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

Question Paper Code : 40302

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

Fourth Semester

Civil Engineering

CE 8402 — STRENGTH OF MATERIALS – II

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define modulus of resilience.

2. State Principle of Virtual work.

3. List the advantages of Continuous beams over Simply supported beams.

4. A fixed beam AB of length 3m is having Moment of Inertia I = 3×10^6 mm^4 and value of E for beam material is 2×10^5 N/mm^2. The support B sinks down by 3mm. Determine fixed end moments at A and B.

5. Derive the expression for core of a rectangular section.

6. State the assumptions involved in Lame's Theory.

7. Define principal planes and principal stresses.

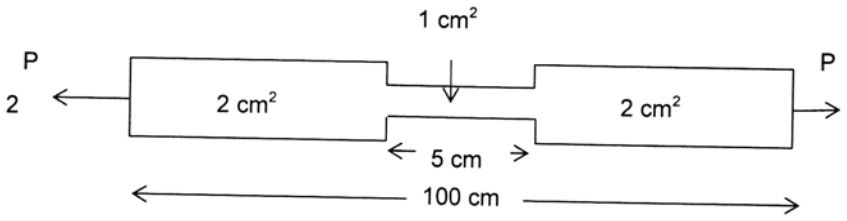
8. State the limitations of maximum shear stress theory.

9. Outline the reasons for unsymmetrical bending.

10. State the assumptions made in Winkler's Bach Theory.

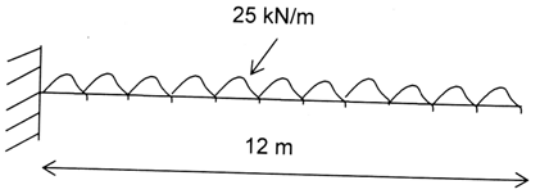
PART B — (5 × 13 = 65 marks)

11. (a) A bar 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) Determine the vertical displacement of point B of the beam shown using method of virtual work. Take E = 2 × 10⁵ MPa, I = 825 × 10⁷ mm⁴. (13)



12. (a) A fixed beam of span 6 m carries point loads of 20 kN and 15 kN at distances 2m and 4 m from the left end A. Find the fixed end moments and the reactions at the supports. Draw Bending Moment and Shear Force diagrams. (13)

Or

(b) Draw the shear force and bending moment diagram of a continuous beam ABC of length 10 m which is fixed at A and is supported on B and C. The beam carries a uniformly distributed load of 2 kN/m length over the entire length. The spans AB and BC are equal to 5 m each. (13)

13. (a) A 2 m long column has a circular cross section of 6 cm diameter. One of the ends of the column is fixed in direction and position and other end is free. Taking factor of safety as 3, Calculate the safe load using (13)

(i) Rankine'sformula take yield stress f_c = 550 N/mm² and Rankine's constant = 1/1600 for pinned ends.

(ii) Euler's formula, Young's modulus for Cast Iron = 1.3 × 10⁵ N/ mm².

Or

(b) A cast iron pipe has 200 mm internal diameter and 50 mm metal thickness. It carries water under a pressure of 5 N/mm^2. Find the maximum and minimum intensities of circumferential stress and radial stress across the section. (13)

14. (a) A rectangular bar of cross-sectional area 12000 mm^2 is subjected to an axial load of 360 N/mm^2. Determine the normal and shear stresses on a section which is inclined at an angle of 30° with the normal cross - section of the bar. (13)

Or

(b) A bolt is under an axial thrust of 7.2 kN together with a transverse shear force of 3.6 kN. Calculate the diameter of the bolt according to

(i) Maximum principal stress theory

(ii) Maximum shear stress theory

(iii) Maximum strain energy theory

Take elastic limit in simple tension = 202 N/mm^2, factor of safety = 3 and Poisson's ratio = 0.3. (13)

15. (a) A channel section has flanges 12 cm × 2 cm and web 16 cm × 1 cm. Determine the shear centre of the channel. (13)

Or

(b) At the critical section of a crane hook, trapezium in section, the inner and outer sides are 4 cm and 2.5 cm respectively and depth is 7.5 cm. The centre of curvature of the section is at a distance of 6 cm from the inner fibres and the load line is 5 cm from the inner fibres. If the maximum stress is not to exceed 120 mN/m^2 what maximum load the hook can carry? (13)

PART C — (1 × 15 = 15 marks)

16. (a) The rectangular stress components of a point in three dimensional stress system are defined as : σ_x = 20 Mpa , σ_y = –40 Mpa , σ_z = 80 Mpa, τ_{xy} = 40 Mpa, τ_{yz} = –60 Mpa , τ_{xz} = 20 Mpa . Determine the principal stresses and principal planes. (15)

Or

(b) A 40 mm × 40 mm × 5 mm angle is used as a simply supported beam over a span of 2.4 m. It carries a load of 200 N along the vertical axis passing through the centroid of the section. Determine the resulting bending stresses on the outer corners of the section, along the middle section of the beam. (15)