Ministry of Higher Education
Giza Higher Institute of Engineering & Technology
Civil Engineering Department
Course Name: **Theory of Structures (1)B**
Course Code: **CIV 121**   Date: **24 / 6 / 2021**

Academic Year: **2020/2021**
Semester: **Second**
Level: **1st Civil**
Time: 3 **Hours**
Examiner: *Dr. M. Abdel-Kader*

Final Exam

Total Marks: **90**   No. of Questions:**45** (Attempt all questions)

Choose the nearest answer. (a1, a5, b1, b7, d6)

1. The shown cross-section is ......
   (A) Symmetrical about x_B-axis.
   (B) Symmetrical about y_L-axis.
   (C) Symmetrical about horizontal axis.
   (D) Symmetrical about vertical axis.

2. The areas 1, 2 and 3 are:
   (A) 36 cm^2 6.28 cm^2 6 cm^2
   (B) 30 cm^2 12.56 cm^2 6 cm^2
   (C) 36 cm^2 3.14 cm^2 6 cm^2
   (D) 36 cm^2 12.56 cm^2 6 cm^2
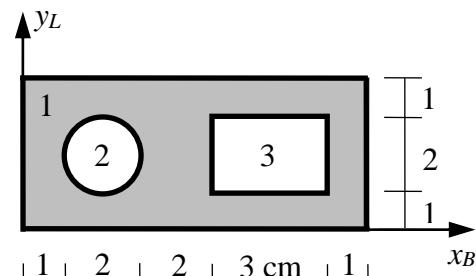
3. The total area of the cross-section is:
   (A) 26.86 mm^2 (B) 45.14 m^2 (C) 45.14 cm^2 (D) 26.86 cm^2

4. The first moments of areas 1, 2 and 3 about the y_L-axis are:
   (A) -162, -6.28 and -39 cm^3 (B) 72, -6.28 and -12 cm^3 (C) 36, -3.14 and -6 cm^3 (D) 162, -6.28 and -39 cm^3

5. The centroidal Y_C-axis of the cross-section is at $\bar{x} =$...... from y_L-axis.
   (A) 4.35 cm   (B) 4.35 cm^3 (C) 2 cm   (D) -4.35 cm

6. The centroidal X_C-axis of the cross-section is at $\bar{y} =$...... from x_B-axis.
   (A) 2 cm   (B) 4.35 cm^3 (C) 4.35 cm   (D) -4.35 cm

7. The second moments of areas 1, 2 and 3 about their centroidal x_c-axes are:
   (A) 48, -0.79 and -2 cm^4 (B) 243, -0.79 and -4.5 cm^4 (C) 48, -0.79 and -40.5 cm^4 (D) -48, 0.79 and 4.5 cm^4

8. The second moments of areas 1, 2 and 3 about the cross-section centroidal X_C-axis are:
   (A) 48, -0.79 and -2 cm^4 (B) 243, -0.79 and -4.5 cm^4 (C) 48, -0.79 and -20 cm^4 (D) 48, 0.79 and 2 cm^4

9. The second moment of the cross-section about its centroidal X_C-axis is:
   (A) 50.79 cm^4 (B) 45.21 cm^4 (C) 54.12 cm^4 (D) 50.79 cm^3

10. The product (mixed) moment of the cross-section about its centroidal X_C and Y_C-axes is:
    (A) -237.21 cm^4 (B) zero   (C) -45.21 cm^4 (D) 45.21 cm^3

11. The principal axes (u and v) of the cross-section makes an angle θ with the horizontal axis = ... :
    (A) 45°   (B) zero   (C) 60°   (D) 16°

12. The radius of gyration of the cross-section about its centroidal X_C -axis is:
   (A) 5.9 cm   (B) 1.3 cm   (C) 54.2 cm   (D) 54.9 cm^4

A column of variable circular cross-section is shown.
Given Data: **For Steel**: Allowable compressive and tensile stresses = **140 *MPa***
For Concrete: Allowable compressive stress = **80 *MPa***
and Allowable tensile stress = **10 *MPa***

Choose the nearest answer.

13. The column is subjected to:
    (A) Shear   (B) Moment   (C) Normal stress   (D) Twisting moment

14. The normal force in Part *AB* is:
    (A) 100 kN   (B) 700 kN   (C) -100 kN   (D) -300 kN

15. The normal stress in Part *AB* is:
    (A) 100 kN   (B) 15.3 kN/cm^2 (C) -5.09 kN/cm^2 (D) -15.3 kN/cm^2

16. The normal force in Part *BC* is:
    (A) 300 kN   (B) 700 kN   (C) -100 kN   (D) -300 kN

17. The safe radius *R* of Part *BC* is:
    (A) 0.02 m   (B) 22 mm   (C) 2.5 cm   (D) 27 mm

18. The normal force in Part *CD* is:
    (A) 700 kN   (B) -700 kN   (C) 1000 kN   (D) -300 kN

19. The normal stress in Part *CD* is:
    (A) 1.55 kN/cm^2 (B) -1.55 kN/cm^2 (C) -2.2 kN/cm^2 (D) 2.2 kN/cm^2

20. Part *AB* is:
    (A) Rectangle   (B) Unsafe   (C) Concrete   (D) Safe

21. Part *CD* is:
    (A) Square   (B) Safe   (C) Steel   (D) Unsafe

22. The column is:
    (A) Unsafe   (B) Safe   (C) Square   (D) Rectangle
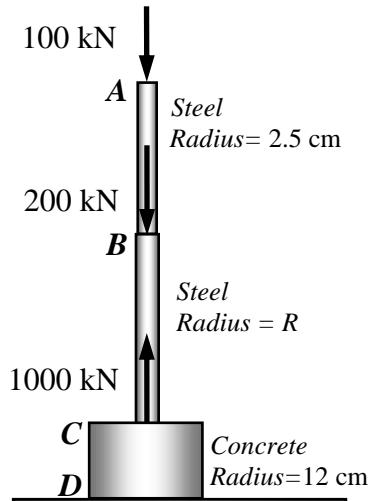
Please turn over

For the shown cantilever with the shown cross-section

150 kN

50 kN/m

a

b

4 m

Cross-section of the cantilever

4 | 16 cm | 4

y

4

x | 24 cm

4

Choose the nearest answer.

23. The normal force at section a is:
    (A) 150 kN (B) Zero (C) 350 kN (D) 200 kN

24. The bending moment at section a is:
    (A) -600 kN.m (B) -1000 kN.m (C) -400 kN.m (D) -700 kN.m

25. The second moment of the cross-section about x-axis is:
    (A) 65536 cm⁴ (B) 18432 cm⁴ (C) 47104 cm⁴ (D) 83968 cm⁴

26. The maximum tensile normal stress is at $y =$
    (A) 32 cm (B) 4 cm (C) -32 cm (D) 16 cm

27. The maximum compressive normal stress is at $y =$
    (A) 32 cm (B) 4 cm (C) -32 cm (D) -16 cm

28. The normal stress due to normal force is
    (A) $\sigma = \dfrac{N}{A}$ (B) $\sigma = \dfrac{M}{I} y$ (C) $\sigma = \dfrac{N}{I} y$ (D) $\sigma = \dfrac{M}{y} I$

29. The normal stress due to bending moment is
    (A) $\sigma = \dfrac{N}{A}$ (B) $\sigma = \dfrac{M}{I} y$ (C) $\sigma = \dfrac{N}{I} y$ (D) $\sigma = \dfrac{M}{y} I$

30. The maximum tensile normal stress at section a is:
    (A) 340 kN/cm² (B) 68 MPa (C) 34 N/cm² (D) 340 MPa

31. The maximum compressive normal stress at section a is:
    (A) -340 kN/cm² (B) -68 MPa (C) -34 N/cm² (D) -34 kN/cm²

32. The normal stress distribution over the cross-section at a is:
    (A) (B) (C) (D)
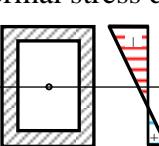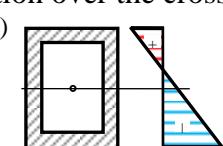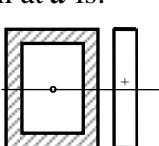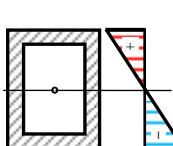
33. The shear force at section a is:
    (A) 150 kN (B) Zero (C) 350 kN (D) 200 kN

34. The maximum shear stress at section a is:
    (A) 3 kN/cm² (B) 3868 kN/cm² (C) 34 kN/cm² (D) 1783 kN/cm²

For the shown loaded column of base section of 40 cm × 60 cm. Neglect the column weight.

Choose the nearest answer.

225 kN

1.2 m

25 kN

3 m

80 kN

y

x

60 cm

40

35. The normal force at the base section is:
    (A) -305 kN (B) 305 kN (C) -225 kN (D) 25 kN

36. The bending moment about the x-axis of the base section is:
    (A) 9150 kN.cm (B) 6750 kN.cm (C) 225 kN.cm (D) 2400 kN.cm

37. The bending moment about the y-axis of the base section is:
    (A) -11000 kN.cm (B) -4500 kN.cm (C) 75 kN.cm (D) 1600 kN.cm

38. The area of the base section is:
    (A) 2400 cm² (B) 240 cm² (C) 120 cm² (D) 600 cm²

39. The second moment of area about x-axis I_x of the base section is:
    (A) 720000 cm⁴ (B) 320000 cm⁴ (C) 240000 cm⁴ (D) 3200 cm⁴

40. The second moment of area about y-axis I_y of the base section is:
    (A) 32000 cm⁴ (B) 320000 cm⁴ (C) 240000 cm⁴ (D) 3200 cm⁴

41. The normal stress at the centroid of the base section is:
    (A) -7 kN/cm² (B) -12.7 kN/cm² (C) -0.13 kN/cm² (D) -450 kN/cm²

42. The maximum tensile normal stress at the base section is:
    (A) 7 kN/cm² (B) 41.7 kN/cm² (C) 0.94 kN/cm² (D) 450 kN/cm²

43. The maximum compressive normal stress at the base section is:
    (A) -96.5 kN/cm² (B) -11.9 kN/cm² (C) -1.2 kN/cm² (D) -450 kN/cm²

44. The shear force at the base section is:
    (A) -305 kN (B) 305 kN (C) -225 kN (D) 25 kN

45. The twisting moment about the z-axis of the base section is:
    (A) 2400 kN.cm (B) 6750 kN.cm (C) 225 kN.cm (D) 750 kN.cm
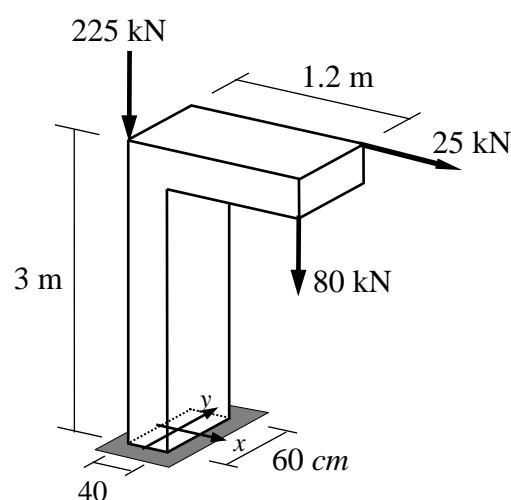
With best wishes

Dr. M. Abdel-Kader