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Question Paper Code : X10241

B.E./B.Tech. DEGREE EXAMINATIONS, NOV/DEC 2020 & APRIL/MAY 2021

Fourth Semester

Civil Engineering

CE 8402 – STRENGTH OF MATERIALS – II

(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. State Maxwell's reciprocal theorem.
2. Mention the application of Williot Mohr's Diagram.
3. How will you differentiate an indeterminate structure from a determinate one ?
4. Determine the fixed end moments for a beam 'L' subjected to a couple 'M' at its midspan.
5. Distinguish between thin and thick cylinders.
6. What are the limitations of Euler's formula ?
7. Define principal stresses and principal planes.
8. List any four theories of failure.
9. Recall shear centre.
10. What are the assumptions made in Winkler Bach theory ?



PART – B

(5×13=65 Marks)

11. a) Find the horizontal deflection of the joint A of the truss shown in Fig. 1 by Castigliano's first theorem. Assume all members are of same material and same cross section areas.

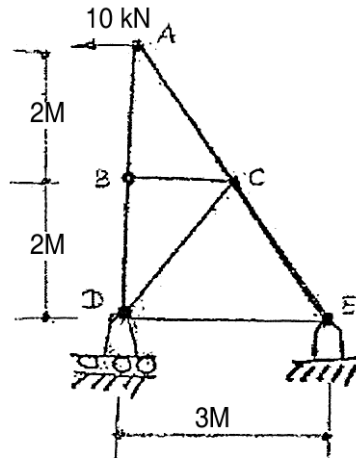


Fig. 1

(OR)

- b) A simply supported beam AB of length 6 m carries a concentrated load of 80 kN at its midspan C. Find the slope at A and vertical deflection at C of the beam. Take EI as constant.
12. a) Determine the reactions and support moments using theorem of three moments for the continuous beam shown in Fig. 2. EI is constant throughout the span.

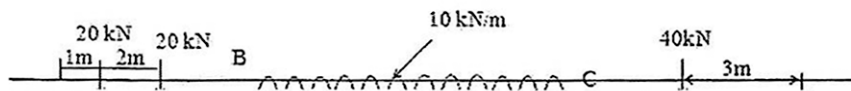


Fig. 2

(OR)

- b) A fixed beam of constant EI is shown in the Fig. 3. Calculate the end reactions and sketch bending moment diagram and shear force diagram.

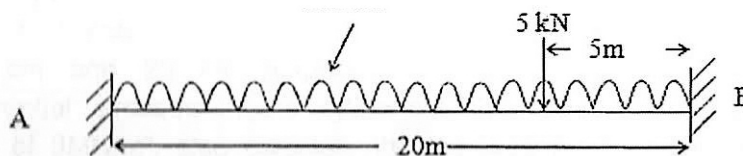


Fig. 3



13. a) A rectangular box of outer dimensions 300 mm × 200 mm of uniform thickness 10 mm is used as a column with both the ends fixed, if the unsupported length is 8 m, find the Euler's buckling load and Rankine's buckling load. Take $E = 200 \text{ GPa}$ and yield stress as 350 MPa.

(OR)

- b) A thin spherical shell is 1.5 m in diameter, with its wall of 1.3 cm thickness is filled with the fluid at atmospheric pressure. What intensity of pressure will be developed in it if 160 cm^3 more of fluid is pumped into it? Also calculate the hoop stress at that pressure and increase in diameter. Take $m = 10/3$, $E = 200 \text{ GN/m}^2$.

14. a) In a material the principal stresses are 60 MN/m^2 , 48 MN/m^2 and -36 MN/m^2 . Calculate : (i) Total strain energy; (ii) Volumetric strain energy; (iii) Shear strain energy; and (iv) Factor of safety on the total strain energy criterion if the material yields at 120 MN/m^2 . Take $E = 200 \text{ GN/m}^2$ and $1/m = 0.3$.

(OR)

- b) The principal stresses at a point in an elastic material are 200 N/mm^2 (tensile), 100 N/mm^2 (tensile) and 50 N/mm^2 (compressive). If the stress at the elastic limit in simple tension is 200 N/mm^2 , determine whether the failure of the material will occur according to maximum principal strain theory. Take Poisson's ratio 0.3.

15. a) A curved bar is formed of a tube 40 mm radius. The centre line of this beam is a circular arc of radius 150 mm. A bending moment of 2 kNm tending to increase the curvature of the bar is applied. Calculate the maximum tensile and compressive stresses set up in the bar.

(OR)

- b) Locate the shear centre of the cross section shown in Fig. 4.

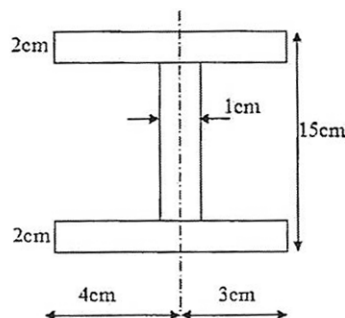


Fig. 4



PART – C

(1×15=15 Marks)

16. a) A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50 cm and 25 cm respectively. Evaluate the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 MN/m^2 , also calculate the increase in length, diameter and volume of the vessel. Take $E = 200 \text{ GN/m}^2$ and Poisson's ratio = 0.3.

(OR)

- b) A cantilever of length 1 m carries a point load of 2 kN at the free end. The cross Section of the cantilever is an unequal angle of dimensions $100 \text{ mm} \times 60 \text{ mm}$ and 10 mm thick. The small leg of the angle is horizontal. The load passes through the centroid of the cross section. Locate the position of neutral axis and evaluate the magnitude of maximum stress set up at the fixed section of the cantilever.
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