

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fourth Semester

CIVIL ENGINEERING

CEE107: Strength Of Materials

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

- A cantilever beam of length 'l' carries a point load 'W' at the free end. The strain energy stored by the beam is
 - $\frac{W^2 l^2}{3EI}$
 - $\frac{W^2 l^3}{4EI}$
 - $\frac{W^2 l^3}{5EI}$
 - $\frac{W^2 l^3}{6EI}$
- The central deflection of a simply supported beam of span 'l' carries uniformly distributed load 'w' per unit run over whole span is
 - $\frac{5wl^4}{384EI}$
 - $\frac{5wl^3}{384EI}$
 - $\frac{5wl^4}{394EI}$
 - $\frac{5wl^3}{394EI}$
- A fixed beam of span 'l' carries a symmetrical triangular loading whose intensity uniformly varies from zero at each end to 'w' at the centre. The fixed end moment at each end is
 - $\frac{6wl^2}{96}$
 - $\frac{5wl^2}{96}$
 - $\frac{5wl^3}{96}$
 - $\frac{wl^2}{46}$
- A continuous beam 12 m long supported over two spans 6 m each, carries a concentrated load of 40 kN each at the center of the span. The bending at the center of the support is
 - 30 kNm
 - 45 kNm
 - 90 kNm
 - 150 kNm
- Slenderness area of a column is the ratio of its length to
 - Radius of column
 - Maximum radius of gyration
 - Minimum radius of gyration
 - Moment of inertia
- In thick cylinders the variation in the radial and circumferential stress across the thickness is determined by
 - Clapeyron's theorem
 - Castigliano's theorem
 - Elastic stress theory
 - Lame's theory

7. Which of the following theory is suitable for ductile material
 - a) Maximum principal stress theory
 - b) Maximum principal strain theory
 - c) Maximum shear stress theory
 - d) Mohr's theory
8. Strain energy theory was postulated by
 - a) Rankine
 - b) Mohr
 - c) Tresca
 - d) Haigh
9. If the load pass through the shear centre of the beam section then there will be
 - a) No bending moment
 - b) Bending only
 - c) Bending and twisting
 - d) Twisting only
10. In a curved beams the distribution of bending stress is
 - a) Hyperbolic
 - b) Parabolic
 - c) Uniform
 - d) Linear

PART B (10 x 2 = 20 Marks)

11. Mention the principle virtual work
12. Define Maxwell's reciprocal theorem.
13. Find the reaction at the prop of propped cantilever beam of span 'l' when subjected to uniformly distributed load 'w' per unit run over span
14. Mention the advantages of continuous beams over simply supported beams for the same span and loadings.
15. Draw the core section for rectangular and circular sections.
16. Write the assumption made in Lamé's theory.
17. Name any four theories of failures.
18. What are residual stresses?
19. What are the reasons for unsymmetrical bending ?
20. When will stress concentration occur in a structural member and how will you prevent stress concentration.

PART C (5 x 14 = 70 Marks)

21. a) Using Castigliano's theorem, determine vertical and horizontal deflection at the free end of a bent beam shown in figure 1. Assume uniform flexural rigidity.

Figure 1

(OR)

- b) The steel truss shown in figure 2 is anchored at A and supported on rollers at B. (10+4)
If truss is so designed that, under the given loading, all tension members are stressed to 100 N/mm^2 and all compression members to 80 N/mm^2 , find the vertical deflection at the point C. Take $E = 2 \times 10^5 \text{ N/mm}^2$. Find also horizontal displacement of the end B.

Figure 2

22. a) A fixed beam of 6 m span carries two point loads of 100 kN and 75 kN which (7+7)
are located at 2 m from left and right support respectively.
Find the 1) Fixing moment at the end
2) Reactions at the supports. Draw the bending moment and shear force diagrams also.

(OR)

- b) A continuous beam ABC consists of two consecutive spans AB and BC OF 3 (7+7)
meters each and carrying a distributed load of 50 kN/m run. The end A is fixed
and the end C is simply supported. Determine the support moment and reactions.
Assuming A, B and C are at same level. Draw BMD and SFD.
23. a) (i) Write the assumptions made in Euler's column theory (2)
(ii) A prismatic column of height 'L' and flexural rigidity EI is fixed at both ends. (12)
Derive an expression for crippling load.

(OR)

- b) Find Euler's load for a rectangular column 50 mm x 40 mm in cross section and 2 m long, if one of the ends is fixed and other end is hinged. E for the material of the column is 200 kN / mm². Find also the Rankine's load for the same column if the yield stress in compression is 325 N/ mm² and $\alpha = 1/ 7500$. (7+7)

24. a) The state of stress at a point is given by the following stress tensor. Determine the principal stress stresses and the directions

$$\sigma_{tensor} = \begin{bmatrix} -5 & -6 & 5 \\ -6 & 3 & 4 \\ 5 & 4 & 2 \end{bmatrix} \text{ N/mm}^2$$

(OR)

- b) A bolt is under an axial thrust of 9 kN together with a transverse force of 4.5 kN. Calculate its diameter according to
1. Maximum principal stress theory;
 2. Maximum principal strain theory;
 3. Maximum strain energy theory;
 4. Maximum shear strain energy theory
- Given: factor of safety = 3, yield strength of material of bolt = 225 N/mm² and poisson's ratio = 0.3

25. a) A cantilever beam of span 4m has rectangular cross section 40 mm wide by 60 mm deep. The beam is subjected to a concentrated load of 1 kN which is inclined at an angle of 30 degrees to the vertical plane and located at the free end of the cantilever. Calculate the bending stress developed at all the four corner points of the beam section near the fixed end.

(OR)

- b) A rectangular beam 50 mm wide and 75 mm deep is curved in a plane perpendicular to its depth. The mean radius of curvature being 100 mm and radial distance upto inner face of rectangular section is 62.5 mm . If the beam is subjected to a bending moment of 3.75 kN m which tends to reduce the curvature, find the maximum intensity of compressive and tensile stresses.
