Register Number: ……

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Fourth Semester

CIVIL ENGINEERING

U07CE402: Strength of Materials

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. A rod carrying an axial load is subjected to a normal stress of 100 MPa. If modulus of elasticity of the material of the rod is 10^5 MPa and volume of the rod is 200 mm^3, the strain energy in the bar is

   A)10 Nmm B)10 Nm C)100 Nmm D) 5 Nmm.

2. A load of 10 kN produces a stress of 50 MPa in an axially loaded bar when the load is gradually applied. If the same load is suddenly applied, the maximum instantaneous stress set up will be

   A)50 MPa B) 100 MPa C)150 MPa D) 200 MPa.

3. A beam of length l, fixed at both the ends carries a uniformly distributed load w per unit length throughout the span. The bending moments at the ends is

   A) $\frac{wl^2}{8}$ B) $\frac{wl^2}{12}$ C) $\frac{wl^3}{12}$ D) $\frac{wl^2}{24}$

4. A beam fixed at both the ends carries a uniformly distributed load of 20 kN/m over the entire span of 6m. The bending moment at the mid-span section of the beam is

   A) 10 kNm B) 30 kNm C) 60 kNm D) 120 kNm

5. Euler's critical load for a column of effective length l, moment of inertia I and modulus of elasticity E is given by

   A) $\frac{\pi^2 EI}{l}$ B) $\frac{\pi EI}{l^2}$ C) $\frac{\pi^2 EI}{l^2}$ D) $\frac{\pi EI}{l}$

6. The ratio of effective length of a column, having both ends fixed, to its full length is

   A) 2 B) $\frac{1}{2}$ C) $\sqrt{2}$ D $\frac{1}{\sqrt{2}}$

7. The Principal Stresses at a point of a stressed body are : f_1 = 100 MPa (tension), f_2 = 80 MPa (tension) and f_3 = 50 MPa (compression). The maximum shear stress is

   A. 50 MPa B. 75 MPa C. 25 MPa. D. 100 Mpa.

8. Which of the following theories of failure is suitable for brittle materials

A) Maximum strain energy B) Maximum shear stress theory

C) Maximum principal stress theory D) Distortion energy theory

9. Which of the following is the reason for unsymmetrical bending?

A) The section is symmetrical but the load line is inclined to both the principal axes

B) The section itself is unsymmetrical and the load line is along centroidal axis

C) Either A or B

D) Both A and B.

10. If the load passes through the shear centre of the section of the beam, then there will be

A) No bending of the beam B) Bending only in the beam

C) Bending accompanied by twisting D) Only twisting in the beam.

PART B (10 x 2 = 20 Marks)

11. Explain the principle of virtual work.

12. State Maxwell's reciprocal theorem.

13. State the general theorem of three moments.

14. A fixed beam of span 10 m carries a central concentrated load of 20 kN. Sketch the shear force diagram.

15. Give the Rankine – Gordon formula for eccentrically loaded columns.

16. Distinguish between a thin walled cylinder and a thick walled cylinder with respect to the mechanism of withstanding the internal pressure.

17. What is a spherical stress tensor?

18. Explain the strain energy theory of failure.

19. What is meant by stress concentration?

20. Explain the meaning of the term 'Creep'

PART (5 x 14 = 70 Marks)

21. a) A bar 12mm in diameter gets stretched by 3mm under a gradually applied load of 8 kN. What stress would be produced in the same bar by a weight of 0.8 kN. which falls freely vertically through a distance of 8 cm to a rigid collar attached at its end?

Take $E = 2 \times 10^5$ MPa

(OR)

b) A simply supported beam of span 3 m carries a uniformly distributed load of 20 kN/m over the entire span. Taking $EI = 2.25 \times 10^6$ Nm^2, determine the deflection at the centre of the beam using Castigliano's theorem.

22. a) A fixed beam of span 6 m carries point loads of 200 kN and 150 kN at 2 m from left and right supports respectively. Sketch the shear force and bending moment diagrams.

(OR)

b) A two span continuous beam ABC is fixed at the ends. AB = 10 m and BC =7 m. It carries a uniformly distributed load of 6 kN/m in AB and a clockwise couple of moment 120 kNm at 3 m from C. Assuming uniform section throughout, sketch the bending moment diagram.

23. a) A slender pin ended 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 = 70 GN/m^2.

(OR)

b). A pipe of internal diameter 200 mm and wall thickness 50 mm carries a fluid at a pressure of 10 MPa. Sketch the distributions of radial and circumferential stresses across the wall of the section.

24. a) A shaft is subjected to maximum torque of 10 kNm and a bending moment of 7.5 kNm at a particular section. It the allowable stress in simple tension is 160 MPa, find the required diameter according to the maximum shear stress theory.

(OR)

b) Solve the above problem using shear strain energy theory.

25. a) A channel section has flanges 120 mm x 20 mm and web 160 mm x 10 mm. Proceeding from fundamentals, determine the shear centre of the channel.

(OR)

b) Derive the Winkler – Bach formula for determining the stresses in a curved beam.

****