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

Question Paper Code : 70280

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fourth Semester

Civil Engineering

CE 6402 — STRENGTH OF MATERIALS

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

(Regulations 2013)

(Also Common to PTCE 6402 – Strength of Materials for B.E. (Part-Time) – Second Semester – Civil Engineering – Regulations 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. A tensile load of 60 kN is gradually applied to a circular bar of 40 m diameter and 5 m long. If $E = 2.0 \times 10^5$ N/mm^2, determine the strain energy absorbed by the rod.

2. State "principle of virtual work".

3. What is fixed beam?

4. Enlist the advantages and limitations of the theorem of three moments.

5. What is equivalent length of a column?

6. Define slenderness ratio.

7. Define stress tensor.

8. State Guest's theory.

9. Write down Winkler Bach formula.

10. Define shear centre.

PART B — ($5 \times 13 = 65$ marks)

11. (a) A tension bar 5 m long is made up of two parts, 3 metre of its length has a cross-sectional area of $10\,cm^2$ while the remaining 2 m has a cross-sectional area of $20\,cm^2$. An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take $E = 2 \times 10^5\ N/mm^2$. (13)

Or

(b) State and prove Maxwell's reciprocal theorem. (13)

12. (a) A fixed beam of 6 m span is loaded with point loads of 150 kN at distance of 2 m from each support. Draw the bending moment diagram and shear force diagram. Also find the maximum deflection. Take E = 200 GPa and $I = 8 \times 10^8\ mm^4$. (13)

Or

(b) A continuous beam ABCD is simply supported at A, B, C, D AB = BC = CD = 5 m span AB carries a load of 30 kN at 2.5 m from A. Span BC carries an UDL of 20 kN/m span CD carries a load of 40 kN at 2 m from C. Draw the shear force and bending moment diagrams. (13)

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. (13)

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 (7)

(ii) The circumferential stress developed in the two tubes after shrinking on. Take E = 200 GN/mm². (6)

14. (a) Direct stresses of 120 N/mm^2 tensile and 80 N/mm^2 compression exist on two perpendicular planes at a certain point in a body. There are also accompanied by shear stress on the planes. The greatest principal stress at the point due to these is 160 N/mm^2. (13)

(i) What must be the magnitude of the shearing stresses on the two planes?

(ii) What will be the maximum shearing stress at the point?

Or

(b) Find the diameter of the shaft according to the distorsion energy theory if the shaft is subjected to a maximum torque of 12 KNm and a maximum bending moment of 10 kNm at a particular section. Take allowable equivalent stress in simple tension as 180 MN/m^2. (13)

15. (a) (i) Write a detail note on shear centre. (5)

(ii) A channel section has flanges 12 cm × 2 cm and web 16 cm × 1 cm as shown Fig15(a)(ii). Determine the shear centre of the channel. (8)

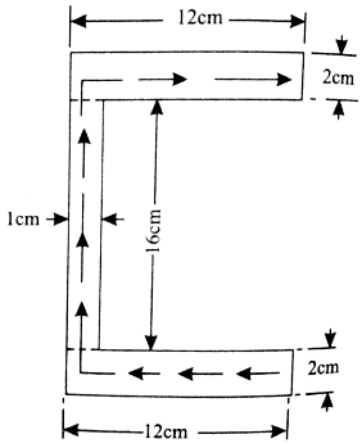

Fig.15(a)(ii)

Or

(b) Determine (i) position of neutral axis, and (ii) maximum and minimum stresses when a curved beam of circular section of diameter 100 mm is subjected to pure bending moment of +11.5 kNm. The radius of curvature is 100 mm. (13)

PART C — ($1 \times 15 = 15$ marks)

16. (a) In an experimental determination of the buckling load for 1.2 cm diameter mild steel pin ended struts of various lengths, two of the values obtained were :

(i) When length = 50 cm the load = 10 kN, and

(ii) When length = 20 cm, the load = 30 kN.

Make the necessary calculations and then state whether either of the above values of loads conforms with the Eulers formula for the critical load. Take E = 200 GN/m^2. (15)

Or

(b) A solid circular shaft is subjected to a bending moment of 50 kN-m and a torque of 20 kN-m. Design the diameter of the shaft according to

(i) The maximum principal stress theory.

(ii) The maximum shear stress theory.

(iii) The maximum distortion energy theory.

Take $\mu = 0.3$, stress at elastic limit = 300N/mm^2, factor of safety = 2.5. (15)

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