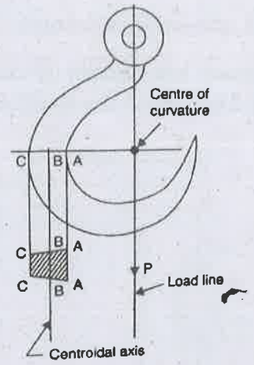
(b) A hook carries a load of 7.5 kN and the load line is at a distance of 20 mm from the inner edge of the section which is trapezoidal. The load line also passes through the centre of curvature of the hook. The dimensions of the central section are : inner width = 30 mm; outer width = 15 mm; depth = 30 mm as shown in Fig. Calculate the maximum and minimum stresses. Also plot the variation of stress across the section. (15)



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Reg. No. :

Question Paper Code : 20260

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third/Fourth Semester

Civil Engineering

CE 6402 — STRENGTH OF MATERIALS

(Common to : Petrochemical Engineering/Plastic Technology/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

Assume suitable data if found necessary.

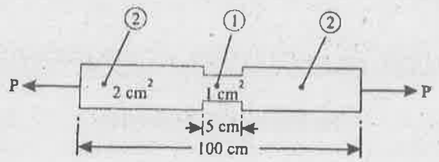
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the terms Resilience and Proof Resilience.
2. State Catigliano's first theorem.
3. What is fixed beam?
4. Enlist the advantages and limitations of the theorem of three moments.
5. Give the parameters influencing buckling load of a long column.
6. What are the advantages of compound cylinders?
7. Define stress tensor at a point.
8. State the limitations of Distortion energy theory
9. What are the reasons of unsymmetrical bending?
10. Write the assumptions made in Winkler-Bach Theory.

PART B — (5 × 13 = 65 marks)

11. (a) A bar of 100 cm in length is subjected to an axial pull, such that the maximum stress is equal to 150 MN/m². Its area of cross section is 2 cm² over a length of 95 cm and for the middle 5 cm length it is only 1 cm². If E = 200 GN/m², calculate the strain energy stored in bar. (13)



Or

(b) Using Castigliano's theorem, obtain the deflection under a single concentrated load of 60 kN applied at a distance of 1 m from right end of simply supported beam whose length equal to 4 m. Take EI = 2.2 MNm². (13)

12. (a) A cantilever AB of span 6 m is fixed at the end A and propped at the end B. It carries a point load of 50 kN at the mid span. Level of the prop is the same as that of the fixed end. Determine reaction at the prop and draw S.F. and B.M. diagrams. (13)

Or

(b) A fixed beam of 6 m span carries point loads of 100 kN and 75 kN at a distance 2 m and 4 m respectively from left support. Find (i) fixing moments at the ends; (ii) reaction at the supports. Draw S.F. and B.M diagrams also. (13)

13. (a) A slender pin ended aluminium column 1.8 m long and of circular cross section is to have an outside diameter of 50 mm. Calculate the necessary internal diameter to prevent failure by buckling if the actual load applied is 13.6 kN and the critical load applied is twice the actual load. Take E for aluminium as 70 GN/m². (13)

Or

(b) A steel cylinder of 1000 mm inside diameter is to be designed for an internal pressure of 4.8 MN/m². Calculate the thickness if the maximum shearing stress is not to exceed 21 MN/m². Take E = 200 GN/m²; Poisson's ratio = 1/3. (13)

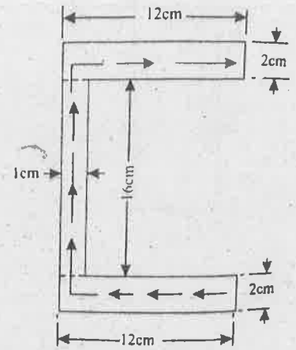
14. (a) The principal stresses at a point across two perpendicular planes are 75 MN/m² (tensile) and 35 MN/m² (tensile). Find the normal, tangential stress and the resultant stress and its obliquity on a plane at 20° with major principal plane. (13)

Or

(b) A steel shaft is subjected to an end thrust producing a stress of 90 MPa and the minimum shearing stress on the surface arising from torsion is 60 MPa. The yield point of the material in simple tension was found to be 300 MPa. Calculate the factor of safety according to the following theories : (i) Maximum shear stress theory; (ii) Maximum distortion theory. (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 Fig. Determine the shear centre of the channel. (8)

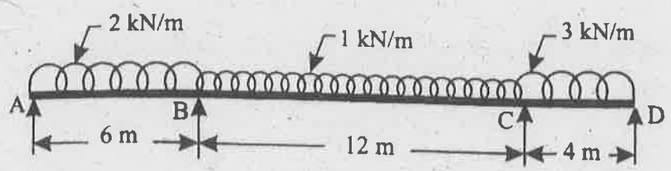


Or

(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 × 15 = 15 marks)

16. (a) A continuous beam ABCD of uniform cross section is loaded as shown in Fig. Find (i) Bending moments at supports B and C; (ii) Reaction at the supports. Draw B.M. and S.F. diagrams also. (15)



Or