Register Number: ……..

B.E DEGREE EXAMINATIONS: MAY/JUNE 2013

Fourth Semester

MEC109: STRENGTH OF MATERIALS

(Common to Mechatronics Engineering & Mechanical Engineering & Automobile Engineering)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. When the deformation is within elastic limits, the stress developed in a body is directly proportional to the strain is called as
   a) elasticity b) plasticity
   c) Hooke's law d) Young's modulus
2. The negative ratio of lateral strain to longitudinal strain is known as
   a) bulk modulus b) Poisson's ratio
   c) modulus of elasticity d) modulus of rigidity
3. If the beam extends beyond the supports on one or both sides is known as
   a) overhanging beam b) cantilever beam
   c) simply supported beam d) continuous beam
4. The net force to the left or right of the section is defined as
   a) bending moment b) point of contraflexure
   c) normal force d) shear force
5. The shear stress is _____ on the surface of the shaft and is _____ at the axis of the shaft
   a) minimum, maximum b) maximum, minimum
   c) maximum, zero d) zero, maximum
6. Strength of a shaft means the _____torque the shaft can transmit.
   a) minimum b) maximum
   c) minimum d) maximum, minimum
7. For maximum deflection, the slope (dy/dx) is
   a) Zero b) Maximum
   c) Zero d) None of these
8. In the equation, which is used in double integration method, the first integration gives the value of
   a) deflection b) elongation
   c) shear force d) slope
9. Maximum shear stress by Mohr's circle method is equal to the _____ of the Mohr's circle
   a) chord b) diameter
   c) radius d) half of the chord
10. If the thickness of the wall of the cylindrical vessel is less than _____of its internal diameter, The cylindrical vessel is known as thin cylinder
    a) 1/2 to 1/5 b) 1/10 to 1/15
    c) 1/5 to 1/10 d) 1/15 to 1/20

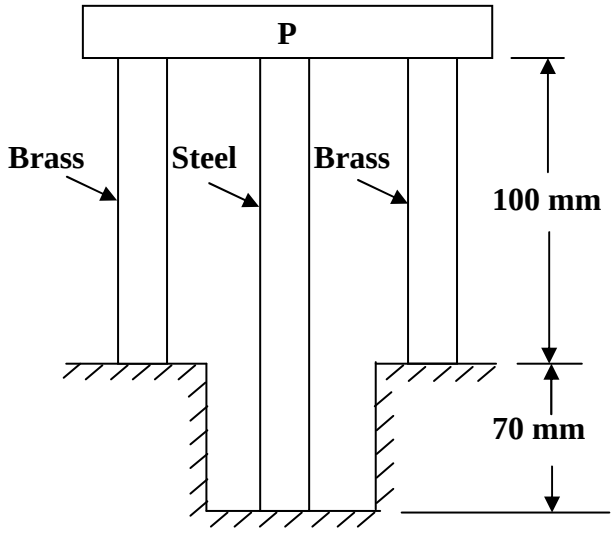
PART B (10 x 2 = 20 Marks)

11. Write the relationship between young's modulus and bulk modulus
12. Define temperature stress.
13. What is simple bending?
14. Define shear flow .
15. Name the types of helical springs
16. Write the methods for finding the slope and deflection at a section in a loaded beam.
17. What is slenderness ratio?
18. Write the Rankine's formula.
19. Define principle plane and principle stress**.**
20. Write the expression for hoop stress on thin cylinder.

PART C (5 x 14 = 70 Marks)

21. a) Two brass rods and one steel rod together support a load as in fig 1. If the stresses in brass and steel are not to exceed 60 N/mm^2 and 120 N/mm^2, find the safe load (P) that can be supported. Take E for steel and brass as 2 x 10^5 N/mm^2 and 1 x 10^5 N/mm^2 respectively. The cross sectional area of steel rod is 1500 mm^2 and of each brass rod is 1000 mm^2.

Figure 1

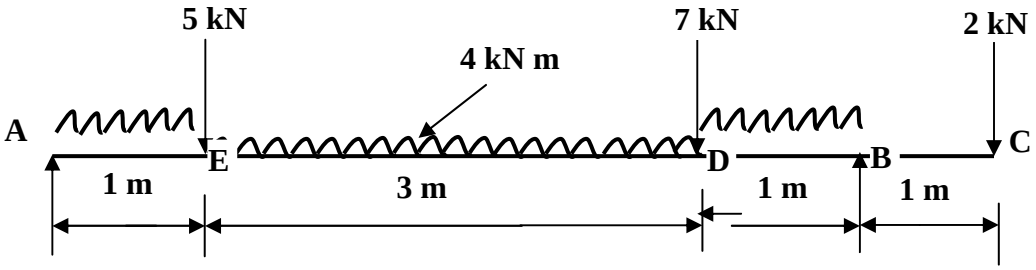


(OR)

b) A tension bar 5 m long is made up of two parts, 3 m of its length has a cross sectional area of 10 cm^2 while the remaining 2 m has a cross sectional area of 20 cm^2. An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take E = 2 x 10^5 N/mm^2.

22. a) Draw shear force and bending moment diagram for the simply supported beam shown in fig 2.

Figure 2



(OR)

b) Draw shear force and bending moment diagram for the simply supported beam shown in fig 3.

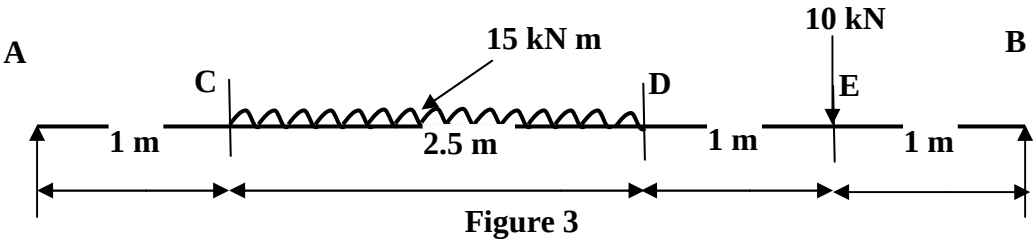


Figure 3

23. a) A solid circular shaft and a hollow circular shaft whose inside diameter is (3/4) of the outside diameter, are of the same material, of equal lengths and are required to transmit a given torque. Compare the weights of these two shafts if the maximum shear stress developed in the two shafts are equal.

(OR)

b) (i) A closely coiled helical spring is to carry a load of 500 N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 80 N/mm^2. If the stiffness of the spring is 20 N per mm deflection and modulus of rigidity is 8.4 x 10^4 N/mm^2, find the number of coils. (8)

(ii) A closely coiled helical spring of round steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 200 N. Determine (i) deflection of spring (ii) maximum shear stress in the wire (iii) Stiffness of spring. Take C = 8 x 10^4 N/mm^2 (6)

24. a) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN at a distance of 1 m and 3 m respectively from the left support. Find (i) deflection under each load (ii) maximum deflection and (iii) the point at which maximum deflection occurs.

(OR)

b) Determine the Euler's crippling load for a T section of dimensions 10 cm x 10 cm x 2 cm and the length of 5 m when it is used as strut with both of its end hinged. Take the young's modulus E = 2.0 x 10 ^{5} N/mm^2.

25. a) The stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60^0 to the axis of the major axis. Also determine the maximum intensity of shear stress in the material at the point by analytical method and check the values by using Mohr's circle method.

(OR)

b) (i) A cylindrical pipe of diameter 1.5 m and thickness 1.5 cm is subjected to an internal fluid pressure of 1.2 N/mm^2. Determine (i) longitudinal stress developed in the pipe and (ii) circumferential stress developed in the pipe (8)

(ii) A thin cylinder of internal diameter 1.25 m contains a fluid at an internal pressure of 2 N/mm^2. Determine the maximum thickness of the cylinder if (i) the longitudinal stress is not to exceed 30 N/mm^2 and (ii) the circumferential stress is not to exceed 45 N/mm^2. (6)

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