KUMARAGURU
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Register Number: ……..

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Fourth Semester

MEC109 : STRENGTH OF MATERIALS

(Common to MECH/ MCE/AUE)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The combined effect of external forces acting on a body is called
   a) stress b) strain
   c) load d) bending
2. _____ strain is the deformation of the bar per unit length in the direction of the force.
   a) Volumetric b) Shear
   c) Lateral d) Linear
3. In a cantilever with uniformly distributed load the shearing force varies is based on
   a) Linear law b) Parabolic law
   c) Cubic law d) Cyclical law
4. Bending moment at supports in case of simply supported beams is always
   a) less than unity b) more than unity
   c) zero d) unity
5. For a solid or a hollow shaft subject to a twisting moment T, the torsional shearing stress τ at a distance r from the centre will be
   a) $\tau = Tr/J$ b) $\tau = Tr$
   c) $\tau = TJ/r$ d) $\tau = TJ$
6. The coil is having stiffness value k. It is cut into two halves, then the stiffness of the cut coils are
   a) Same b) Half
   c) Double d) 1/4
7. Beams of uniform strength are better as compared to beams of uniform cross section as they are economical
   a) for short spans b) for large spans

c) for heavy weight beams
d) for light weight beams

8. The ratio of the maximum deflections of a beam simply supported at its ends with an isolated central load and that of with a uniformly distributed load over its entire length, is
   a) 2/3
   b) 3/2
   c) 1
   d) 1/3

9. At the principal planes
   a) Tensile stress is zero and the shear stress is maximum
   b) Tensile and compressive stresses are zero
   c) Normal stress is maximum or minimum and the shear stress is zero
   d) No stress act

10. Mohr's circle can be used to determine the following stress on inclined surface
   a) Principal stress
   b) Normal stress
   c) Tangential stress
   d) Maximum shear stress

PART B (10 x 2 = 20 Marks)

11. Define Hooke's Law.
12. Differentiate between young's modulus and modulus of rigidity.
13. Write the equation for the theory of simple bending.
14. What do you mean by point of contra flexure?
15. What are Flitched beam?
16. How will you find maximum shear stress induced in the wire of a close-coiled helical spring carrying an axial load?
17. Define the term 'Crippling load'.
18. State the limitations of Euler's formula.
19. List the different methods to reduce hoop stress.
20. What are the necessary conditions for maximum shear stress?

PART C (5 x 14 = 70 Marks)

21. a) The following data related to a bar subjected to a tensile test:

Diameter of the bar, d= 30 mm

Tensile Load, P= 54 kN

Gauge length l= 300 mm

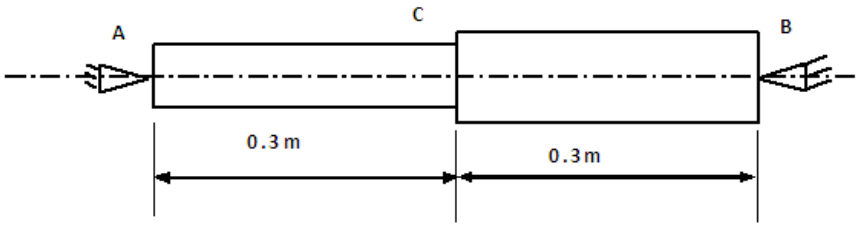
Extension of the bar, δl= 0.112 mm

Change in diameter, δd= 0.00366 mm

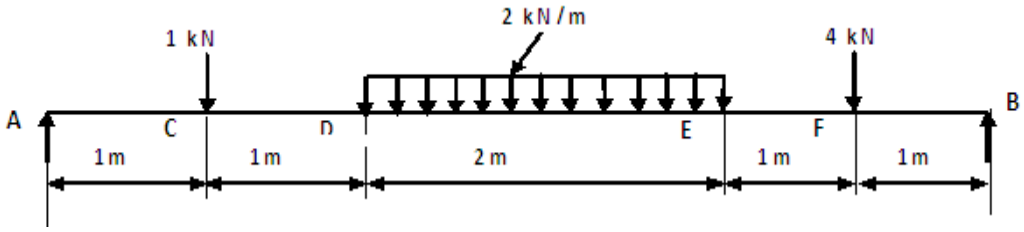
Calculate: (i) Poisson's ratio (ii) The values of three modulii.

(OR)

b) Calculate the values of the stress and strain in portions AC and CB of steel bar as shown in fig 1. A close fit exists at both of rigid supports at room temperature and the temperature is raised by 75°C. Take E = 200GPa and $\alpha = 12x10^{-6}$/°C for steel. Area of cross sections of AC is 400mm^2 and of BC is 800mm^2.

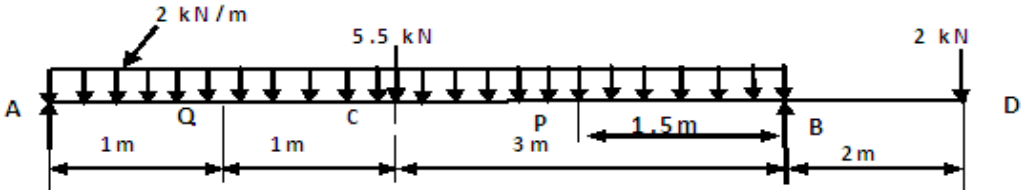


22. a) Draw the shear force and bending moment diagrams for the beam as shown in fig. 2. Clearly mark the position of the maximum bending moment and determine its value.



(OR)

b) Draw the shear force and bending moment diagrams for the loaded beam shown in fig 3.



23. a) A hollow circular shaft 20 mm thick transmits 294 kW at 200 r.p.m. Determine the diameters of the shaft if shear strain due to torsion is not to exceed 8.6×10^{-4}. Take modulus of rigidity as 80 GN/ m^2

(OR)

b) A close-coiled helical spring has stiffness of 10 N/mm. Its length when fully compressed with adjacent coils touching each other is 400 mm. The modulus of

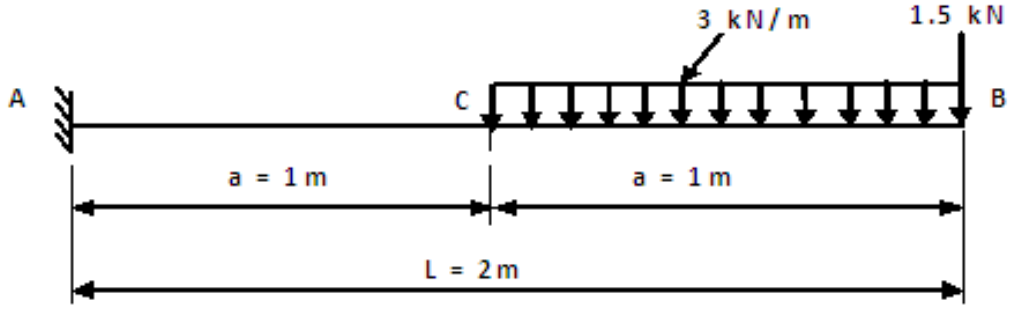
rigidity of material of the spring = 80000 N/ mm^2

(i) Determine the wire diameter and mean coil diameter, if their ratio is 1/10.

(ii) If gap between any two adjacent coils is 2mm, what maximum load can be applied before the spring becomes solid i.e., adjacent coils touch.

(iii) What is the corresponding maximum shear stress in the spring?

24. a) A 2 meters long cantilever of rectangular section 150 mm wide and 300 mm deep is loaded as shown in fig 4. Calculate the deflection at free end. Take, E = 10.5 GN/m^2.



(OR)

b) A cantilever 150 mm wide and 200 mm deep projects 2m out of a wall, and is carrying a point load of 40 kN at the free end. Determine the slope and deflection of the cantilever at the free end. Take, E = $2.1x10^5$ MN/m^2.

25. a) A material is subjected to two mutually perpendicular linear strains together with a shear strain. One of the linear strains is 0.00025 tensile. Determine the magnitudes of the other linear strain and shear strain if the principal strains are 0.0001 compressive and 0.0003 tensile.

(OR)

b) A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50cm and 25cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 MN/m^2. Also calculate the increase in length, diameter and volume of the vessel. Take E = 200 GN/m^2 and 1/m = 0.3.

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