

**B.E. DEGREE EXAMINATIONS: NOV/DEC 2010**

Third Semester

**CIVIL ENGINEERING**

CEE103: Mechanics of Solids

**Time: Three Hours**

**Maximum Marks: 100**

**Answer ALL Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. The deformation per unit length is called
  - a) tensile stress
  - b) compressive stress
  - c) shear stress
  - d) strain
2. The modulus of elasticity of mild steel is approximately equal to
  - a) 10 KN/m<sup>2</sup>
  - b) 80 KN/m<sup>2</sup>
  - c) 100 KN/m<sup>2</sup>
  - d) 210 KN/m<sup>2</sup>
3. A perfect frame should satisfy the following condition
  - a)  $j = 2m - 3$
  - b)  $m = 2j - 3$
  - c)  $j = 3m - 2$
  - d)  $m = 3j - 2$where,  $m$  is the number of members and  $j$  = number of joints.
4. The circumferential stress in a thin cylinder due to internal radial pressure 'p' is equal to
  - a)  $pd/4t$
  - b)  $pd/2t$
  - c)  $pt/2d$
  - d)  $pt/4d$
5. In a cantilever beam with vertical downward loads applied on the beam, maximum bending moment and maximum shear force occurs respectively at
  - a) both at the fixed ends
  - b) both at the free end
  - c) maximum bending moment at fixed and maximum shear force at free end
  - d) maximum bending moment at free and maximum shear force at fixed end
6. In a simply supported beam with downward vertical force acting on the beam, the maximum compressive stress at a section occurs
  - a) at top fibre
  - b) bottom fibre
  - c) at neutral axis level
  - d) at centroid
7. Maximum deflection produced in a simply supported beam with span 'L' and uniformly distributed load 'w' applied over the whole span length is given by
  - a)  $wL^4/8EI$
  - b)  $5wL^4/384EI$
  - c)  $wL^3/48EI$
  - d)  $wL^3/3EI$
8. In a rectangular cross section the maximum shear stress developed is
  - a) 2.5 times the average shear stress
  - b) 1.5 times the average shear stress
  - c) 3 times the average shear stress
  - d) 3.5 times the average shear stress

9. The deflection of a closely coiled helical spring is given by

- a)  $64WR^3n / Cd^4$       b)  $16WR^3n / Cd^4$       c)  $64Cd^4 / WR^3n$       d)  $32WR^3n / Cd^4$

10. Power transmitted by a shaft in Watts is given by

- a)  $P = 2\pi NT/60$       b)  $P = 60 / 2\pi NT$       c)  $P = 2\pi NT/360$       d)  $P = 2\pi NT/600$

where, T is the Torsion in N-m, N- speed in r.p.m

**PART B (10 x 2 = 20 Marks)**

11. Define poisson's ratio and young's modulus.

12. What is meant by principal stress.

13. What are the assumptions made in the analysis of truss?

14. Define hoop stress and longitudinal stress in a thin cylinder.

15. Draw the bending moment diagram for a simply supported beam of span 'L' carrying udl of intensity 'w' over its whole length.

16. What is meant by point of contraflexure?

17. What is the maximum slope and deflection produced in a cantilever beam of span 'L' subjected to a point load W at its free end.

18. Draw the conjugate beam for the beam shown in Fig.1

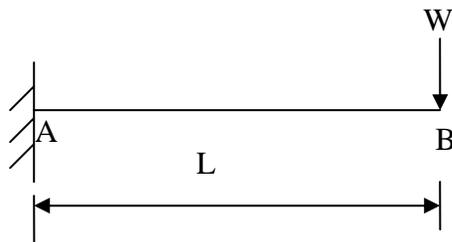


Fig 1

19. What is meant by leaf spring what are its uses?

20. Define stiffness of a spring, what is the unit of stiffness.

**PART C (5 x 14 = 70 Marks)**

21. a) A steel rod of 30 mm diameter is enclosed centrally in a hollow copper tube of external diameter 50mm and internal diameter 40mm. the composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is equal to 150 mm, determine:

(i) the stresses in the rod and tube.

(ii) load carried by each bar.

Take E for steel =  $2.1 \times 10^5 \text{ N/mm}^2$  and for copper =  $1.1 \times 10^5 \text{ N/mm}^2$

(OR)

- b) A rectangular block of material is subjected to a tensile stress of  $110 \text{ N/mm}^2$  on one plane and a tensile stress of  $47 \text{ N/mm}^2$  on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of  $63 \text{ N/mm}^2$  and that associated with the former tensile stress tends to rotate the block anticlockwise. Find :
- (i) the direction and magnitude of each of the principal stress and
  - (ii) magnitude of the greatest shear stress.

22. a) Determine the forces in the truss shown in Fig 2 which carries a horizontal load of 12 KN and a vertical load of 18 KN.

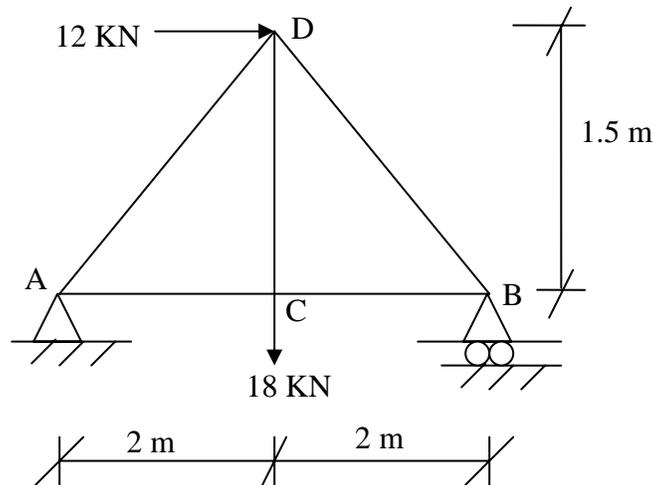
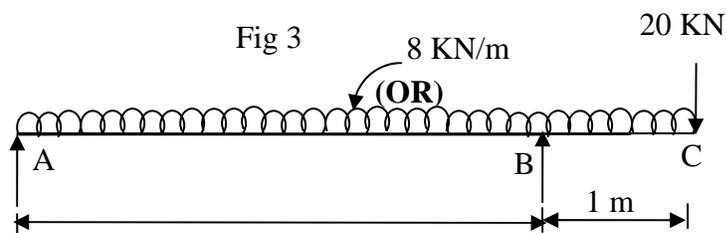


Fig 2

(OR)

- b) A closed cylindrical vessel made of steel plates 4mm thick with plane ends carries fluid under pressure of  $3 \text{ N/mm}^2$ . the diameter of cylinder is 250mm and length is 750 mm, calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take  $E = 2.1 \times 10^5 \text{ N/mm}^2$  and  $1/m = 0.286$ .

23. a) Draw the shear force and bending moment diagram for the beam shown in Fig.3



b) A timber beam of rectangular section is to support a load of 20 KN uniformly distributed over a span of 3.6 m when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed  $7 \text{ N/mm}^2$ , find the dimensions of the cross-section.

24. a) A cantilever of length 3m carries two point loads of 2 KN at the free end and 4 KN at a distance of 1m from the free end. Find the deflection at the free end. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 10^8 \text{ mm}^4$ .

**(OR)**

b) An I-section beam 350mm x 150mm has a web thickness of 10mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 KN, find the maximum shear stress developed in the I-section. And draw the shear stress distribution diagram across the section.

25. a) A solid circular shaft transmits 75 KW power at 200 r.p.m. calculate the shaft diameter, if the twist in the shaft is not to exceed  $1^\circ$  in 2 metres length of shaft, and shear stress is limited to  $50 \text{ N/mm}^2$ . take  $C = 1 \times 10^5 \text{ N/mm}^2$ .

**(OR)**

b) A laminated spring 1m long is made up of plates each 50 mm wide and 10mm thick. If the bending stress in the plate is limited to  $100 \text{ N/mm}^2$ , how many plates would be required to enable the spring to carry a central point load of 2 Kn ? if  $E = 2.1 \times 10^5 \text{ N/mm}^2$ , what is the deflection under the load ?

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