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

Question Paper Code : 77062

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Civil Engineering

CE 6402 — STRENGTH OF MATERIALS

(Common to Fourth Semester Petrochemical Engineering and Third Semester Plastic Technology and Polymer Technology)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Derive a relation for strain energy due to flexure.

2. State Maxwell's Reciprocal theorem.

3. Determine the prop reaction for a cantilever beam with udl over entire span.

4. Write the three moment equation, stating all the variables used.

5. Compare the failure of a long column with that of a short column due to axial compression.

6. Differentiate the failure a thin and thick cylinder.

7. What are called principal stresses?

8. State Van Mises theory.

9. Write down Winkler Bach formula.

10. Define shear centre.

PART B — (5 × 16 = 80 marks)

11. (a) Determine the maximum deflection of a simply supported beam with udl over entire span using principle of virtual work method.

Or

(b) A crane is shown in fig. Q. 11(b) the cross sectional area of the member AC is 3000 mm^2 and that of member BC is 7000 mm^2. Determine the vertical deflection of the joint C. Take E = 2.0×10^5 N/mm^2. Use Williot diagram method.

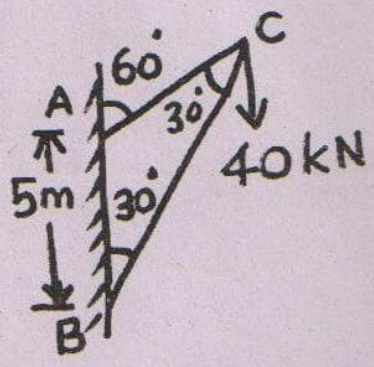

Fig. Q. 11(b)

12. (a) A fixed beam ACB of span 6 m is carrying a concentrated clockwise couple of 150 kN.m applied at a section 4 m from the left end. Find the end moments from the first principles. Draw BM and S.F diagrams.

Or

(b) For the beam given in fig. Q. 12(b), find the moment and reaction at the supports. Draw SFD and BMD. Take AB = 2 m; BC = 3 m; CD = 4 m, DE = 3 m, EF = 8 m.

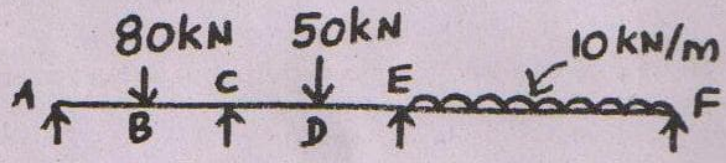

Fig. Q. 12(b)

13. (a) Compare the ratio of the buckling strengths of two columns of circular section one with hollow and the other solid when both are made of the same material, having the same length, same cross sectional area and same end conditions. The internal diameter of the hollow column is half of the External Diameter.

Or

(b) A steel tube of 300 mm external diameter is to be shrunk on to another steel tube of 90 mm internal diameter, after shrinking the diameter at the junction is 180 mm, before shrinking on the difference of diameter at the junction is 0.12 mm. Find the

(i) The radial pressure at the junction (8)

(ii) The circumferential stress developed in the two tubes after shrinking on. Take E = 200 GN/mm^2. (8)

14. (a) In a material the principle 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

(iv) Factor of safety on the total strain energy criterion if the material yields at 120 MN/m^2.

Take E = 200 GN/m^2, 1/m = 0.3. (4 × 4 = 16)

Or

(b) Determine the principal stresses and principal directions for the following 3D-stress field.

$$[\sigma] = \begin{bmatrix} 30 & 15 & 20 \\ 15 & 20 & 25 \\ 20 & 25 & 40 \end{bmatrix} \text{ MPa.}$$

15. (a) A curved bar is formed of a tube of 120 mm outside diameter and 7.5 mm thickness. The center line of this beam is a circular arc of radius 225 mm. A bending moment of 3 kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses set up, in the bar.

Or

(b) A curved bar of rectangular section 60 mm wide by 75 mm deep in the plane of bending initially unstressed is subjected to bending moment of 2.25 kNm which tends to straighten the bar. The mean radius of curvature is 150 mm. Find

(i) The position of the neutral axis

(ii) The greatest bending stresses.

Draw a diagram to show approximately how the stress varies across the section.

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