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

Question Paper Code : 21201

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fourth Semester

Civil Engineering

CE 2252/CE 43/10111 CE 403/080100019 — STRENGTH OF MATERIALS

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define principle of virtual work.

2. What is meant by Maxwell's reciprocal theorem?

3. Explain briefly about fixed end moments.

4. Define theorem of three moments.

5. What are the assumptions made in Euler's column theory?

6. Explain briefly about Middle third rule.

7. Define Principal stress and Principal strain.

8. What is meant by Proof resilience and Modulus of resilience?

9. Explain briefly about stress concentration.

10. What is meant by fatigue and fracture due to fatigue?

PART B — (5 × 16 = 80 marks)

11. (a) Calculate the central deflection and the slope at ends of a simply supported beam carrying a U.D.L. of w per unit length over the whole span. (16)

Or

(b) (i) Find the strain energy stored in a steel bar 50 cm long and 3 cm × 1 cm in cross-section, shown in fig. Q. 11(b)(i) when it is subjected simultaneously to an axial pull of 50 kN and compressive stress of 100 N/mm^2 on its narrow edge. (8)

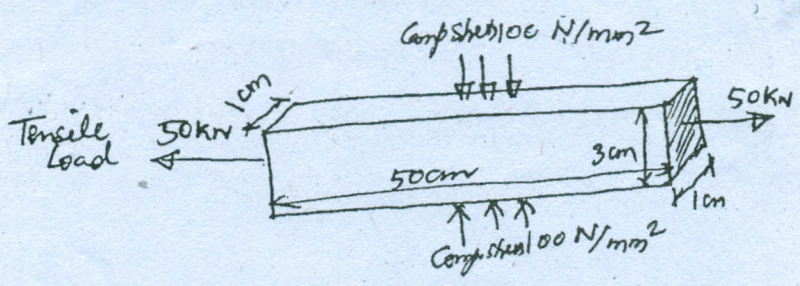

fig. Q. 11(b)(i)

(ii) A piece of material is subjected to two perpendicular stresses f_1 (tensile) and f_2 (compressive). Find an expression for the strain energy stored per unit volume. If a stress of 128 N/mm^2 acting alone gives the same value of strain energy as per the expression already found, find the value of f_2 when $f_1 = 112$ N/mm^2. Take 1/m = 0.30. (8)

12. (a) A cantilever ABC is fixed at A and propped at C is loaded as shown in fig. Q. 12 (a). Find the reaction at C. (16)

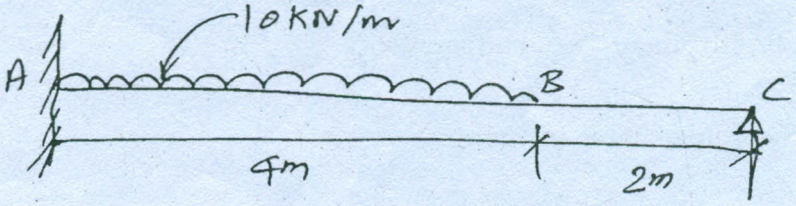

Fig. Q. 12 (a)

Or

(b) A two span continuous beam ABC fixed at the ends is loaded as shown in fig. Q. 12 (b). Find (i) moment at supports (ii) reactions at the supports. Draw the B.M. and S.F. diagrams. (16)

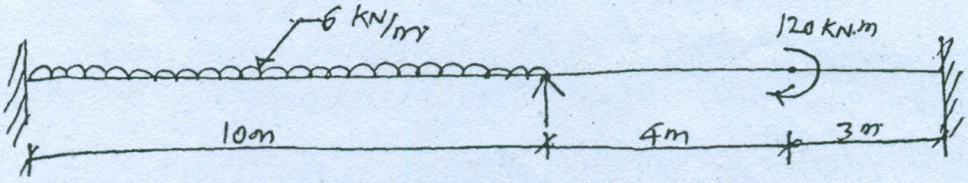

Fig. Q. 12 (b)

13. (a) A bar of length 4 m when used as a simply supported beam and subjected to a u.d.l. of 30 kN/m over the whole span, deflects 15 mm at the centre. Find the EI value for the above beam and hence determine the crippling loads when it is used as a column with the following end conditions :

(i) Both ends pin-jointed;

(ii) One end fixed and the other end hinged;

(iii) Both ends fixed. (16)

Or

(b) A cylinder of 200 mm internal diameter and 50 mm thickness carries a fluid at a pressure of 10 MN/m^2. Calculate the maximum and minimum intensities of circumferential stresses across the section. Also sketch the radial stress distribution and circumferential stress distribution across the section. (16)

14. (a) The principal tensile stresses at a point across two perpendicular planes are 120 MN/m^2 and 60 MN/m^2. Find

(i) the normal and tangential stress and the resultant stress and its obliquity on a plane at 20° with the major principal plane.

(ii) the intensity of stress which acting alone can produce the same maximum strain. Take Poisson's ratio = 1/4. (16)

Or

(b) The inside and outside diameters of a cast-iron cylinder are 240 mm and 150 mm respectively. If the ultimate strength of a cast-iron is 180 MN/m^2 find, according to each of the following theories the internal pressure which would cause rupture :

(i) maximum principal stress theory,

(ii) maximum strain theory and

(iii) maximum strain energy theory.

Poisson's ratio = 0.25. Assume no longitudinal stress in the cylinder. (16)

15. (a) A 80 mm × 80 mm angle as shown in fig. Q. 15 (a) having $I_{XX} = I_{YY} = 87.36 \times 10^{-8}$ m^4. It is used as a freely supported beam with one leg vertical. On the application of the bending moment in the vertical plane *YY*, the mid section of the beam deflects in the direction *AA'* at 30°15′ to the vertical.

(i) Calculate the second moment of area of the section about its principal axis.

(ii) What is the bending stress at the corner B if the bending moment is 1.5 kN-m? (16)

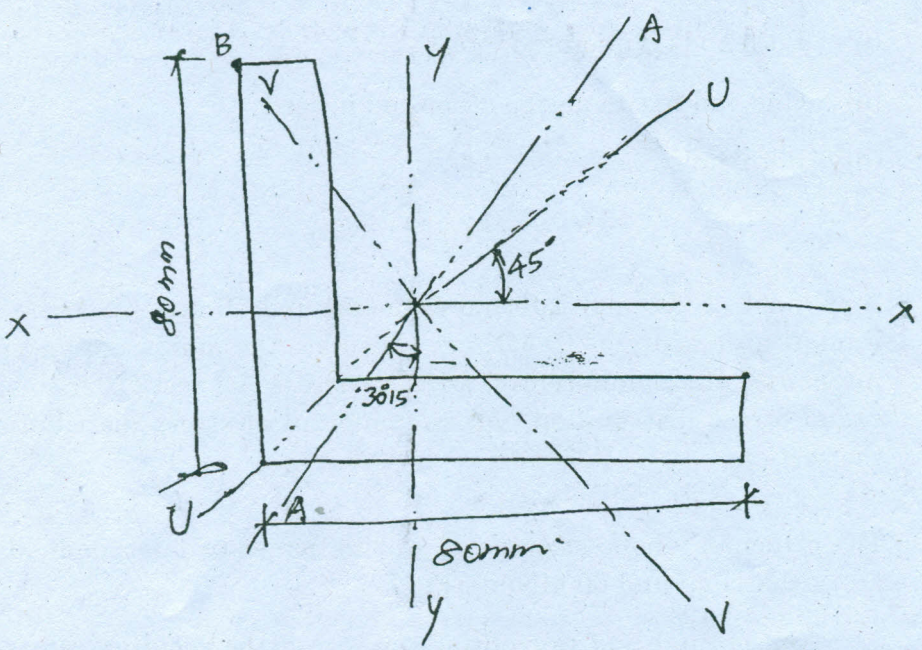

Fig. Q. 15 (a)

Or

(b) A ring as shown in fig. Q. 15 (b) is carrying a load of 30 kN. Calculate the stresses at 1 and 2. (16)

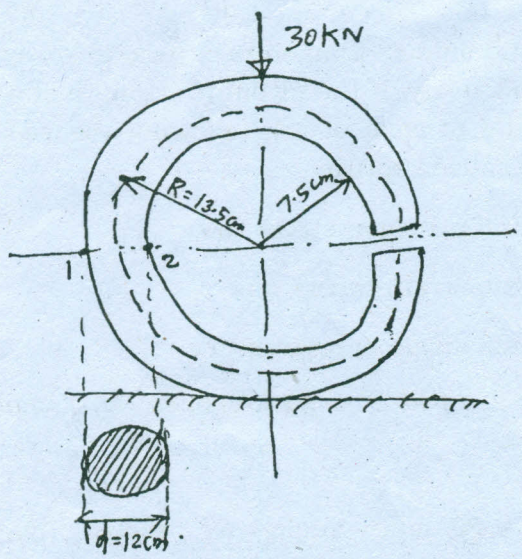

Fig. Q. 15 (b)