| Roll No. | | | | | | | | | | | | |
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# PRESIDENCY UNIVERSITY

## BENGALURU

**End - Term Examinations – December 2025**

**Date:** 16 – 12- 2025 **Time:** 09:30am – 12:30pm

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|---|---|---|
| **School:** SOE | **Program:** B Tech | |
| **Course Code :** CIV2500 | **Course Name:** Strength of Materials | |
| **Semester**: III | **Max Marks**: 100 | **Weightage**: 50% |

| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
|---|---|---|---|---|---|
| **Marks** | **10** | **26** | **10** | **26** | **28** |

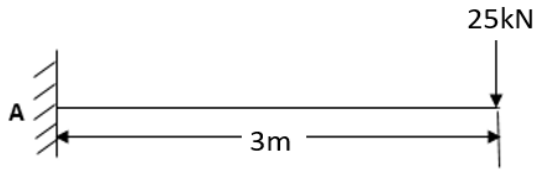
**Instructions:**

*(i) Read all questions carefully and answer accordingly.*

*(ii) Do not write anything on the question paper other than roll number.*

## Part A

**Answer ALL the Questions. Each question carries 2marks.** **10Q x 2M=20M**

| | | | | |
|---|---|---|---|---|
| 1. | Define Shear force and Bending Moment at a section of a beam | 2 Marks | L1 | CO2 |
| 2. | Determine the moment at the fixed end in the Fig. 2(a)   Fig. 2(a) | 2 Marks | L2 | CO2 |
| 3. | List the different types of beams. | 2 Marks | L1 | CO2 |
| 4. | List any two assumptions of Torsion formula. | 2 Marks | L1 | CO4 |
| 5. | Write the expression for Power transmitted by the shaft and calculate the power at 250rpm if a torque of 8 X$10^6$ Nmm is induced. | 2 Marks | L2 | CO4 |
| 6. | A solid shaft of 200 mm diameter is used to transmit a torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is 50 N/$mm^2$. | 2 Marks | L2 | CO4 |

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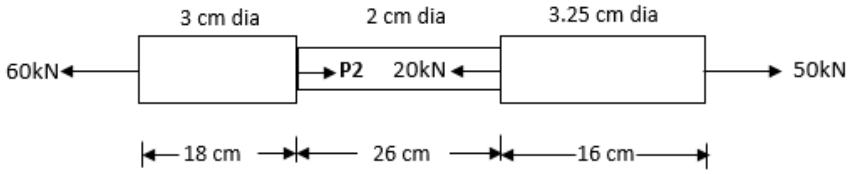
| 7. | Calculate the radius of gyration of the column if the Moment of Inertia is 55 X $10^4$ $mm^4$ and the area of cross-section of the column is 3000$mm^2$. | 2 Marks | L2 | CO5 |
| 8. | Define a Buckling load and write the formula for the buckling load of a long column with one end fixed and other end free. | 2 Marks | L1 | CO5 |
| 9. | Determine the safe load if the crippling load is 990kN and factor of safety is 3. | 2 Marks | L2 | CO5 |
| 10. | Define Slenderness ratio of a column with the formula. | 2 Marks | L1 | CO5 |

## Part B

**Answer the Questions.** **Total Marks 80M**

| | | | | | |
|---|---|---|---|---|---|
| 11. | a. | A member ABCD is subjected to point loads P1, P2, P3 and P4 as shown in the Fig 11(a). Calculate the force P2 necessary for equilibrium if P1 =60 kN, P3=20 kN and P4 =50 kN. Find the stresses in the three parts and the total extension of the bar. Take E=200 kN/$mm^2$.   Fig. 11(a) | 10 Marks | L3 | CO1 |
| | | **Or** | | | |
| 12. | a. | A tension test was carried out on a steel specimen to determine the elastic constants. The original diameter and length of the specimen were 80 mm and 900 mm respectively and the change in length at 200 kN was recorded to be 0.85 mm. If the corresponding change in diameter at the same load was 0.006 mm, compute all three elastic constants or modulli. | 10 Marks | L3 | CO1 |

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| 13. | a. | A cast iron bracket subjected to bending has a cross-section of I form with as shown in the figure 13(a). The beam is simply supported on a span of 5m. If the tensile stress does not exceed 80 N/$mm^2$, find the safe uniformly distributed load the beam can carry. | 10 Marks | L3 | CO3 |

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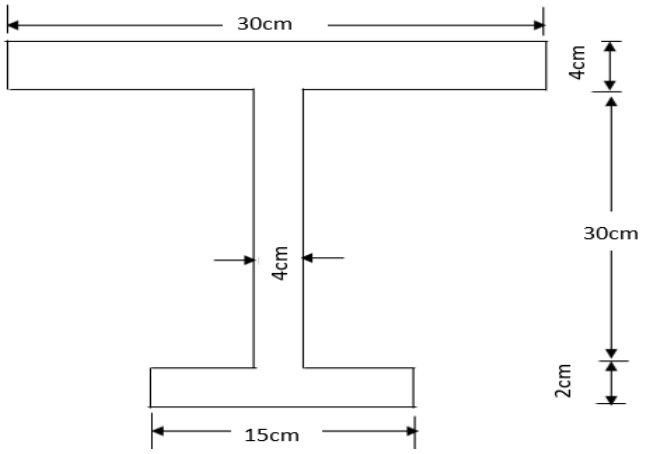
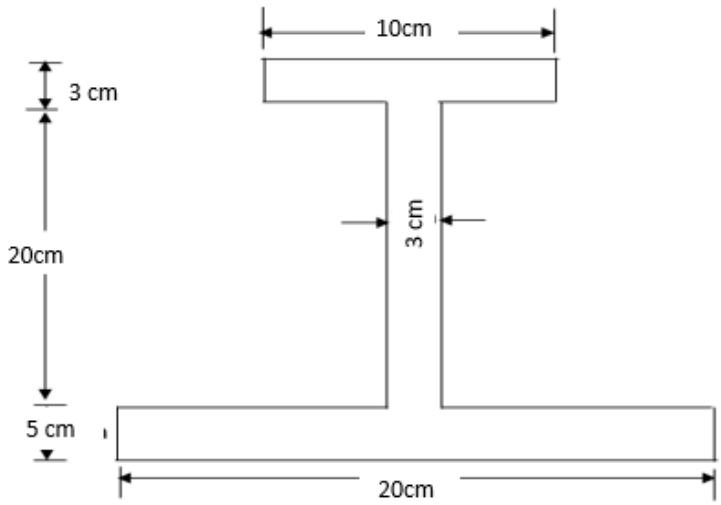
| | |  <br>Fig. 13(a) | | | |
| **Or** | | | | | |
| 14. | a. | A cast iron bracket subjected to bending has a cross-section of I form with as shown in the figure 14(a). The beam is simply supported on a span of 6m. If the tensile stress does not exceed 50 N/mm$^2$, find the safe uniformly distributed load the beam can carry.<br>  <br>Fig. 14(a) | 10 Marks | L3 | CO3 |

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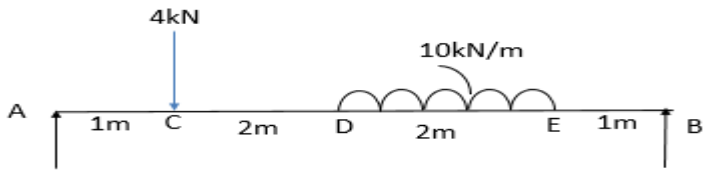
|---|---|---|---|---|---|
| 15. | a. | A simply supported beam of 6m is subjected to a concentrated load of 4kN and a uniformly distributed load of 10kN/m as shown under, determine the shear force and bending moment of the beam and draw the SFD and BMD.<br>  <br>Fig. 15(a) | 20 Marks | L3 | CO2 |

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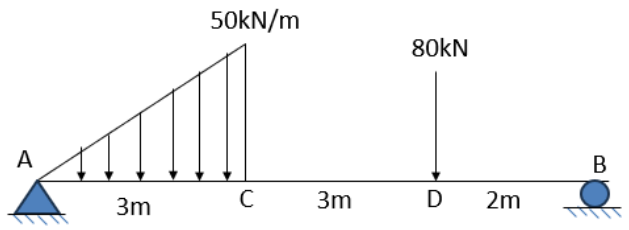
|---|---|---|---|---|---|
| **Or** | | | | | |
| 16. | a. | Determine the Shear force and Bending moment of the beam shown in the figure 16(a). Draw the SFD and BMD too.<br>  <br><br>Fig. 16(a) | 20 Marks | L3 | CO2 |

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| 17. | a. | A hollow circular shaft is to transmit 400 kW power at 100 rpm. If the shear stress is not to exceed 40 N/mm$^2$ and the internal diameter is 0.5 of the external diameter, find the external and internal diameter. Also, find the angle of twist in a length of 3m if C= 8X10$^4$ N/mm$^2$. | 20 Marks | L3 | CO4 |
| **Or** | | | | | |
| 18. | a. | 400Kw power is transmitted at 250rpm. Find the (a)necessary diameter of a solid circular shaft, and (b)necessary diameter of a hollow circular shaft, whose inside diameter is ¾ of the external diameter. Allowable shear stress is 50 N/mm$^2$. | 20 Marks | L3 | CO4 |

| | | | | | |
|---|---|---|---|---|---|
| 19. | a. | A hollow C.I. column whose outside diameter is 80mm has a thickness of 20mm. It is 5m long and is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 3. Calculate the slenderness ratio and the ratio of Euler's and Rankine's critical loads. Take fc = 560 N/mm$^2$, a = 1/1600 in Rankine's formula & E = 8.4 x 10$^4$ N/mm$^2$. | 20 Marks | L3 | CO5 |
| **Or** | | | | | |
| 20. | a. | The external and internal diameter of hollow mild steel column are 8cm and 6cm respectively. If the length of the column is 4m and both of the ends are fixed , then determine the crippling load using<br>**(i)** Rankine's formula taking the value of $f_c$=320N/mm$^2$ and Rankine's constant, a = 1/7500. Also find the safe load if factor of safety =4.<br>**(ii)** Euler's formula taking E = 2 x 10$^5$ N/mm$^2$ | 20 Marks | L3 | CO5 |