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**B 2086**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Fourth Semester

Civil Engineering

CE 236 — STRENGTH OF MATERIALS

Time : Three hours

Maximum : 100 marks

Missing data if any may suitably assumed.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the expression for strain energy stored in a prismatic bar due to an axial force.
2. A cantilever beam of length  $L$ , subjected to a clockwise bending moment  $M$  at the free end. Determine the strain energy stored in the beam due to the bending moment.
3. A fixed beam AB of span 5 m carries a point load of 100 kN at a distance of 3 m from the support A. Write the moments development at each support.
4. Write the theorem of three moment equation for two span continuous beam.
5. State the assumptions made in Euler's theory of long column.
6. The actual length of column is 10 m. Calculate its equivalent length when both of its ends are
  - (a) fixed and
  - (b) hinged.

7. The principal stresses (MPa) at a certain point are 200 (tensile), 150 (tensile) and 100 (tensile) respectively. Determine the normal stress on the octahedral plane.
8. State the Rankine's theory of elastic failure
9. What are the reasons for unsymmetrical bending?
10. What are compound cylinders?

PART B — (5 × 16 = 80 marks)

11. (a) A simply supported beam AB of span 10 m carries a concentrated vertical downward load of 100 kN at a distance 4 m from the support A. Calculate the deflection under the load using energy principle. Assume  $EI = 2 \times 10^4 \text{ kN-m}^2$ .

Or

- (b) For the truss shown in Fig. Q. 11(b) determine the horizontal deflection at the joint B. Assume  $AE = 40 \times 10^5 \text{ kN}$  for each member.

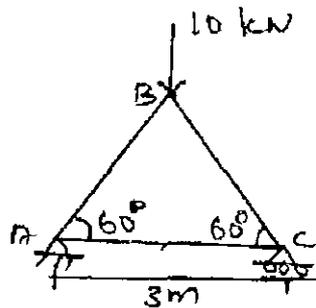


Fig. Q. 11(b)

12. (a) For the fixed beam shown in Fig. Q. 12(a) draw the shear force and bending moment diagrams. Also mark the points of contraflexure and maximum bending moment.

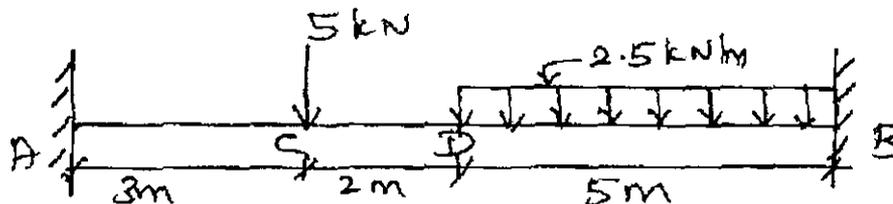


Fig. Q. 12(a)

Or

- (b) For the beam shown in Fig. Q. 12(b) calculate reaction and moment induced at each support.

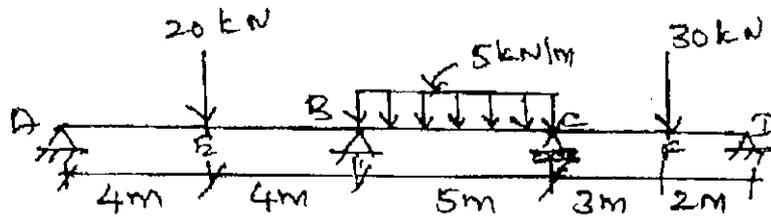


Fig. Q. 12(b)

13. (a) From first principles, derive an expression for buckling load for a long column hinged at both ends.

Or

- (b) Calculate crippling load given by Rankine's formula for a tubular strut 2.3 m long, having an outer and inner diameter 38 mm and 33 mm respectively, loaded through hinged joints at each end. Assume the yield stress of the strut material as 335 MPa and Rankine's constant =  $1/7500$ .

14. (a) Determine principal stresses and the direction cosines of the major principal plane for the stress tensor given below :

$$\begin{bmatrix} 10 & -5 & 15 \\ -5 & 20 & 10 \\ 15 & 10 & 25 \end{bmatrix}$$

Or

- (b) At a point in a steel member, the major principal stress is 200 MPa (tensile) and the minor principal stress is  $\sigma$  compressive. If the yield stress for the material is 250 MPa find the value of  $\sigma$  at which yielding will commence to each of the following criteria.

- (i) Maximum principal stress
- (ii) Maximum shearing stress.

15. (a) Calculate the thickness of a metal necessary for a cylindrical shell of internal diameter 200 mm to withstand an internal pressure of 15 MPa, if the maximum hoop stress is 100 MPa.

Or

- (b) Write a brief technical note on : (4 × 4 = 16)
- (i) Stresses on curved beam
  - (ii) Residual stresses
  - (iii) Deflection in unsymmetrical bending
  - (iv) Stress concentration.