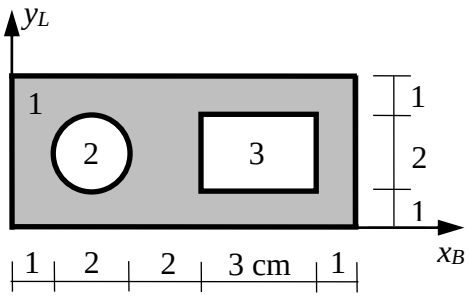
Ministry of Higher Education
Giza Higher Institute of Engineering & Technology
Civil Engineering Department
Course Name: **Theory of Structures (1)B**
Course Code: **CIV 121** Date: **24 / 6 / 2021**

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)

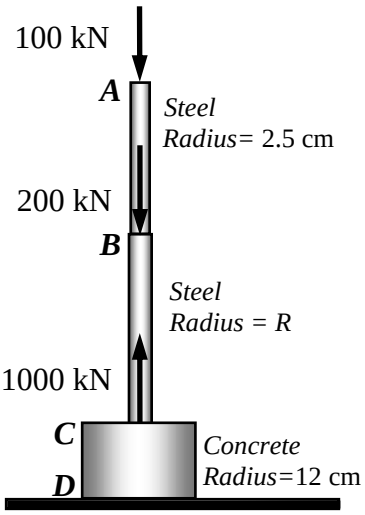
Choose the nearest answer.



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 cm², 6.28 cm², 6 cm² (B) 30 cm², 12.56 cm², 6 cm² (C) 36 cm², 3.14 cm², 6 cm² (D) 36 cm², 12.56 cm², 6 cm²
3. The total area of the cross-section is:
   (A) 26.86 mm² (B) 45.14 m² (C) 45.14 cm² (D) 26.86 cm²
4. The first moments of areas 1, 2 and 3 about the y_L-axis are:
   (A) -162, -6.28 and -39 cm³ (B) 72, -6.28 and -12 cm³ (C) 36, -3.14 and -6 cm³ (D) 162, -6.28 and -39 cm³
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 cm³ (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 cm³ (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 cm⁴ (B) 243, -0.79 and -4.5 cm⁴ (C) 48, -0.79 and -40.5 cm⁴ (D) -48, 0.79 and 4.5 cm⁴
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 cm⁴ (B) 243, -0.79 and -4.5 cm⁴ (C) 48, -0.79 and -20 cm⁴ (D) 48, 0.79 and 2 cm⁴
9. The second moment of the cross-section about its centroidal X_C-axis is:
   (A) 50.79 cm⁴ (B) 45.21 cm⁴ (C) 54.12 cm⁴ (D) 50.79 cm³
10. The product (mixed) moment of the cross-section about its centroidal X_C and Y_C-axes is:
    (A) -237.21 cm⁴ (B) zero (C) -45.21 cm⁴ (D) 45.21 cm³
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 cm⁴

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***



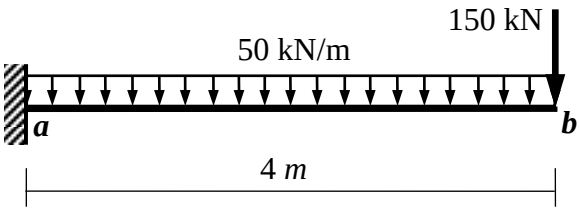
Choose the nearest answer.

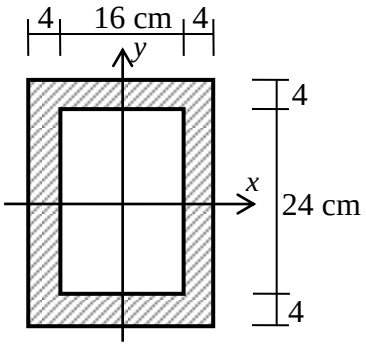
13. The column is subjected to:
    (A) Shear (B) Moment (C) Normal stress (D) Twisting moment
14. The normal force in Part *AB* is:
    (A) 100 kN (B) 700 kN (C) -100 kN (D) -300 kN
15. The normal stress in Part *AB* is:
    (A) 100 kN (B) 15.3 kN/cm² (C) -5.09 kN/cm² (D) -15.3 kN/cm²
16. The normal 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/cm² (B) -1.55 kN/cm² (C) -2.2 kN/cm² (D) 2.2 kN/cm²
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

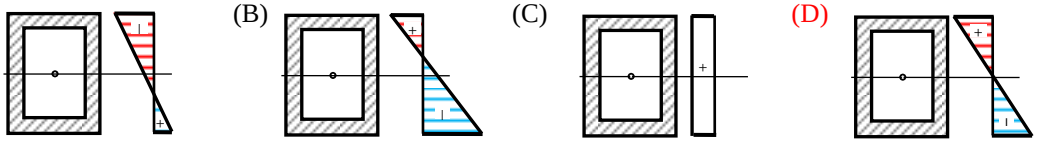
Choose the nearest answer.





Cross-section of the cantilever

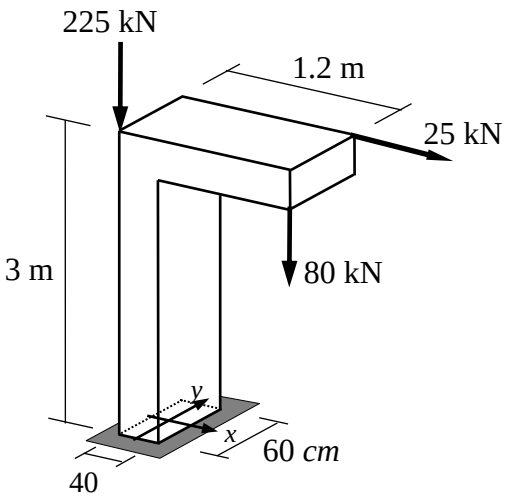
23. The normal force at section ***a*** is:
(A) 150 kN (B) Zero (C) 350 kN (D) 200 kN
24. The bending moment at section ***a*** is:
(A) -600 kN.m (B) -1000 kN.m (C) -400 kN.m (D) -700 kN.m
25. The second moment of the cross-section about *x*-axis is:
(A) 65536 cm^4 (B) 18432 cm^4 (C) 47104 cm^4 (D) 83968 cm^4
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) $\sigma = \frac{N}{A}$ (B) $\sigma = \frac{M}{I} y$ (C) $\sigma = \frac{N}{I} y$ (D) $\sigma = \frac{M}{y} I$
29. The normal stress due to bending moment is
(A) $\sigma = \frac{N}{A}$ (B) $\sigma = \frac{M}{I} y$ (C) $\sigma = \frac{N}{I} y$ (D) $\sigma = \frac{M}{y} I$
30. The maximum tensile normal stress at section ***a*** is:
(A) 340 kN/cm^2 (B) 68 MPa (C) 34 N/cm^2 (D) 340 MPa
31. The maximum compressive normal stress at section ***a*** is:
(A) -340 kN/cm^2 (B) -68 MPa (C) -34 N/cm^2 (D) -34 kN/cm^2
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/cm^2 (B) 3868 kN/cm^2 (C) 34 kN/cm^2 (D) 1783 kN/cm^2

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

Choose the nearest answer.



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 cm^2 (B) 240 cm^2 (C) 120 cm^2 (D) 600 cm^2
39. The second moment of area about *x*-axis I_x of the base section is:
(A) 720000 cm^4 (B) 320000 cm^4 (C) 240000 cm^4 (D) 3200 cm^4
40. The second moment of area about *y*-axis I_y of the base section is:
(A) 32000 cm^4 (B) 320000 cm^4 (C) 240000 cm^4 (D) 3200 cm^4
41. The normal stress at the centroid of the base section is:
(A) -7 kN/cm^2 (B) -12.7 kN/cm^2 (C) -0.13 kN/cm^2 (D) -450 kN/cm^2
42. The maximum tensile normal stress at the base section is:
(A) 7 kN/cm^2 (B) 41.7 kN/cm^2 (C) 0.94 kN/cm^2 (D) 450 kN/cm^2
43. The maximum compressive normal stress at the base section is:
(A) -96.5 kN/cm^2 (B) -11.9 kN/cm^2 (C) -1.2 kN/cm^2 (D) -450 kN/cm^2
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