KUMARAGURU
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Register Number:…….

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Third Semester

MECHANICAL ENGINEERING

U13MET303: Strength of Materials

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Modulus of elasticity is defined as the ratio of
   a) shear stress to shear strain
   b) Linear stress to linear strain
   c) Linear stress to lateral strain
   d) Lateral strain to linear strain.
2. ……. Strain is the deformation of the bar per unit length in the direction of the force
3. The shafts are designed on the basis of _____
   a) Strength
   b) Rigidity
   c) Stress
   d) Both strength and Rigidity.
4. In a beam where shear force changes sign, the bending moment will be_____
5. Resultant stress on an oblique section on a member subjected to stresses is
   a) $\sigma_R = (\sigma_n^2 + \sigma_t^2)^{1/2}$
   b) $\sigma_R = (\sigma_n^2 - \sigma_t^2)^{1/2}$
   c) $\sigma_R = (\sigma_n^2 + \sigma_t^2)$
   d) $\sigma_R = (\sigma_n^2 - \sigma_t^2)$
6. A shaft is in _____, when equal and opposite torques is applied at the two ends of a shaft.
7. 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
8. The point of contraflexure occurs only in _____ beam.
9. If a member is subjected to a uniform bending moment (M),the radius of curvature of the deflected form of the member is given by
   a) M/R = E/I
   b) M/I = E/R
   c) M/I = R/E
   d) M/E = RI
10. For maximum deflection, the slope (dy/dx) is _____

PART B (10 x 2 = 20 Marks)

(Not more than 40 words)

11. Define the two important conditions of Composite bar.
12. What is Proof resilience?
13. Give the assumptions made in theory of simple bending.
14. Define the following terms: “Hogging, Sagging”.
15. Find an expression for section modulus for hollow rectangular section.
16. Write the assumptions made in a circular shaft subjected to torsion.
17. Define the term: “Polar Modulus”.
18. Write any two differences between open and closed coil helical springs.
19. What is mean by torsional rigidity?
20. How the solid length of the spring is calculated?

PART C (5 x 14 = 70 Marks)

(Not more than 400 words)

Q.No. 21 is Compulsory

21. A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in fig.1. Calculate the force P_2 necessary for equilibrium if P_1 = 45 kN, P_3 = 450 kN and P_4 = 130 kN. Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1 x 10^5 N/mm^2. Apply Principle of superposition.

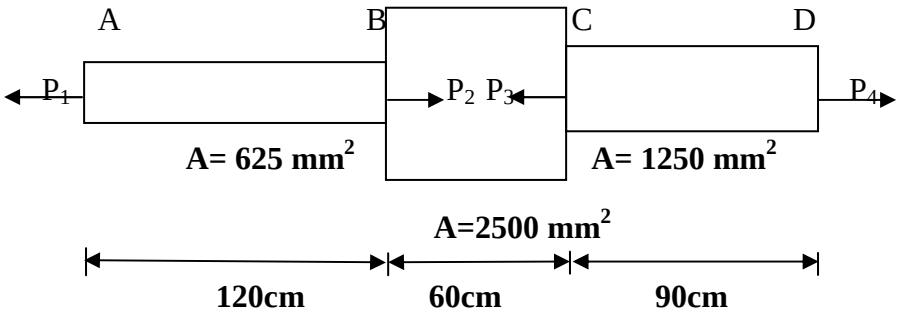

Figure 1.

22. a) A timber beam of rectangular section of length 8m is simply supported. The beam carries a UDL of 12 kN/m run over the entire length and a point load of 10kN at 3m from the left support. If the depth is two times the width and the

stress in the timber is not to exceed 8 N/mm^2. Find the suitable dimension of the section.

(OR)

b) Draw shear force and bending moment diagram for the beam shown in figure 2.

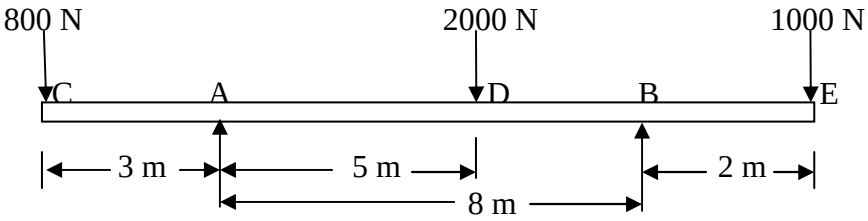

Figure 2.

23. a) A beam of length 5m and of uniform rectangular section is simple supported at its ends. If 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 is 1X 10^4 N/mm^2.

(OR)

b) A beam of length 6m is simply supported at its ends and carries two point loads of 48kN and 40kN at a distance of 1m and 3m respectively from the left support. Find:

i. Deflection under each load,

ii. Maximum deflection,

iii. The point at which maximum deflection occurs.

24. a) A solid cylindrical shaft is to transmit 300kW at 100 rpm

(i) If the shear stress is not to exceed 80 N/mm^2, Find its diameter.

(ii) What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter? The length, the material and maximum shear stress being same.

(OR)

b) The stiffness of a close-coiled helical spring is 1.5 N / mm of compression under a maximum load of 60 N. The maximum shear stress produced in the wire of the spring is 125 N/mm^2. The solid length of the spring is given as 5 cm. Find:

(i) Diameter of wire,

(ii) Mean diameter of the coils and

(iii) Number of coils required.

Take C = $4.5X\ 10^4\ N/mm^2$.

25. a) At a point in a strained material, the principal stresses are $100N/mm^2$(tensile) and 40 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 stress. What is the maximum intensity of shear stress in the material at the point?

(OR)

b) At a point within a body subjected to two mutually perpendicular directions, the stresses are $80N/mm^2$ tensile and 40 N/mm^2 tensile. Each of the above stresses is accompanied by a shear stress of 60 N/mm^2. Determine the normal stress, shear stress and resultant stress on an oblique plane inclined at an angle of 45^0 with the axis of minor tensile stress.

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