Register Number: ……..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Third Semester

CIVIL ENGINEERING

CEE103: Mechanics of Solids

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The relation between bulk modulus and young's modulus is given by
   a) E = 3K (1-2/m) b) EK = 3/2m
   c) K= 3E (1-2/m) d) E = mE/2(m+1)
2. When a body is subjected to a direct tensile stress in one plane, then normal stress on an oblique section of body inclined at an angle to the normal of the section is equal to
   a) p sin 2θ b) p cos 2θ
   c) p/2 sin 2θ d) p/2 sin 2θ
3. A redundant frame is also called
   a) Perfect frame b) Imperfect frame
   c) Deficient frame d) Deformed frame
4. The circumferential stress for a thin cylindrical shell subjected to an internal pressure is
   a) pd/2t b) pd/4t
   c) pd/6t d) pd/8t
5. When shear force at a point is zero, then bending moment at that point will be
   a) Zero b) Minimum
   c) Maximum d) Infinity
6. In a I-Section beam maximum shear stress occurs at
   a) Top fibre b) Bottom fibre
   c) Neutral level d) Junction of the web and flange
7. A simply supported beam of span 'l' carrying u.d.l of intensity 'w' oven it's entire span length, the maximum deflection produced is given by
   a) $\frac{wl^2}{8}$ b) $\frac{WL^3}{48EI}$
   c) $\frac{5Wl^4}{384EI}$ d) $\frac{Wl^4}{8EI}$

8. The differential equation $\frac{EId^2y}{dx^2}$ is equal to
   a) Shean force at the section b) Bending moment at the section
   c) Deflection at the section d) Slope at the section
9. When a solid shaft is subjected to torsion, the shear stress induced in the shaft at its centre is,
   a) Zero b) Minimum
   c) Maximum d) Average
10. When a closely coiled spring is subjected to an axial load, it is said to be under
    a) Bending b) Shear
    c) Torsion d) All of the above

PART B (10 x 2 = 20 Marks)

11. Differentiate tensile and compressive stresses.
12. Define (i) principal plane and (ii) principal stress.
13. List the assumptions in the analysis of trusses.
14. A gas cylinder of internal diameter 40 mm is 5 mm thick. If the tensile stress in the material is not to exceed 30 MPa, find the maximum pressure which can be allowed in the cylinder.
15. List the assumptions in the theory of simple bending.
16. List and sketch the types of supports.
17. Sketch the distribution of shear stress over a rectangular section.
18. Define Mohr's theorem II used in moment area method.
19. Write the torsion equation.
20. List the various types of springs.

PART C (5 x 14 = 70 Marks)

21. a) A steel bar of cross-sectional area 200 mm2 is loaded as shown in Figure 1. Find the change in length of the bar. Take E = 200 GPa.

(OR)

b) The stresses at a point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane at an angle of 55 degrees with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component.

22. a) Find the forces in all the members of the truss shown in Figure 2 by the method of joints. Indicate whether the force is tensile or compressive.

(OR)

b) (i) Briefly explain circumferential and longitudinal stresses in thin cylinders with neat sketches. (7)

(ii) A cylindrical vessel 2 m long and 500 mm in diameter with 10 mm thick plates is subjected to an internal pressure of 3 MPa. Calculate the change in volume of the vessel. Take E = 200 GPa and Poisson's ratio = 0.3 for the vessel material. (7)

23. a) (i) What is bending stress? Write the assumptions in the theory of simple bending. (7)

(ii) Derive the bending equation with a neat sketch. (7)

(OR)

b) A simply supported beam of span 4.5 m carries a uniformly distributed load of 3.6 kN/m over a length of 2 m from the left end A. Draw the shear force and bending moment diagrams for the beam.

24. a) Derive the expressions for slope and deflection of a simply supported beam subjected to uniformly distributed load 'w' over the entire span.

(OR)

b) An I – section beam 350 mm x 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a shearing force of 200 kN at a section. Sketch the shear stress distribution across the section.

25. a) (i) A closely coiled helical spring of round steel wire 5 mm in diameter having 12 complete coils of 50 mm mean diameter is subjected to an axial load of 100 N. Find the deflection of the spring and the maximum shearing stress in the material. Take C = 80 GPa. (7)

(ii) A leaf spring is to be made of seven steel plates 65 mm wide and 6.5 mm thick. Calculate the length of the spring, so that it may carry a central load of 2.75 kN, the bending stress being limited to 160 MPa. Also calculate the deflection at the centre of the spring. Take E for the spring material as 200 GPa. (7)

(OR)

b) i) A circular shaft of 50 mm diameter is required to transmit torque from one shaft to another. Find the safe torque, which the shaft can transmit, if the shear stress is not to exceed 40 MPa. (7)

ii) A circular shaft of 60 mm diameter is running at 150 rpm. If the shear stress is not to exceed 50 MPa, find the power which can be transmitted by the shaft. (7)

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