ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE

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

REGULATIONS : 2008

THIRD SEMESTER - CIVIL ENGINEERING

080100010 - MECHANICS OF SOLIDS

**TIME: 3 Hours** **Max Marks: 100**

## PART - A

**(20 x 2 = 40 MARKS)**

**ANSWER ALL QUESTIONS**

1. State Hooke's Law.
2. Define: Poisson's ratio
3. Write the relationship between three elastic constants
4. Define: Principal Plane and Principal Stresses.
5. When a truss is said to be perfect or efficient?
6. Define: Tension Co-efficient.
7. A cylindrical shell of 300mm diameter made up of 18mm thick plates. If it is subjected to an internal pressure of 3 MPa determine the stresses developed?
8. A Spherical shell of 800mm diameter is subjected to an internal pressure of 1.5 MPa. What should be the minimum thickness of the shell if the tensile stress is not to exceed 40MPa?
9. Define: Point of contraflexure and in which beam it occurs?
10. Write the relationship between bending moment and shear force.
11. List out the assumptions made in the theory of simple bending.
12. Draw the SFD and BMD for a cantilever beam of span 'l' subjected to a point load W at the free end
13. State moment area theorems.
14. What is conjugate beam?
15. Define: flexural rigidity and torsional rigidity
16. What do you meant by shear flow and shear centre?
17. Write the torsion equation
18. Define: Polar modulus of section



19. A leaf spring carries a central load of 3000N. The leaf spring is to be made of 10 steel plates 5cm wide and 6mm thick. If the bending stress is limited to 150N/mm$^2$. Determine the length of the spring
20. What is meant by solid length of spring and how to calculate the solid length?

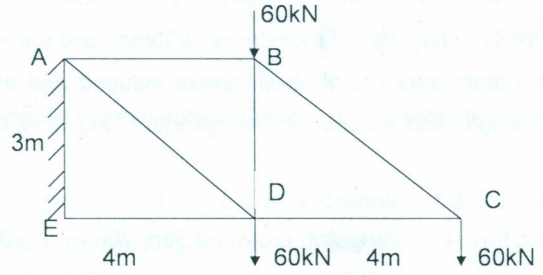
## PART – B

**(5 x 12 = 60 Marks )**

**ANSWER ANY FIVE QUESTIONS**

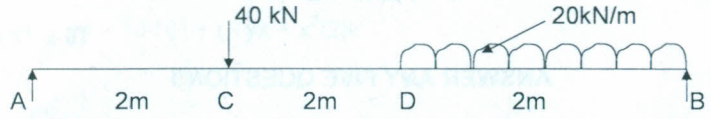
21. A Compound bar is made of a central steel plate 60 mm wide and 10 mm thick to which copper plates of 40 mm wide and 5 mm thick are connected rigidly on each side. The length of the bar at normal temp is 1m. If the temperature is raised by 80° C, determine the stresses in each metal & change in length.Take $E_s$ = 200GN/m$^2$; $E_c$=100GN/m$^2$; $\alpha_s$= 12x 10$^{-6}$/ °C; $\alpha_c$= 17x 10$^{-6}$/ °C

22. Using Method of Joints determine the forces in the members of the truss shown in figure




23. Draw the shear force and bending moment diagram for the overhanging beam shown in figure and hence find the position of point of contraflexure.

24. Using Macaulay's method find the maximum deflection and the maximum slope for the beam loaded as shown in figure




25. A shaft is required to transmit 245kW power at 240rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40 $N/mm^2$ and the twist $1^\circ$ per metre length. Determine the diameter required if
    a. the shaft is solid
    b. the shaft is hollow with external diameter twice the internal diameter

    Take modulus of rigidity = 80 $kN/mm^2$

26. A closed cylindrical vessel made of steel plates 15mm thick carries a fluid under a pressure of 1.5 $N/mm^2$.The diameter of cylinder is 1000mm and the length is 3000mm. Calculate the the maximum intensity of shear stress induced and also determine the change in diameter, length and volume of the cylinder. Take $E=2.0x10^5$ $N/mm^2$ and poison's ratio=0.3

27. A 500mm long bar has a rectangular cross-section 20mm x 40mm. This bar is subjected to 40kN tensile force on 20mm x 40mm faces, 200kN compressive force on 20mm x 500mm faces and 300kN tensile force on 40mm x 500mm faces. Find the changes in volume if $E=2x10^5$ $N/mm^2$ and poisson's ratio = 0.3

28. A simply supported beam of span 5m has a cross section 150mm x 250mm. if the permissible stress is 10 $N/mm^2$, find
    a. Maximum intensity of uniformly distributed load it can carry
    b. Maximum central concentrated load it can carry

*****THE END*****