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

Question Paper Code : 71555

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third/Fourth Semester

Civil Engineering

CE 6402 — STRENGTH OF MATERIALS

(Common to Petrochemical Engineering, Plastic Technology, Polymer Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Resilience, Proof Resilience and Modulus of Resilience.
2. State the various methods for computing the joint deflection of a perfect frame.
3. What are the fixed end moments for a fixed beam of length 'L' subjected to a concentrated load 'w' at a distance 'a' from left end?
4. What are the advantages and limitations of the theorem of three moments?
5. State the assumptions made in the Euler's column theory.
6. What is a thick cylinder?
7. Define spherical tensor.
8. Explain shear strain Energy theory.
9. Define Unsymmetrical bending. State the two reasons for unsymmetrical bending.
10. Write the shear centre equation for channel section.

PART B — (5 × 13 = 65 marks)

11. (a) A cantilever of rectangular section breadth b, depth d and of length 1 carries uniformly distributed load spread from free end to the mid section of the cantilever. Using Castigliano's theorem. Find Slope and deflection due to bending at the free end. (13)

Or

(b) An axial pull of 40 kN is suddenly applied to a steel rod 2 m long and 1000 mm^2 in cross section. Calculate the strain energy that can be absorbed if E = 200 GN/m^2. (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) A built up column consisting of rolled steel beam ISWB 300 with two plates 200 mm × 10 mm connected at the top and bottom flanges. Calculate the safe load the column can carry, if the length is 3 m and both ends are fixed. Take factor of safety 3 fc = 320 N/mm^2 and α = 17500. Take properties of joist: A = 6133 mm^2 I_{xx} = 9821.6 × 104 mm^4 ; I_{yy} = 990.1 × 104 mm^4. (13)

Or

(b) A Thick walled steel cylindrical shell of internal diameter 150 mm and external diameter 500 mm is subjected to fluid pressure of 100 MPa. Calculate the principal stress at a point on the inside surface of the cylinder and calculate the increase in inside diameter due to fluid pressure. Assume E = 200 kN/mm^2 and 1/m = 0.3. (13)

14. (a) For the state of stress shown in fig 14 (a) Find the principal plane, principal stress and maximum shear stress. (13)

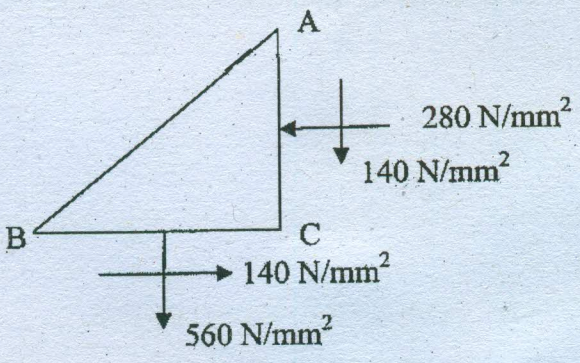

Fig 14 (a)

Or

(b) In a steel member, at a point the major principal stress is 200 MN/m^2 and the minor principal stress is compressive. If the tensile yield point of the steel is 235 MN/m^2, find the value of the minor principal stress at which yielding will commence, according to each of the following criteria of failure

(i) Maximum shearing stress.

(ii) Maximum total strain energy and

(iii) Maximum shear strain energy. Take Poisson Ratio = 0.26. Take $E = 200\ GN/m^2$ and $1/m = 0.3$. (13)

15. (a) A curved bar is formed of a tube of 120 mm outside diameter and 7.5 mm thickness. The centre line of this is a circular arc of radius 225 mm. The bending moment of 3 kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses setup in the bar. (13)

Or

(b) Derive the equation of Shear centre for channel section. (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 $E = 200\ GN/m^2$.

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 = $300 N/mm^2$, factor of safety = 2.5.

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