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: **9 / 1 / 2023**

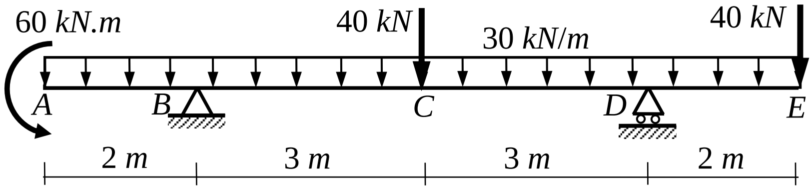
Academic Year: **2022/2023**
Semester: **First**
Level: **2^{nd} Civil**
Time: 3 **Hours**
Examiner**: *Dr. M. Abdel-Kader***

Final Exam

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

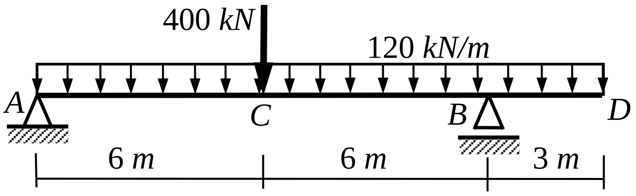
Choose the nearest answer.

For the shown beam, it is required to determine the slope at ***A*** and the deflections at ***A***, ***C*** and ***E*** by using the **double integration method**.
$EI = 1.0\times10^5\ kN.m^2$



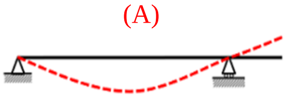
1. The vertical reaction at the support ***D*** is:
   (A) 213.3 *kN*↑ (B) 166.7 *kN*↑ (C) 156.7 *kN*↑ (D) 143.3 *kN*↑
2. The bending moment equation (*M*) in the last part ***DE*** is:
   (A) $-60 -15x^2+500(x-2)/3-40(x-5)+500(x-8)/3$ (B) $-60x^0-15x^2+500(x-2)/3-40(x-5)+640(x-8)/3$
   (C) $-60x -15x^2+500(x-2)/3-40(x-5)+640(x-8)/3$ (D) $-60x^0-15x^2+640(x-2)/3-40(x-5)+500(x-8)/3$
3. EIy = ……
   (A) $-60x -1.25x^4+250(x-2)^3/9-20(x-5)^3/3+320(x-8)^3/9+C_1x+C_2$ (B) $-30x^2-1.25x^4+320(x-2)^3/9-20(x-5)^3/3+250(x-8)^3/9+C_1x+C_2$
   (C) $-60 -1.25x^4+320(x-2)^3/9-20(x-5)^3/3+250(x-8)^3/9+C_1x+C_2$ (D) $-30x^2-1.25x^4+250(x-2)^3/9-20(x-5)^3/3+320(x-8)^3/9+C_1x+C_2$
4. Boundary Conditions are:
   (A) At x= 2, y= 0 & at x= 8, y= 0 (B) At x= 0, y'= 0 & at x= 10, y'= 0 (C) At x= 2, y= 0 & at x= 10, y= 0
5. C_1 = …:
   (A) zero (B) 220 (C) -560 (D) 180
6. C_2 = …:
   (A) -220 (B) -180 (C) -1600 (D) 180
7. The slope at ***A***, $\theta_A = y'_A$ is:
   (A) 0.0018 rad ↺ (B) 0.124 rad ↻ (C) 0.0325 rad ↺ (D) 0.0005 rad ↺
8. The deflection at ***A***, y_A is:
   (A) 10.2 *mm*↓ (B) 8.8 *mm*↓ (C) 2.2 *mm*↓ (D) 6.7*mm*↓
9. The deflection at ***C***, y_C is:
   (A) 20.1 *mm*↓ (B) 13.7 *mm*↓ (C) 7.1 *mm*↓ (D) 1 *mm*↓
10. The deflection at ***E***, y_E is:
    (A) 9.91 *mm*↓ (B) 13.17 *mm*↓ (C) 7.11 *mm*↓ (D) 2.47 *mm*↓

For the shown beam, it is required to determine the slope at ***A*** and the deflections at ***C***&***D*** by using the **moment-area method**. $EI = 1.0\times10^6\ kN.m^2$

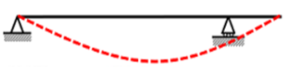


11. The vertical reaction at the hinged support ***B*** is:
    (A) 260 *kN*↑ (B) 200 *kN*↑ (C) 875 *kN*↑ (D) 1325 *kN*↑
12. The bending moment at ***B*** is:
    (A) -360 *kN.m* (B) -960 *kN.m* (C) -2400 *kN.m* (D) -540 *kN.m*
13. The bending moment at ***C*** is:
    (A) 2160 *kN.m* (B) 2400 *kN.m* (C) 2625 *kN.m* (D) 3090 *kN.m*
14. The deviation of ***B*** relative to the tangent of the elastic curve at ***A***, $t_{B/A}$ is:
    (A) 0.064 *m* (B) 0.032 *m* (C) 0.134 *m* (D) 0.092 *m*
15. The deviation of ***C*** relative to the tangent of the elastic curve at ***A***, $t_{C/A}$ is:
    (A) 0.065 *m* (B) 0.053 *m* (C) 0.025 *m* (D) 0.092 *m*
16. The slope of the tangent of the elastic curve at ***A***, θ_A is:
    (A) 0.0112 rad ↻ (B) 0.0048 rad ↻ (C) 1.2 rad ↻ (D) 1.2 rad ↺
17. The deviation of ***D*** relative to the tangent of the elastic curve at ***A***, $t_{D/A}$ is:
    (A) 0.104 *m* (B) 0.048 *m* (C) 0.196 *m* (D) 0.072 *m*
18. The deflection at ***C***, δ_C is:
    (A) 41.9 *mm*↓ (B) 8.3 *mm*↓ (C) 24.5 *mm*↓ (D) 18.3 *mm*↓
19. The deflection at ***D***, δ_D is:
    (A) 18.3*mm*↑ (B) 29.0 *mm*↓ (C) 18.3 *mm*↓ (D) 29.0 *mm*↑
20. The nearest elastic curve of the shown beam is:

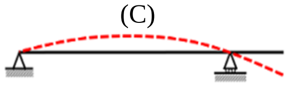
(A)



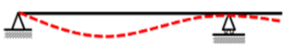
(B)



(C)



(D)



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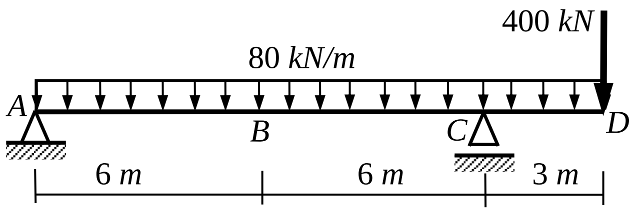
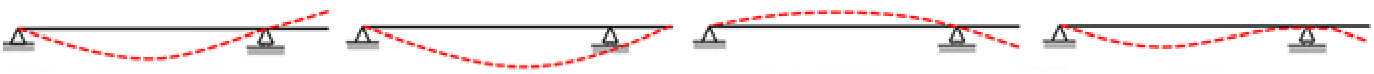
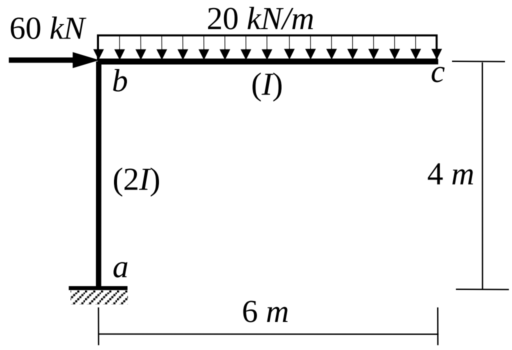
For the shown beam, it is required to determine the slopes at ***A&D***, the deflections at ***B&D*** and the maximum deflection for the beam by using the **conjugate beam method**. $EI = 1.0 \times 10^6 kN.m^2$.



21. After loading *M* on the conjugate beam, the elastic reaction at support ***A*** is:
    (A) 2640 $kN.m^2$↑ (B) 1208 $kN.m^2$↑ (C) 604 $kN.m^2$↓ (D) 1320 $kN.m^2$↑
22. After loading *M* on the conjugate beam, the elastic reaction at support ***D*** is:
    (A) 1208 $kN.m^2$↑ (B) 1320 $kN.m^2$↓ (C) 604 $kN.m^2$↑ (D) 2640 $kN.m^2$↓
23. The slope of the tangent of the elastic curve at ***A***, θ_A is:
    (A) 0.006 rad ↺ (B) 0.0013 rad ↻ (C) 0.0026 rad ↻ (D) 0.0006 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) 0.0026 rad ↻ (D) 0.0006 rad ↺
25. The deflection at ***B***, δ_B is:
    (A) 4.27 *mm*↑ (B) 17.56 *mm*↑ (C) 3.78 *mm* ↓ (D) 7.56 *mm* ↓
26. The deflection at ***D***, δ_D is:
    (A) 14.27 *mm*↑ (B) 8.53 *mm*↑ (C) 5.85 *mm* ↓ (D) 2.93*mm* ↓
27. The maximum downward deflection is at a distance from support ***A*** =….:
    (A) 4.91 *m* (B) 6.00 *m* (C) 9.82 *m* (D) 2.99 *m*
28. The maximum downward deflection is:
    (A) 4.0 *mm* (B) 8.0 *mm* (C) 6.5 *mm* (D) 12.1 *mm*
29. The nearest elastic curve of the shown beam is:
    (A) (B) (C) (D)

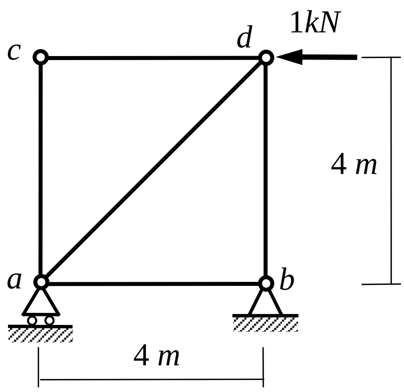


For the shown frame, it is required to determine the horizontal and vertical displacements at ***c*** (δ_{ch} and δ_{cv}) and the slope at ***c*** (θ_c) using the **virtual work method**. The relative moments of inertia are given between brackets. $EI=1.0\times10^6 kN.m^2$.



30. The bending moment at ***b*** due to the given load is:
    (A) -20*kN.m* (B) -160 *kN.m* (C) -360 *kN.m* (D) -240 *kN.m*
31. The bending moment at ***a*** due to the given load is:
    (A) -600 *kN.m* (B) -60 *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) 4 *kN.m* (B) 1 *kN.m* (C) 6 *kN.m* (D) 24 *kN.m*
33. The horizontal displacement at ***c***, δ_{ch} is:
    (A) 8.1 *mm*→ (B) 3.2*mm*← (C) 0.1 *mm*→ (D) 2.1 *mm*→
34. The vertical displacement at ***c***, δ_{cv} is:
    (A) 5 *mm*↑ (B) 9 *mm*↓ (C) 26 *mm*↓ (D) 2 *mm*↓
35. The slope at ***c***, θ_c is:
    (A) 0.0097 rad ↻ (B) 0.0017 rad ↻ (C) 0.0072 rad ↻ (D) 0.0172 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) zero (D) 1 *kN*
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 ***bd*** 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) 9.3 *mm* ← (C) 3.2 *mm* ← (D) 19.3 *mm* ←
40. The vertical displacement at ***d***, δ_{dv} is:
    (A) 4 *mm*↑ (B) 2 *mm*↑ (C) zero (D) 20 *mm*↓

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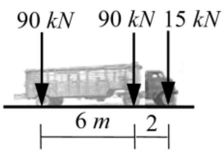
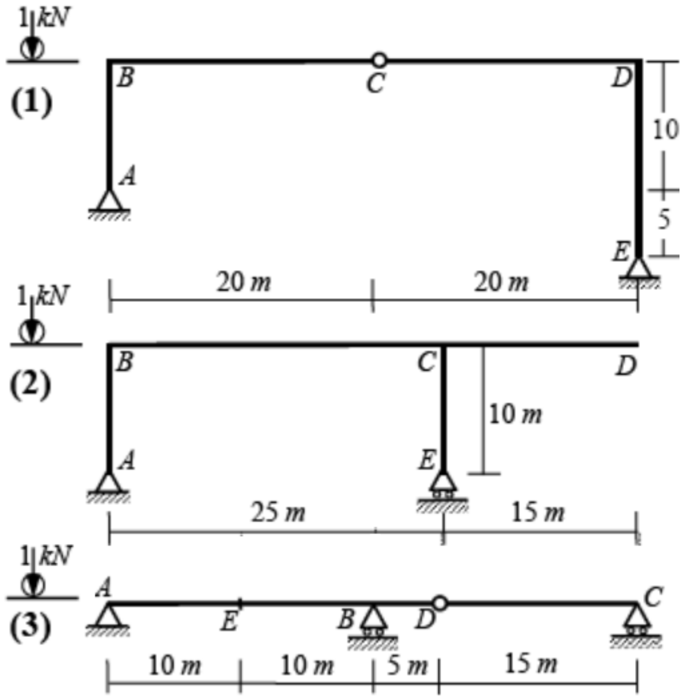
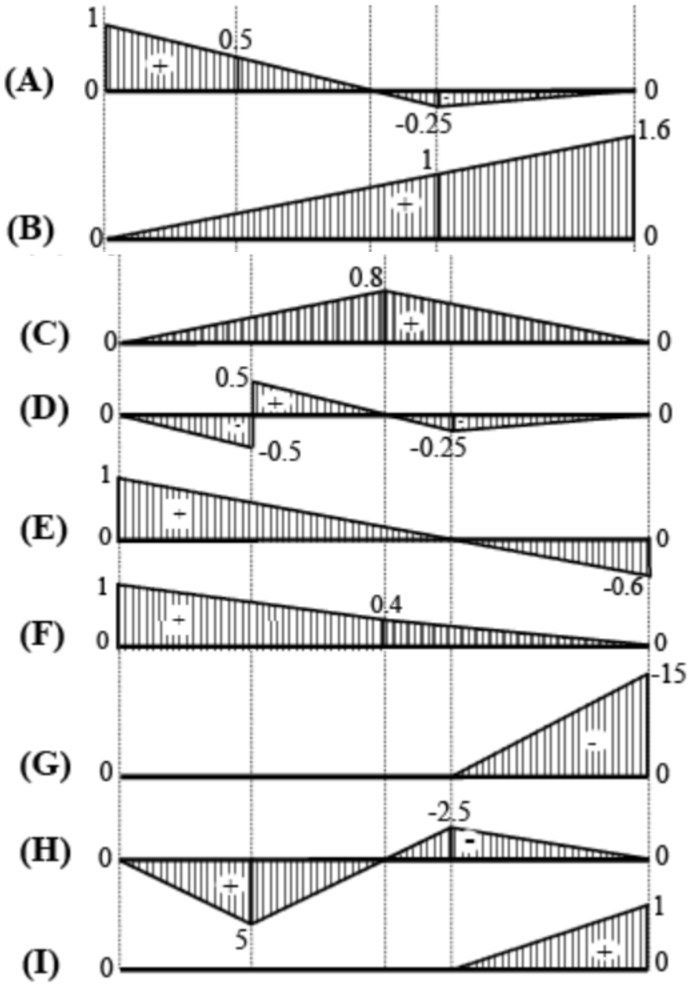
For the shown frames in **1** and **2** and beam in **3**, it is required to draw the influence line (*I.L.)* for some functions (reaction - shear force - bending moment).

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