Reg. No. _____

Karunya University

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – November / December 2008

Subject Title: MECHANICS OF SOLIDS **Time : 3 hours**
Subject Code: CE203 **Maximum Marks: 100**

Answer ALL questions

PART – A (10 x 1 = 10 MARKS)

1. State Hooke's law.
2. The relation between young's modulus and bulk modulus is given by _____.
3. Bending moment is maximum at a section where the shear force is _____after changing its sign.
4. A load acting at a point is known as _____load.
5. The stresses produced due to constant bending moment are known as _____.
6. What are the types of springs?
7. The planes of maximum and minimum normal stresses are at an angle of _____to each other.
8. The stresses acting on principal planes are known as _____stresses.
9. Deflection of a cantilever beam of length (L) at the free end is given by _____when the point load (W) is at the free end.
10. What do you mean by crippling load of a column?

PART – B (5 x 3 = 15 MARKS)

11. A rectangular bar made of steel is 2.8m long and 15mm thick . The rod is subjected to an axial tensile load of 40 kN. The width of the rod varies from 75mm at one end to 30mm at the other. Find the extension of the rod if E =2 x 10^5 N/mm^2.
12. What are the different types of beams? Explain with sketches?
13. The shearing stress is a solid shaft is not to exceed 40 N/mm^2 when the torque transmitted is 20000 N-m. Determine the minimum diameter of the shaft.
14. Find the diameter of a circular bar which is subjected to an axial pull of 160 kN, if the maximum allowable shear stress on any section is 65 N/mm^2.
15. Explain with neat sketches, how the failure of short and of a long column takes place.

PART – C (5 x 15 = 75 MARKS)

16. A steel rod of 3cm diameter is enclosed centrally in a hollow copper tube of external diameter 5cm and internal diameter of 4cm. The composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is equal to 15cm, determine.
    a. The stresses in the rod and tube and
    b. Load carried by each bar

    Take E for steel = 2.1 x 10^5 N/mm^2 and for copper = 1.1 x 10^5 N/mm^2.

(OR)

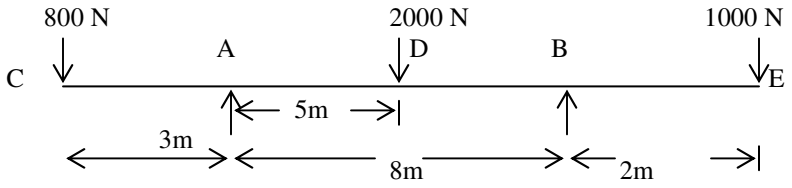
17. A boiler shell is to be made of 15mm thick plate having a limiting tensile stress of 120 N/mm^2. If the efficiencies of the longitudinal and circumferential joints are 70% and 30% respectively determine:
    a. The maximum permissible diameter of the shell for an internal pressure of 2 N/mm^2 and
    b. Permissible intensity of internal pressure when the shell diameter is 1.5m.

18. Draw the shear force and bending moment diagram for a simply supported beam of length 9m and carrying a uniformly distributed load of 10 kN/m for a distance of 6m from the left end. Also calculate the maximum Bending moment on the section.

(OR)

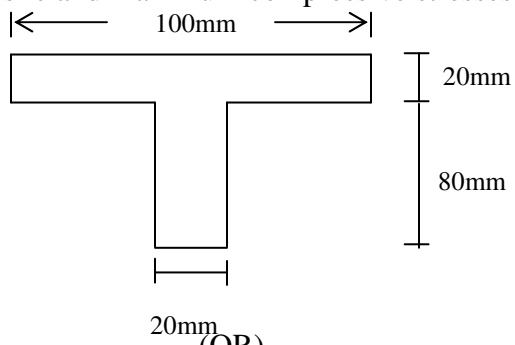
[P.T.O]

19. Draw the shear force and Bending moment diagrams for the beam which is loaded as shown in figure 1. Determine the points of contra flexure within the span AB.



(Fig. 1)

20. A cast iron beam is of T-section as shown in figure – 2. The beam is simply supported on a span of 8m. The beam carries a uniformly distributed load of 1.5 kN/m length on the entire span. Determine the maximum tensile and maximum compressive stresses.

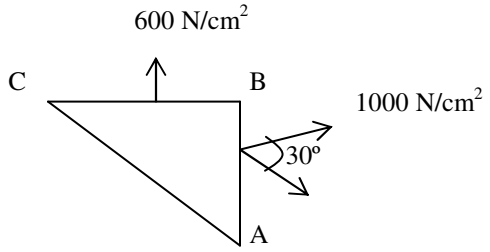


(Fig.2)

(OR)

21. A closely coiled helical spring of mean diameter 20cm is made of 3cm diameter rod and has 16 turns. A weight of 3 kN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that spring may be compressed by 18cm. Take $C = 8 \times 10^4 N/mm^2$.

22. At a certain point in a material under stress the intensity of the resultant stress on a vertical plane is 1000 N/cm^2 inclined at 30º to the normal to that plane and the stress on a horizontal plane has a normal tensile component of intensity 600 N/cm^2 as shown in figure 3. Find the magnitude and direction of the resultant stress on the horizontal plane and the principal stresses.



(Fig.3)

(OR)

23. A rectangular block of material is subjected to a tensile stress of 110 N/mm^2on one plane and a tensile stress of 47 N/mm^2 on the plane at right angler to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find.
    a. the direction and magnitude of each of the principal stress and
    b. magnitude of the greatest shear stress

24. A beam of length 5m and of uniform rectangular section is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire length. Calculate the width and depth of the beam if permissible bending stress is 7 N/mm^2 and central deflection is not to exceed 1 cm. Take E for beam material = 1×10^4 N/mm^2.

(OR)

25. Determine the crippling load for a T – section of dimensions 10cm x 10 cm x 2 cm and of length 5m when it is used as strut with both of its ends hinged. Take E as 2.0×10^5 N/mm^2.