B.E. DEGREE ARREAR EXAMINATION, NOV./DEC. 2012

IV SEMESTER

CIVIL ENGINEERING

8

CE 9251 – STRENGTH OF MATERIALS –II {Regulations 2008}

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART – A (10 x 2 = 20 marks)

1. Determine the strain energy stored in a cantilever beam when it is subjected to a point load 'W' at the free end. Assume that the beam has uniform flexural rigidity throughout.
2. State Maxwell's reciprocal theorem.
3. Write the value of maximum deflection induced in a fixed beam when it is subjected to a uniformly distributed load 'w' spread over the entire span.
4. What are the merits and limitations of theorem of three moments?
5. Distinguish between short and long columns.
6. What do you mean by core of a column section?
7. What are principal planes?
8. Name the theories of failures suitable for ductile materials.
9. Define shear centre.
10. What is meant by fatigue failure?

PART – B (5 x 16 = 80 marks)

11. Determine the vertical and horizontal displacement of the joint 'C' of the pin jointed plane frame as shown in figure Q. (11). The cross sectional area of AB is 1000 mm^2 and of AC and BC is 1500 mm^2. Take the modulus of elasticity, E = 200 GPa.

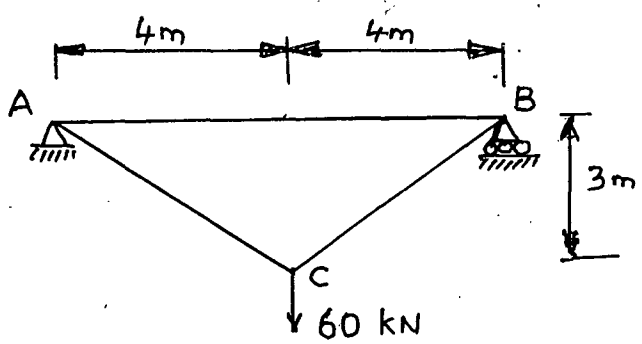

Figure Q (11)

12. (a) A propped cantilever of span 8 m is subjected to a uniformly distributed load of 10 kN/m over a span 4 m from the fixed end and a point load of 20 kN at 6 m from the fixed end. Draw the shearing force and bending moment diagrams.

(Or)

(b) A continuous beam ABC is fixed at A and simply supported at B and C. Length of the spans are, AB = 6 m and BC = 4 m. The beam carries a uniformly distributed load of 2 kN/m over the span AB and a central concentrated load of 10 kN on the span BC. Draw the shearing force and bending moment diagrams.

13 (a) Derive expression for Euler's critical load of a column with one end hinged and the other end fixed from first principles.

(Or)

(b) A hollow cylindrical cast iron column is 4 m long, both ends being fixed. Design the column to carry an axial load of 250 kN. Use Rankine's formula and adopt a factor of safety of 5. The internal diameter may be taken as 0.80 times the external diameter. Take the crushing strenth of material as 550 N/mm^2 and Rankine's constant as 1/1600.

14 (a) Determine the principal stresses for the state of stress at a point characterized by the components shown below as stress tensor.

$$\begin{bmatrix} 16 & 8 & 12 \\ 8 & 12 & 4 \\ 12 & 4 & 6 \end{bmatrix} N/mm^2$$

(Or)

(b) A cylindrical shaft made of steel for which the yield point stress in tension is 650 N/mm^2, is subjected to static loads consisting of a bending moment M = 12 kNm and a torque T = 36 kNm. Determine the diameter 'D' which the shaft must have for a factor of safety of 2. Apply (i) Distorsion energy theory and (ii) Principal stress theory.

15 (a) A beam of T section (flange: 100 mm x 20 mm; web: 150 mm x 10 mm) is 2.5 m in length and is simply supported at the ends. It carries a central concentrated load of 3.2 kN inclined at 20° to the vertical and passing through the centroid of the section. If the modulus of elasticity is 200 GPa, determine (i) maximum tensile stress; (ii) maximum compressive stress and (iii) position of the neutral axis.

(Or)

(b) A compound cylinder is formed by shrinking a tube of 200 mm internal diameter and 20 mm thick over another tube of 120 mm diameter and 40 mm thick. If radial pressure at the common surface after shrinking is 12 N/mm^2, determine the final stresses across the section when a fluid under pressure of 45 N/mm^2 is admitted into the cylinder.