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Reg. No. : | | | | | | | | | | | | |

**Question Paper Code : 20511**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fourth Semester

Civil Engineering

CE 3402 — STRENGTH OF MATERIALS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write a few words on thermal stresses.
2. How will you obtain shear stress distribution for unsymmetrical section.
3. Write the theory of bending equation.
4. Define shear force and Bending moment.
5. State moment area theorems.
6. Write the advantages of Macaulay's method over integration method.
7. State the theorem of three moment equation.
8. Calculate the fixed end moment for the fixed beam subjected to eccentric point load.
9. Outline the qualitative stress and pressure diagram across the cross section of thick cylinder.
10. Define Unsymmetrical bending.

PART B — (5 × 13 = 65 marks)

11. (a) If $\sigma_x = 45\,MPa$, $\sigma_y = 55\ Mpa$, $\tau_{xy} = -30\,Mpa$, determine the principal stresses on the element. Solve the problem using Mohr's circle.

Or

(b) A solid shaft of 250mm diameter is to be replaced by a hollow steel shaft with internal diameter equal to 0.5D where D is the external diameter. Design the hollow shaft and find out the saving in material. The value of maximum shear stress may be assumed as same for both the shafts of equal length.

12. (a) A simply supported beam of 2m span carries a UDL load of 140 KN/m over the whole span. The cross section of the beam is a T section with a flange width of 120mm web and flange thickness of 20mm and over all depth of 160 mm. Determine the maximum shear stress in the beam and draw the shear stress distribution for the section.

Or

(b) A 10m long simply supported beam caries two-point loads of 10kN and 6 kN at 2m and 9m respectively from the left end. It also has a UDL of 4kN/m run for the length between 4m and 7m from the left end. Draw shear force and bending moment diagrams.

13. (a) A simply supported beam of 12m span carries a concentrated load of 30kN at a distance of 9m from the end A. Determine the deflection at the load point and the slopes at the load point and at the two ends. Take $I = 2 \times 10^9$ mm$^4$ and E = 205 GPa. Use moment area method.

Or

(b) A simply supported beam of 8 m length carries two-point loads of 64kN and 48kN at 1 m and 4m respectively from the left hand. Find the deflection under each load and the maximum deflection E=210GPa and I $=180 \times 10^6$ mm$^4$. Use Macaulay's method.

14. (a) Using the theorem of three moments, analyze the continuous beam as shown in figure 14 (a) below and draw the shear force and bending moment diagrams.

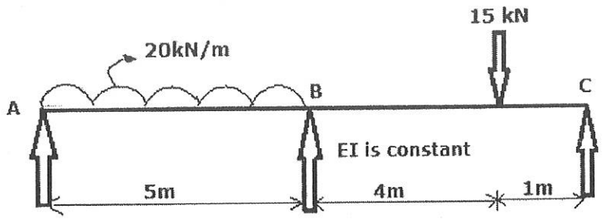


Figure 14 (a)

Or

(b) Obtain the end moments of a two-span continuous beam as shown in figure 14 (b) using theorem of three moment and draw the bending moment diagram.

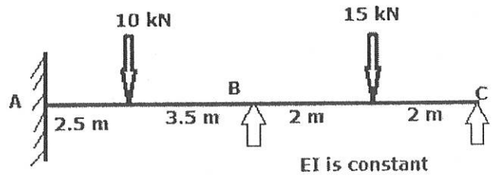


Figure 14 (b)



15. (a) A Channel section has flanges 120mm × 20mm and web 160mm × 10mm. Total depth of the section is 200 mm. Determine the shear center of the channel section.

Or

(b) Explain in detail on various theories of failure with its application.

PART C — (1 × 15 = 15 marks)

16. (a) A propped cantilever of span 6 m is subjected to a UDL of 3 kN/m over a length of 5m from the fixed end. Find the prop reaction and draw the SFD and BMD.

Or

(b) A fixed beam AB of span 5m carries a point load of 90 kN at its mid span and a UDL of 15 kN/m throughout its length.

Investigate

(i) Fixed end moments

(ii) Reactions.

Also Draw the SFD and BMD.