**Printed Pages: 03** **Sub Code: KME-502**

**Paper Id:** 232012 **Roll No.** | | | | | | | | | | |

**B.TECH**
**(SEM V) THEORY EXAMINATION 2022-23**
**STRENGTH OF MATERIALS**

***Time: 3 Hours*** ***Total Marks: 100***

**Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

**1. Attempt *all* questions in brief. 2 x 10 = 20**

a. What is Hook's law? Explain.
b. What are thermal stress and thermal strain?
c. What is spring? What are different types of spring?
d. Differentiate between thin and thick shells
e. Using Area-moment method find the maximum deflection and slope for a simply supported beam with a uniform distributed load "w" on it.
f. What are principal stresses and principal planes?
g. Explain Castigiliano's theorem.
h. Explain are shear Centre.
i. Differentiate between open coiled and closed coiled helical spring.
j. Explain:
   (i) Section Modulus
   (ii) Slenderness Ratio

**SECTION B**

**2. Attempt any *three* of the following: 10 x 3 = 30**

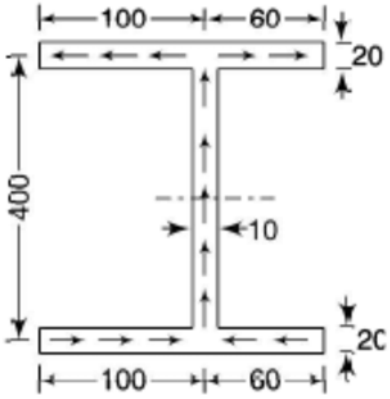
a. A tensile load of 60KN is gradually applied to a circular bar of 4 cm diameter of 5 m long. If the value of E = 2 x 105 N/mm$^2$. Determine:
   (i) Stretch in the rod
   (ii) Stress in the rod
   (iii) Strain energy absorbed
   If tensile load of 60 KN is applied suddenly. Determine
   (iv) Maximum instantaneous stress is induced
   (v) Instantaneous elongation in the rod
   (vi) Strain energy absorbed in the rod

b. A compound cylinder is formed by shrinking one tube to another, the inside and outside diameters of the outer tube being 120 mm and 180 mm respectively and of the inner tube being 60 mm and 120 mm respectively. After shrinking, the radial pressure at the common surface is subjected to an internal pressure of 80 MPa; determine the final stresses set up at various surfaces of the cylinder. What is the resultant radial pressure at the common surface?

c. Compare hollow shaft and solid shaft.
   (i) On the basis of Strength.
   (ii) On the basis of weight.

d. A 3.2 m long fixed end hollow cast iron column has its internal and external diameter as 60 mm and 80 mm respectively. Determine Rankine's crippling load using the value of crushing stress to be 500 MPa and the value of Rankine's constant 1/1600.

e. Locate the shear center for the given *I-channel section*.




## SECTION C

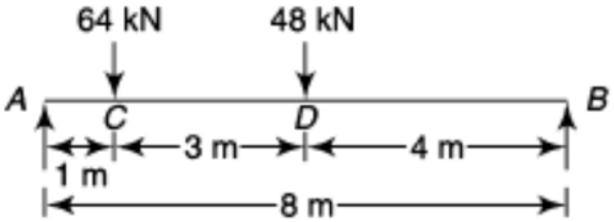
**3. Attempt any *one* part of the following: 10 x 1 = 10**

a. The stresses on two perpendicular planes through a point in a body are 30 MPa and 15 MPa both tensile along with a shear stress of 25 MPa. Find
   (i) The magnitude and direction of principal stresses
   (ii) The planes of maximum shear stress
   (iii) The normal and shear stresses on the planes of maximum shearing stress.

b. Principal stresses at a point in an elastic material are 100 MPa tensile and 25 MPa compressive. Determine the factor of safety against failure based on ***five*** various theories. The elastic limit in simple tension is 220 MPa and Poission's ration 0.3

**4. Attempt any *one* part of the following: 10 x 1 = 10**

a. A simply supported beam of 8-m length carries two point loads of 64 KN and 48 KN at 1m and 4 m respectively from the left hand end. Find the deflection under each load and the maximum deflection. Take E=210 GPa and I = 180 X $10^6$ $mm^4$.




b. Two wooden planks 150 x50 mm each are connected to form a T- section of a beam. If a moment of 3.4 KNm is applied around the horizontal neutral axis, inducing tension below the neutral axis. Find the stresses at the extreme fiber of the cross section. Also analyze the total tensile force on the cross-section

**5. Attempt any *one* part of the following: 10 x 1 = 10**

a. Derive an expression for axial elongation and maximum shear stress for a closed coiled helical spring, taking all the necessary assumption in to account. Also discuss Wahl's correction factor.

b. A leaf spring of semi-elliptical type having 8 plates is 1 m long. The metallic plates have a proof stress in bending of 600 MPa. Each plate is 60mm wide and 12 mm thick. Find the initial radius of the plates. Also find the height from which a load of 400 N may fall on the centre of the spring if the

maximum stress so produced is one half of the proof stress. Take E= 204 GPa.

**6. Attempt any *one* part of the following: 10 x 1 = 10**

a. Derive Lame' Equation for thick cylindrical shell (with neat sketch). Also write assumptions in deriving the equation.

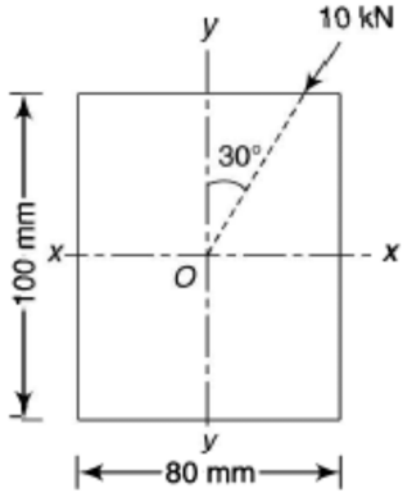
b. For thin cylindrical shell. Derive a relation for:

(i) Stresses (Circumferential stress, Longitudinal stress, Radial stress)

(ii) Strain (Circumferential strain, longitudinal strain, and volumetric strain)

**7. Attempt any *one* part of the following: 10 x 1 = 10**

a. A 4 meter long simply supported beam of 80 mm width and 100 mm depth carries a load of 10KN at the midspan. The load is inclined at $30^0$ to the vertical longitudinal plane and the line of action of the load passes through the centroid of the rectangular section of the beam. Determine the stresses at all the corners of the section.




b. A curved bar of rectangular section of 30mm width, 40mmdepth and mean radius of curvature of 30 mm is initially unstressed. If a bending moment of 400Nm is applied to the bar which tends to straighten it, determine the stresses at the inner and outer surfaces and sketch a diagram to show the variation of stresses across the section. Also find the location of neutral axis.