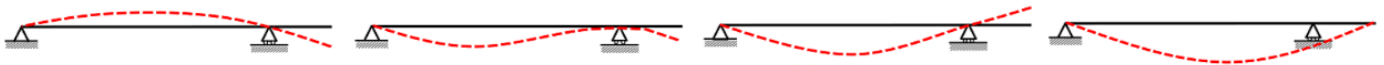
- The vertical reaction at the hinged support **A** is:
 (A) 100 kN ↑ (B) 100 kN ↓ (C) 437.5 kN ↑ (D) 560 kN ↑
- The bending moment at **C** is:
 (A) -60 kN.m (B) -270 kN.m (C) -180 kN.m (D) -90 kN.m
- The bending moment at **B** is:
 (A) 1080 kN.m (B) 1200 kN.m (C) 2625 kN.m (D) 1545 kN.m
- The deviation of **B** relative to the tangent of the elastic curve at **A**, $t_{B/A}$ is:
 (A) 0.0325 m (B) 0.0265 m (C) 0.0125 m (D) 0.0465 m
- The deviation of **C** relative to the tangent of the elastic curve at **A**, $t_{C/A}$ is:
 (A) 0.032 m (B) 0.016 m (C) 0.067 m (D) 0.046 m
- The slope of the tangent of the elastic curve at **A**, θ_A is:
 (A) 0.0056 rad ⤴ (B) 0.0024 rad ⤴ (C) 0.6 rad ⤴ (D) 0.6 rad ⤴
- The deviation of **D** relative to the tangent of the elastic curve at **A**, $t_{D/A}$ is:
 (A) 0.012 m (B) 0.024 m (C) 0.098 m (D) 0.036 m
- The deflection at **B**, δ_B is:
 (A) 4.27 mm ↑ (B) 20.97 mm ↓ (C) 12.25 mm ↓ (D) 4.27 mm ↓
- The deflection at **D**, δ_D is:
 (A) 40.1 mm ↑ (B) 10.5 mm ↓ (C) 23.1 mm ↓ (D) 14.5 mm ↑
- The nearest elastic curve of the shown beam is:



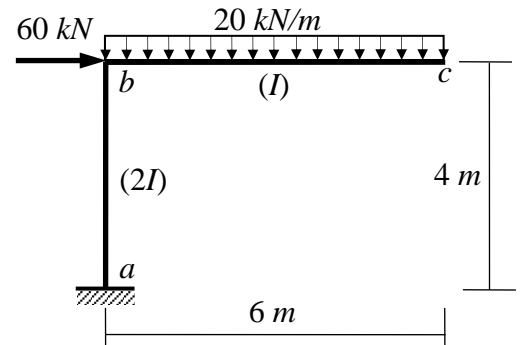
For the shown beam, it is required to determine the slopes at A & D , the deflections at B & D and the maximum deflection for the beam by using the **conjugate beam method**. $EI = 1.0 \times 10^6 \text{ kN.m}^2$.



21. After loading M on the conjugate beam, the elastic reaction at support A is:
 (A) $302 \text{ kN.m}^2 \uparrow$ (B) $604 \text{ kN.m}^2 \uparrow$ (C) $302 \text{ kN.m}^2 \downarrow$ (D) $1320 \text{ kN.m}^2 \uparrow$
22. After loading M on the conjugate beam, the elastic reaction at support D is:
 (A) $604 \text{ kN.m}^2 \uparrow$ (B) $1320 \text{ kN.m}^2 \downarrow$ (C) $302 \text{ kN.m}^2 \uparrow$ (D) $302 \text{ kN.m}^2 \downarrow$
23. The slope of the tangent of the elastic curve at A , θ_A is:
 (A) $0.006 \text{ rad } \curvearrowright$ (B) $0.0013 \text{ rad } \curvearrowright$ (C) $0.0003 \text{ rad } \curvearrowright$ (D) $0.0003 \text{ rad } \curvearrowleft$
24. The slope of the tangent of the elastic curve at D , θ_D is:
 (A) $0.0013 \text{ rad } \curvearrowright$ (B) $0.006 \text{ rad } \curvearrowright$ (C) $0.0003 \text{ rad } \curvearrowright$ (D) $0.0003 \text{ rad } \curvearrowleft$
25. The deflection at B , δ_B is:
 (A) $4.27 \text{ mm } \uparrow$ (B) $8.53 \text{ mm } \uparrow$ (C) $3.78 \text{ mm } \downarrow$ (D) $8.78 \text{ mm } \downarrow$
26. The deflection at D , δ_D is:
 (A) $4.27 \text{ mm } \uparrow$ (B) $8.53 \text{ mm } \uparrow$ (C) $8.78 \text{ mm } \downarrow$ (D) $2.93 \text{ mm } \downarrow$
27. The maximum downward deflection is at a distance from support A =....:
 (A) 3.83 m (B) 5.00 m (C) 4.91 m (D) 2.99 m
28. The maximum downward deflection is:
 (A) 4.0 mm (B) 5.00 mm (C) 6.53 mm (D) 12.1 mm
29. The nearest elastic curve of the shown beam is:
 (A) (B) (C) (D)

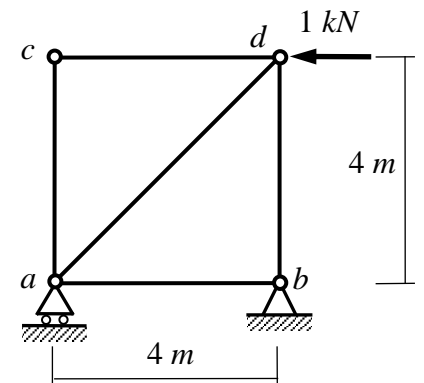


For the shown frame, it is required to determine the horizontal and vertical displacements at c (δ_{ch} and δ_{cv}) and the slope at c (θ_c) using the **virtual work method**. The relative moments of inertia are given between brackets. $EI = 1.0 \times 10^6 \text{ kN.m}^2$.



30. The bending moment at b due to the given load is:
 (A) -20 kN.m (B) -360 kN.m (C) -160 kN.m (D) -240 kN.m
31. The bending moment at a due to the given load is:
 (A) -60 kN.m (B) -600 kN.m (C) -240 kN.m (D) -360 kN.m
32. The value of the bending moment at b due to unit vertical load at c is:
 (A) 6 kN.m (B) 1 kN.m (C) 4 kN.m (D) 24 kN.m
33. The horizontal displacement at c , δ_{ch} is:
 (A) $8.1 \text{ mm } \rightarrow$ (B) $3.2 \text{ mm } \leftarrow$ (C) $2.1 \text{ mm } \rightarrow$ (D) $0.1 \text{ mm } \rightarrow$
34. The vertical displacement at c , δ_{cv} is:
 (A) $5 \text{ mm } \uparrow$ (B) $2 \text{ mm } \downarrow$ (C) $26 \text{ mm } \downarrow$ (D) $9 \text{ mm } \downarrow$
35. The slope at c , θ_c is:
 (A) $0.0017 \text{ rad } \curvearrowright$ (B) $0.0097 \text{ rad } \curvearrowright$ (C) $0.0072 \text{ rad } \curvearrowright$ (D) $0.017 \text{ rad } \curvearrowright$

For the shown truss, it is required to determine the horizontal and vertical displacement at d (δ_{dh} and δ_{dv}) using the **virtual work method**. $EA = 1000 \text{ kN}$

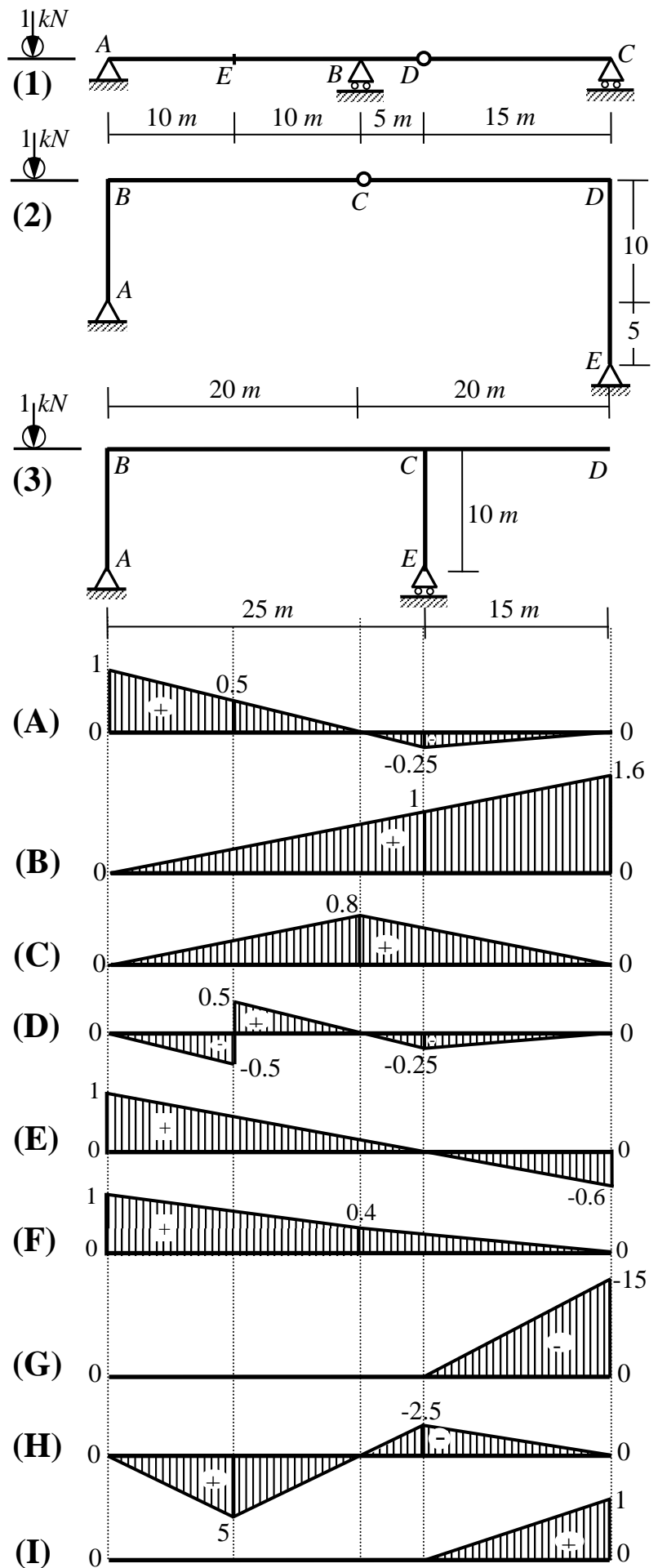
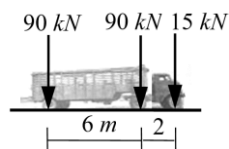


36. The force in member cd due to the given load (N_o) is:
 (A) -1.4 kN (B) -1 kN (C) 1 kN (D) zero
37. The force in member bd due to the given load (N_o) is:
 (A) zero (B) -1 kN (C) 1 kN (D) -1.4 kN
38. The value of the force in member cd due to vertical unit load at d is:
 (A) zero (B) 1 kN (C) 0.5 kN (D) 1.4 kN
39. The horizontal displacement at d , δ_{dh} is:
 (A) $12.1 \text{ mm } \rightarrow$ (B) $19.3 \text{ mm } \leftarrow$ (C) $3.2 \text{ mm } \leftarrow$ (D) $7.9 \text{ mm } \leftarrow$
40. The vertical displacement at d , δ_{dv} is:
 (A) $12 \text{ mm } \uparrow$ (B) $4 \text{ mm } \uparrow$ (C) zero (D) $20 \text{ mm } \downarrow$

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For the shown beam in **1** and frames in **2** and **3**, it is required to draw the influence line (I.L.) for some functions (reaction - shear force - bending moment).

41. The diagram shown in **A** is the I.L. for:
 (A) A_y of the beam **1**.
 (B) A_y of the frame **2**.
 (C) A_y of the frame **3**.
 (D) Shear force at **A** of the frame **3**.
42. The diagram shown in **B** is the I.L. for:
 (A) B_y of the beam **1**.
 (B) C_y of the beam **1**.
 (C) E_y of the frame **2**.
 (D) E_y of the frame **3**.
43. The diagram shown in **C** is the I.L. for:
 (A) B_y of the beam **1**.
 (B) A_x of the frame **2**.
 (C) A_x of the frame **3**.
 (D) Bending moment at C_{right} of the frame **3**.
44. The diagram shown in **D** is the I.L. for:
 (A) A_y of the beam **1**.
 (B) A_y of the frame **2**.
 (C) Shear force at **E** of the beam **1**.
 (D) Shear force at **E** of the frame **2**.
45. The diagram shown in **E** is the I.L. for:
 (A) A_y of the beam **1**.
 (B) A_y of the frame **2**.
 (C) A_y of the frame **3**.
 (D) Shear force at **E** of the frame **3**.
46. The diagram shown in **F** is the I.L. for:
 (A) A_x of the beam **1**.
 (B) A_y of the frame **2**.
 (C) A_x of the frame **3**.
 (D) A_y of the frame **3**.
47. The diagram shown in **G** is the I.L. for:
 (A) Bending moment at **D** of the beam **1**.
 (B) Bending moment at C_{right} of the frame **3**.
 (C) Shear force at C_{right} of the frame **3**.
 (D) C_y of the beam **1**.
48. The diagram shown in **H** is the I.L. for:
 (A) Bending moment at **E** of the beam **1**.
 (B) Shear force at **E** of the beam **1**.
 (C) A_y of the beam **1**.
 (D) A_y of the frame **2**.
49. The diagram shown in **I** is the I.L. for:
 (A) Bending moment at **D** of the beam **1**.
 (B) Bending moment at C_{right} of the frame **3**.
 (C) Shear force at C_{right} of the frame **3**.
 (D) C_y of the beam in **1**.
50. The maximum E_y of the frame **3** caused by the shown moving truck is:
 (A) 168.6 kN.
 (B) 195 kN.
 (C) 285.6 kN.
 (D) 390.1 kN.



With my best wishes

Dr. M. Abdel-Kader