Ministry of Higher Education
Giza Higher Institute of Engineering & Technology
Civil Engineering Department
Course Name: **Theory of Structures (2)A**
Course Code: **CIV 211** Date: **15 / 1 / 2022**

Academic Year: **2021/2022**
Semester: **First**
Level: **2nd Civil**
Time: 3 **Hours**
Examiner: ***Dr. M. Abdel-Kader***

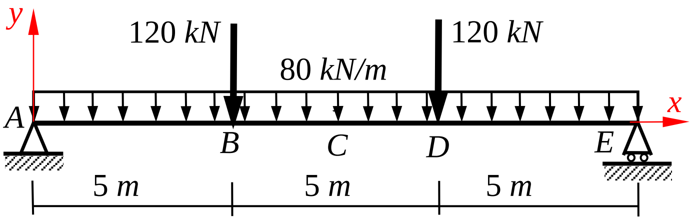
Final Exam

Total Marks: **70** No. of Questions: **50** (Attempt all questions)

Choose the nearest answer.

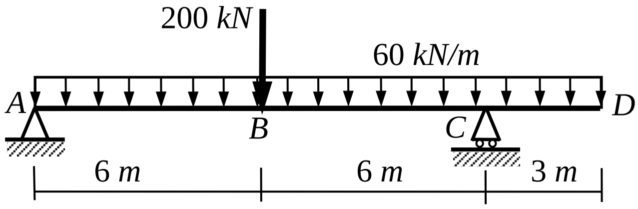
For the shown beam, it is required to determine the deflections at ***B*** and ***C*** and the slope at ***A*** by using the **double integration method**.

$EI = 1.0\times10^6\ kN.m^2$



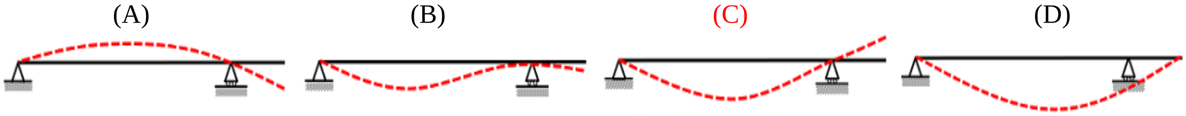
1. The vertical reaction at the hinged support ***A*** is:
   (A) 600 kN ↑ (B) 1200 kN ↑ (C) 120 kN ↑ (D) 720 kN ↑
2. The bending moment equation (M) in the last part ***DE*** is:
   (A) $600x-40x^2-120(x-15)$ (B) $720x-40x^2-120(x-5)-120(x-10)$ (C) $120x-40x^2-120(x-5)-120(x-10)$
3. $EIy' =$ ……
   (A) $300x^2-40x^3/3-60(x-15)^2+C_1$ (B) $60x^2-40x^3/3-60(x-10)^2+C_1$ (C) $360x^2-40x^3/3-60(x-5)^2-60(x-10)^2+C_1$
4. $EIy =$ ……
   (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) $120x^3-10x^4/3-20(x-5)^3-20(x-10)^3+C_1x+C_2$
5. 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 $x = 10$, $y = 0$
6. C_2 is:
   (A) 160 (B) 50 (C) -560 (D) zero
7. C_1 is:
   (A) -14250 (B) -2450 (C) -1600 (D) zero
8. The deflection at ***B***, y_B is:
   (A) 101.2 mm ↓ (B) 8.8 mm ↓ (C) 58.3 mm ↓ (D) 91.7 mm ↓
9. 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 ↓
10. 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**. $EI = 1.0\times10^6\ kN.m^2$



11. The vertical reaction at the hinged support ***A*** is:
   (A) 100 kN ↑ (B) 100 kN ↓ (C) 437.5 kN ↑ (D) 560 kN ↑
12. The bending moment at ***C*** is:
   (A) -60 $kN.m$ (B) -270 $kN.m$ (C) -180 $kN.m$ (D) -90 $kN.m$
13. The bending moment at ***B*** is:
   (A) 1080 $kN.m$ (B) 1200 $kN.m$ (C) 2625 $kN.m$ (D) 1545 $kN.m$
14. 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
15. 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
16. 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 ↺
17. 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
18. The deflection at ***B***, δ_B is:
   (A) 4.27 mm ↑ (B) 20.97 mm ↓ (C) 12.25 mm ↓ (D) 4.27 mm ↓
19. The deflection at ***D***, δ_D is:
   (A) 40.1 mm ↑ (B) 10.5 mm ↓ (C) 23.1 mm ↓ (D) 14.5 mm ↑
20. The nearest elastic curve of the shown beam is:

(A) (B) (C) (D)



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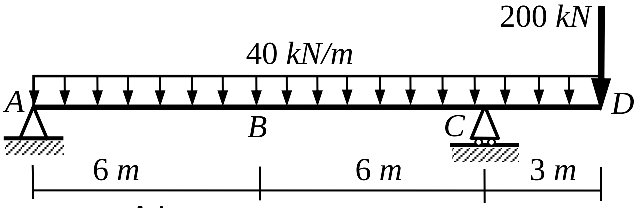
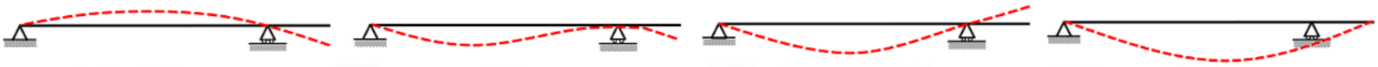
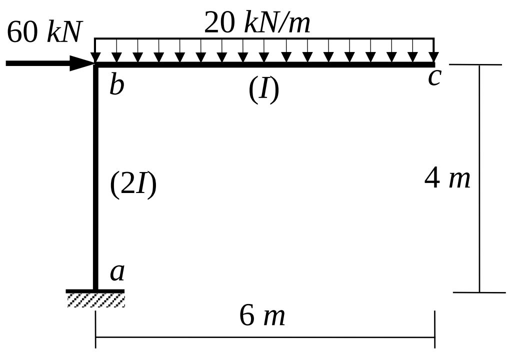
For the shown beam, it is required to determine the slopes at ***A*** & ***D***, the deflections at ***B*** & ***D*** and the maximum deflection for the beam by using the **conjugate beam method**. $EI = 1.0\times10^6$ $kN.m^2$.



21. After loading *M* on the conjugate beam, the elastic reaction at support ***A*** is:
    (A) 302 $kN.m^2$ ↑ (B) 604 $kN.m^2$ ↑ (C) 302 $kN.m^2$ ↓ (D) 1320 $kN.m^2$ ↑
22. After loading *M* on the conjugate beam, the elastic reaction at support ***D*** is:
    (A) 604 $kN.m^2$ ↑ (B) 1320 $kN.m^2$ ↓ (C) 302 $kN.m^2$ ↑ (D) 302 $kN.m^2$ ↓
23. The slope of the tangent of the elastic curve at ***A***, θ_A is:
    (A) 0.006 rad ↺ (B) 0.0013 rad ↻ (C) 0.0003 rad ↻ (D) 0.0003 rad ↺
24. The slope of the tangent of the elastic curve at ***D***, θ_D is:
    (A) 0.0013 rad ↻ (B) 0.006 rad ↻ (C) 0.0003 rad ↻ (D) 0.0003 rad ↺
25. The deflection at ***B***, δ_B is:
    (A) 4.27 *mm* ↑ (B) 8.53 *mm* ↑ (C) 3.78 *mm* ↓ (D) 8.78 *mm* ↓
26. The deflection at ***D***, δ_D is:
    (A) 4.27 *mm* ↑ (B) 8.53 *mm* ↑ (C) 8.78 *mm* ↓ (D) 2.93 *mm* ↓
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)

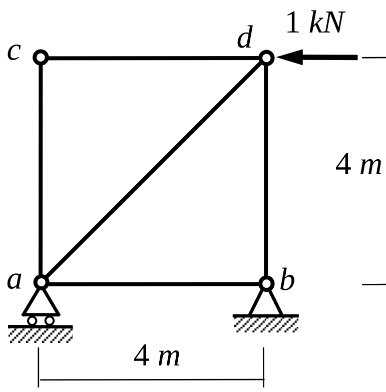


For the shown frame, it is required to determine the horizontal and vertical displacements at ***c*** (δ_{ch} and δ_{cv}) and the slope at ***c*** (θ_c) using the **virtual work method**. The relative moments of inertia are given between brackets. $EI=1.0\times10^6$ $kN.m^2$.



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 *mm* → (B) 3.2 *mm* ← (C) 2.1 *mm* → (D) 0.1 *mm* →
34. The vertical displacement at ***c***, δ_{cv} is:
    (A) 5 *mm* ↑ (B) 2 *mm* ↓ (C) 26 *mm* ↓ (D) 9 *mm* ↓
35. The slope at ***c***, θ_c is:
    (A) 0.0017 rad ↻ (B) 0.0097 rad ↻ (C) 0.0072 rad ↻ (D) 0.017 rad ↻

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 *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 *mm* → (B) 19.3 *mm* ← (C) 3.2 *mm* ← (D) 7.9 *mm* ←
40. The vertical displacement at ***d***, δ_{dv} is:
    (A) 12 *mm* ↑ (B) 4 *mm* ↑ (C) zero (D) 20 *mm* ↓

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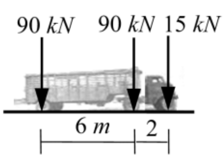
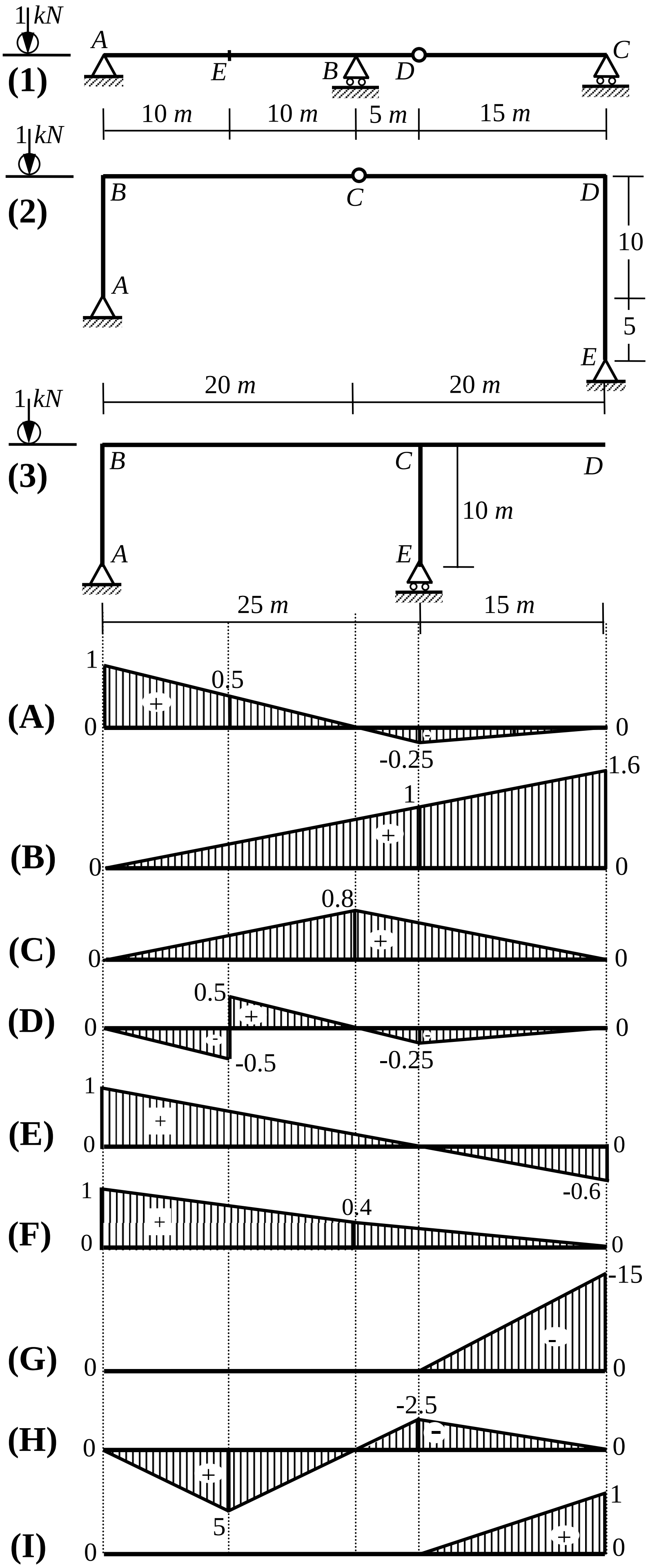
For the shown beam in **1** and frames in **2** and **3**, it is required to draw the influence line (*I.L.*) for some functions (reaction - shear force - bending moment).

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