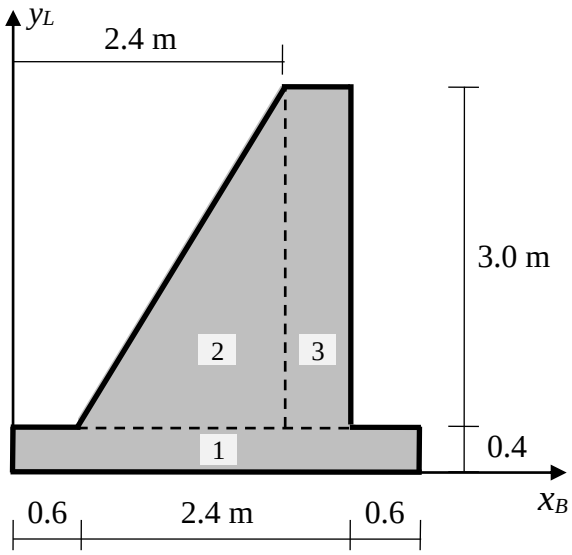
Ministry of Higher Education
Giza Higher Institute of Engineering & Technology
Civil Engineering Department
Course Name: **Theory of Structures (1)B**
Course Code: **CIV 121** Date: **5 / 6 / 2022**

Academic Year: **2021/2022**
Semester: **Second**
Level: **1st Civil**
Time: **3 Hours**
Examiner: ***Dr. M. Abdel-Kader***

Final Exam

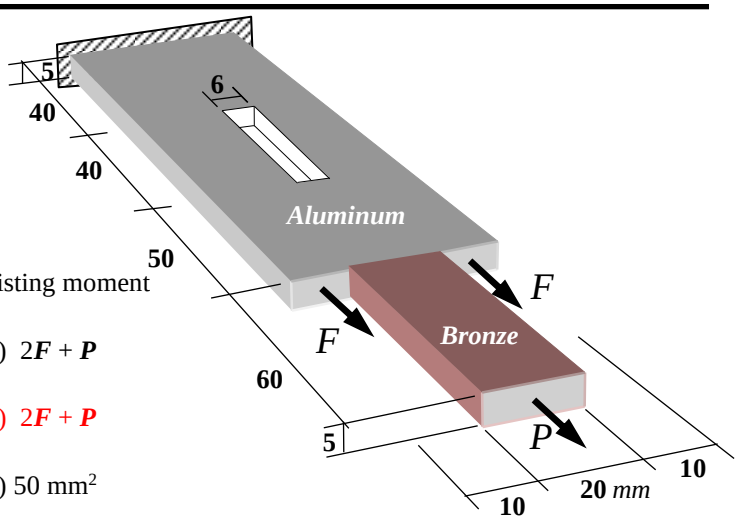
Total Marks: **90** No. of Questions:**45** (Attempt all questions)

Choose the nearest answer.



1. The shown cross-section is:
   (A) Symmetrical about vertical axis. (B) Symmetrical about horizontal axis. (C) Not symmetrical
2. The areas 1, 2 and 3 are:
   (A) 1.44 m², 2.07 m², 1.08 m² (B) 1.22 m², 3.70 m², 1.10 m² (C) 1.44 m², 2.70 m², 1.80 m² (D) 2.40 m², 3.00 m², 0.60 m²
3. The total area of the cross-section is:
   (A) 4.59 m² (B) 5.02 m² (C) 6.20 m² (D) 5.94 m²
4. The first moment of the total area about the y_L-axis is:
   (A) 31.12 m³ (B) 14.22 m³ (C) 7.49 m³ (D) 12.31 m³
5. The first moment of the total area about the x_B-axis is:
   (A) 12.12 m³ (B) 9.47 m³ (C) 7.49 m³ (D) 12.31 m³
6. The centroidal Y_C-axis of the cross-section is at $\bar{x}$ =… from y_L-axis.
   (A) 1.35 m (B) 2.07 m (C) 2.4 m (D) 3.35 m
7. The centroidal X_C-axis of the cross-section is at $\bar{y}$ =… from x_B-axis.
   (A) 1.26 m (B) 1.70 m (C) 1.02 m (D) 1.59 m
8. The second moment of the cross-section about its centroidal X_C-axis is:
   (A) 3.53 m⁴ (B) 4.21 m⁴ (C) 4.21 m³ (D) 5.13 m⁴
9. The second moment of the cross-section about its centroidal Y_C-axis is:
   (A) 3.11 m⁴ (B) 5.01 m⁴ (C) 1.21 m⁴ (D) 2.13 m⁴
10. The product (mixed) moment of the cross-section about its centroidal X_C and Y_C-axes is:
    (A) 7.21 m⁴ (B) 1.44 m⁴ (C) -5.21 m⁴ (D) 4.10 m⁴
11. The principal axes (u and v) of the cross-section makes an angle θ with the horizontal axis = … :
    (A) -45.0° (B) zero (C) -27.5° (D) 26.6°
12. The principal moments of inertia of the cross-section I_u and I_v are:
    (A) 8.58 m⁴ and 1.36 m⁴ (B) 5.88 m⁴ and 2.36 m⁴ (C) 6.44 m⁴ and 3.00 m⁴ (D) 5.21 m⁴ and 1.99 m⁴
13. The polar moment of inertia of the cross-section I_P is:
    (A) 9.94 m⁴ (B) 8.24 m⁴ (C) 9.44 m⁴ (D) 7.20 m⁴
14. The radius of gyration of the cross-section about its centroidal X_C-axis is:
    (A) 0.39 m (B) 0.71 m (C) 0.83 m (D) 0.93 m

A bar of variable cross-section is subjected to axial forces as shown. E =2.0 GPa
Allowable stress for **bronze** = 100 *MPa*
Allowable stress for **aluminum** = 90 *MPa*



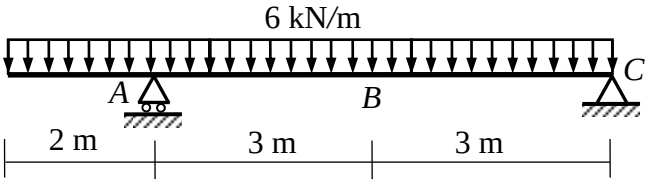
Choose the nearest answer.

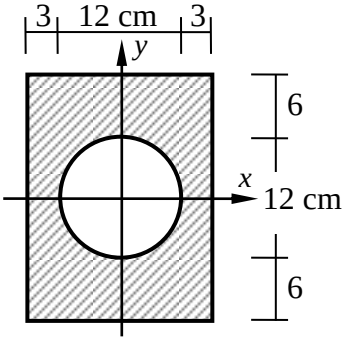
15. The bar is subjected to:
    (A) Shear stress (B) Moment (C) Normal stress (D) Twisting moment
16. The normal force in the **bronze** part is:
    (A) ***P*** (B) ***F*** (C) 2***F*** (D) 2***F*** + ***P***
17. The normal force in the **aluminum** part is:
    (A) ***P*** (B) ***F*** (C) 2***F*** (D) 2***F*** + ***P***
18. The cross-section of the **bronze** part has area of:
    (A) 100 mm² (B) 300 mm² (C) 200 mm² (D) 50 mm²
19. The maximum safe value of ***P*** is:
    (A) 20 kN (B) 10 kN (C) 100 kN (D) 5 kN
20. The axial deformation of the **bronze** part **only** due to the maximum safe value of ***P*** is:
    (A) 6 mm (B) 10 mm (C) 3 mm (D) 1 mm
21. The critical cross-section of the **aluminum** part has area of:
    (A) 200 mm² (B) 30 mm² (C) 650 mm² (D) 170 mm²
22. The maximum safe value of ***F*** is:
    (A) 1100 N (B) 2650 N (C) 7650 N (D) 5300 N

Please turn over

For the shown beam with the shown cross-section

Choose the nearest answer.



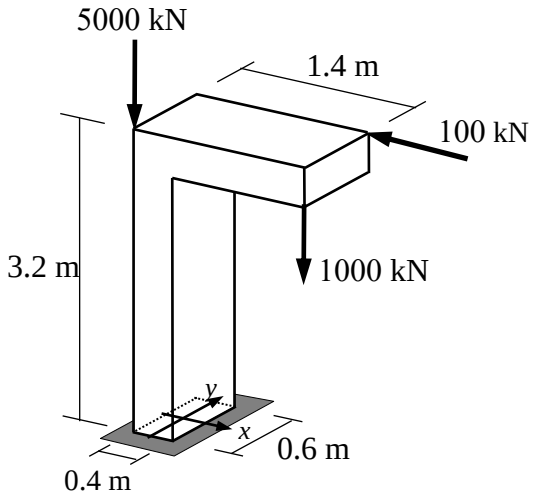


Cross-section of the beam

23. The normal force at cross-section ***B*** is:
(A) 12 kN (B) 32 kN (C) Zero (D) 6 kN
24. The bending moment at cross-section ***B*** is:
(A) 12 kN.m (B) 21 kN.m (C) 27 kN.m (D) 32 kN.m
25. The second moment of the cross-section about *x*-axis is:
(A) 19718 cm^4 (B) 20736 cm^4 (C) 11663 cm^4 (D) 1018 cm^4
26. The maximum tensile normal stress is at *y* =
(A) -6 cm (B) 24 cm (C) 12 cm (D) -12 cm
27. The maximum compressive normal stress is at *y* =
(A) -6 cm (B) 24 cm (C) 12 cm (D) -12 cm
28. 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) $\sigma = \frac{M}{y}I$
29. The maximum tensile normal stress at cross-section ***B*** is:
(A) 12.8 kN/cm^2 (B) 6.39 MPa (C) 9442 N/cm^2 (D) 12.78 MPa
30. The maximum compressive normal stress at cross-section ***B*** is:
(A) -12.8 kN/cm^2 (B) -6.39 MPa (C) -9442 N/cm^2 (D) -12.78 MPa
31. The shear force at the cross-section just to the right of support ***A*** is:
(A) 20 kN (B) -12 kN (C) 32 kN (D) -6 kN
32. The maximum shear stress due to bending at the cross-section just to the right of support ***A*** is:
(A) 1.17 MPa (B) 1.95 MPa (C) 3.12 MPa (D) 0.59MPa

For the shown loaded column of base section of 0.4 m × 0.6 m. Neglect the column weight.

Choose the nearest answer.



33. The normal force at the base section is:
(A) -5000 kN (B) -1000 kN (C) -6000 kN (D) -6100 kN
34. The bending moment about the *x*-axis of the base section is:
(A) 1830 kN.m (B) 300 kN.m (C) 1500 kN.m (D) 1800 kN.m
35. The bending moment about the *y*-axis of the base section is:
(A) 120 kN.m (B) -200 kN.m (C) 1000 kN.m (D) 320 kN.m
36. The area of the base section is:
(A) 1.28 m^2 (B) 0.24 m^2 (C) 0.84 m^2 (D) 2.4 m^2
37. The second moment of area about *x*-axis I_x of the base section is:
(A) 0.0072 m^4 (B) 0.0032 m^4 (C) 0.0024 m^4 (D) 0.32 m^4
38. The second moment of area about *y*-axis I_y of the base section is:
(A) 0.32 m^4 (B) 0.0032 m^4 (C) 0.0024 m^4 (D) 0.0042 m^4
39. The normal stress at the centroid of the base section is:
(A) -20.8 MPa (B) -4.2 MPa (C) -25 MPa (D) -20833 kPa
40. The maximum tensile normal stress at the base section is:
(A) 27.5 MPa (B) 45.7 MPa (C) 75.5 MPa (D) 57.5 MPa
41. The maximum compressive normal stress at the base section is:
(A) -80.9 MPa (B) -27.5 MPa (C) -107.5 MPa (D) -57.5 MPa
42. The value of the shear force at the base section is:
(A) 5000 kN (B) 1000 kN (C) 100 kN (D) zero
43. The value of the twisting moment about the *z*-axis of the base section is:
(A) 30 kN.m (B) 200 kN.m (C) 400 kN.m (D) 60 kN.m

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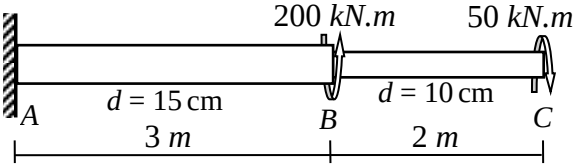
44. For the shown cantilevered beam of variable circular cross-section, the value of the twisting moment at ***A*** is:
(A) 250 kN.m (B) 150 kN.m (C) 200 kN.m (D) 50 kN.m
45. The maximum shear stress in part ***AB*** due to twisting moment is:
(A) 378 MPa (B) 226 MPa (C) 453 MPa (D) 755 MPa



With best wishes

Dr. M. Abdel-Kader