Register Number: ……

B.E. DEGREE EXAMINATIONS: APRIL/MAY 2011

Fourth Semester

MECHANICAL ENGINEERING

U07ME401: Strength of Materials

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

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Modulus of elasticity is the ratio of
   (a) stress to strain (b) stress to original length
   (c) deformation to original length (d) all of these
2. In a bar of large length when held vertically and subjected to a load at its lower end, its own-weight produces additional stress. The maximum stress will be
   (a) at the lower cross-section (b) at the built-in upper cross-section
   (c) at the central cross-section (d) at every point of the bar
3. The B.M. at the centre of a simply supported beam carrying a uniformly distributed load is
   (a) wl (b) wl/2 (c) $wl^2/4$ (d) $wl^2/8$
4. The shape of the bending moment diagram over the length of a beam, carrying a uniformly distributed load is always
   (a) linear (b) parabolic (c) cubical (d) circular
5. A long vertical member, subjected to an axial compressive load, is called
   (a) a column (b) a strut (c) a tie (d) a stanchion
6. S1:The maximum deflection occur in the free end in the case of Cantilever
   S2:The maximum deflection occur in the center in the case of simply supported
   (a) S1 is right (b) S2 is right (c) Both S1 & S2 are right (d)Both S1 & S2 are wrong
7. S1:For the same shear force, maximum shear stress developed in a circular section is lesser than the rectangular section S2:Circular section is stronger in shear
   (a) S1 is right S2 is wrong (b) S2 is right S1 is wrong
   (c) Both S1 & S2 are right (d) Both S1 & S2 are wrong
8. The design of a thin cylindrical shell is based on
   (a) Internal pressure (b) Diameter of shell (c) Longitudinal stress (d) all of these

9. The deflection of a closely coiled helical spring of diameter (D) subjected to an axial load (W) is

(a) 64 WR^3 n/Cd^4 (b) 64 WR^2 n/Cd^4 (c) 64 WR n/Cd^4 (d) 64 WRn^2/Cd^4

10. The shear stress at any section of a shaft is maximum

(a) At the centre of the section (b) At a distance r/2 from the centre

(c) At the top of the surface (d) At a distance 3/4r from the center

PART B (10 x 2 = 20 Marks)

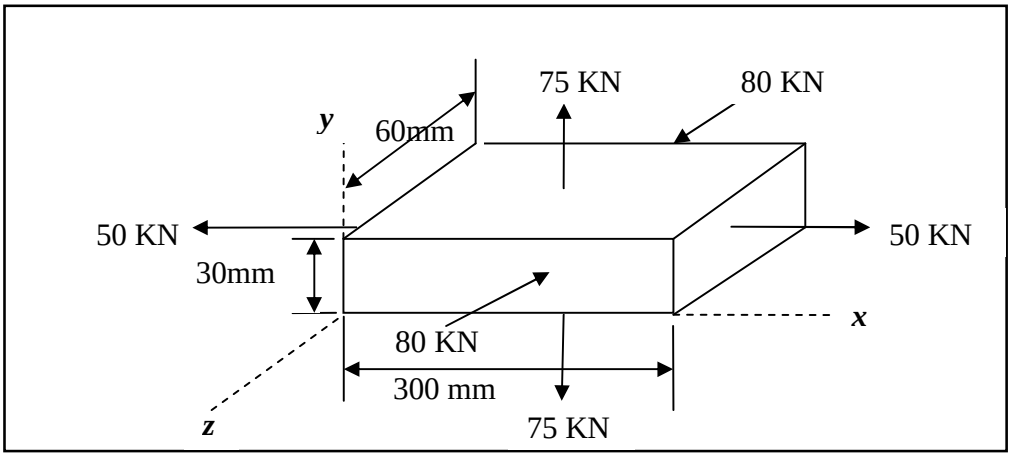
11. State Hooke's Law.
12. Define: (a) Poisson's ratio (b) Rigidity modulus
13. What are the assumptions made in theory of bending?
14. What do you mean by point of contraflexure?
15. Write the maximum slope and maximum deflection when simply supported beam of length *l* subjected to a point load W at its mid point of the span?
16. What do you mean by slenderness ratio of a column?
17. What are principal planes and principal stresses?
18. What is circumferential or hoop stress in shells?
19. Write the torsion equation.
20. What is Wahl's stress factor?

PART C (5 x 14 = 70 Marks)

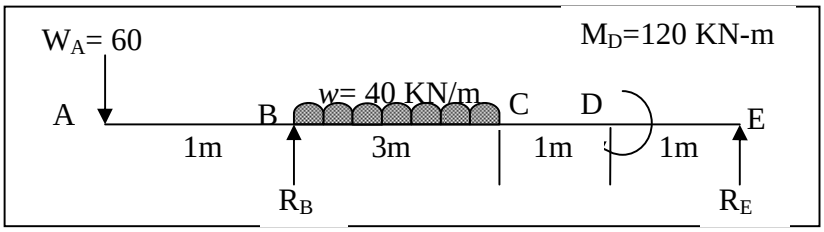
21. a) A rod of length 1 m and diameter 20 mm is subjected to a tensile load 20 kN. The increase in length of the rod is 0.30 mm and decrease in diameter is 0.0018 mm. Calculate the Poisson's ratio and three moduli.

(OR)

b) A steel plate 300 mm long, 60 mm wide and 30 mm deep is subjected to the forces shown in figure. Determine the change in volume. E=200 kN/mm^2 and Poisson's Ratio =0.3.



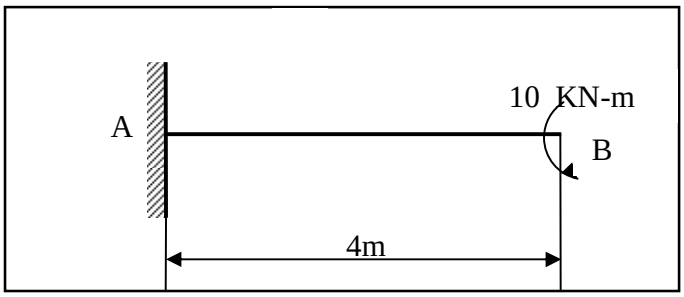
22. a) A beam ABCDE is simply supported over B and E. AB=CD=DE meter, BC=3 meter. The beam is subjected to a concentrated load of 60 kN at A an U.D.L of intensity 40 kN/m over at D. Draw shear force and bending moment diagram. Locate the point of contraflexure if any.



(OR)

b) A T section of a beam has the following dimensions, width of the flange 100 mm, overall depth 80 mm, thickness of the web 10 mm, thickness of the flange 10 mm. Determine the maximum bending stress in the beam, when a bending moment of 200 Nm is acting on the section.

23. a) A cantilever beam of span 4 m carries a concentrated moment 10 kNm at free end. Find the slop and deflection at free end using Macaulay's Method. EI=2 x 10^4 kN/mm^2.



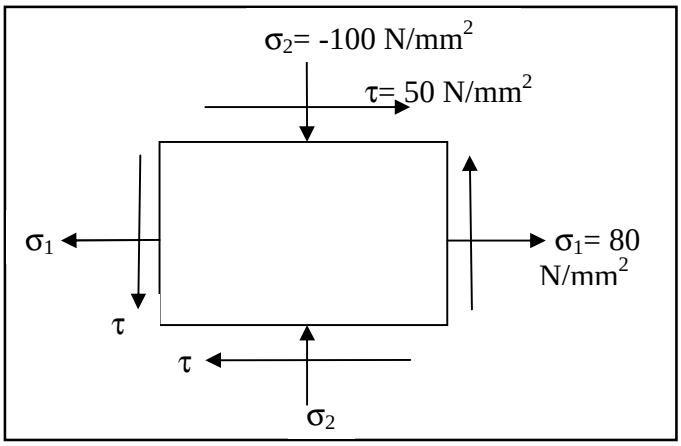
(OR)

b) A bar of rectangular cross section 30 mm x 40 mm hinged at each end is subjected to axial compression. The bar is 2 m long.

(a) Determine the buckling load and corresponding axial stress using Euler's formula.

(b) Determine the minimum length for which Euler's equation may be used to determine the bucking load, if the proportional limit of material is 200 N/mm^2 . Take $E=2x10^5$ $N/mm^{2.}$

24. a) A point in a strained material is subjected to a horizontal tensile stress of 80 N/mm^2 and a vertical compressive stress of 100 N/mm^2 . It is also accompanied by a shear stress of 50 N/mm^2. Determine (i) Principal stress (ii) Principal planes and (iii) Maximum shear stress and its planes.



(OR)

b) Calculate (i)The change in volume (ii)The change in diameter (iii)Change in length of a thin cylindrical shell 100 cm diameter 1 cm thick and 5 m long subjected to an internal pressure of 3 N/mm^2.Take $E=2 x10^5$ N/mm^2 and Poisson's ratio is 0.3.

25. a) A solid circular shaft is subjected to a torque of 150 Nm. Find the minimum diameter required if the allowable shear stress is 100 N/mm^2 the allowable twist is 1° per 3 m length of shaft. Take G=100 kN/mm^2

(OR)

b) A close coiled helical spring made out of 10 mm diameter wire has 20 coils. Each coil is of 100 mm mean diameter. If the maximum allowable stress in the spring is 140 MPa, Determine the allowable load on the spring, elongation of the spring and stiffness of the spring? Take G=82 kN/mm^2.

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