4. A boiler drum consists of a cylinder 2 m long, 1 m diameter and 25 mm thick closed by hemispherical ends. In a hydraulic test 10 N/mm², how much additional water will be pumped in after initial filling at atmospheric pressure ?

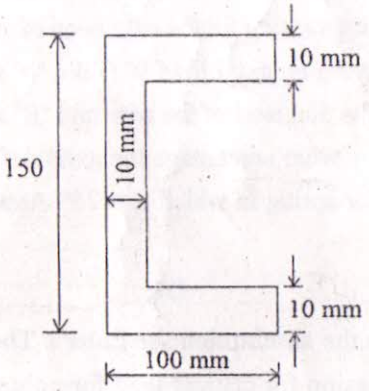
Assume the circumferential strain at junction of cylinder and hemisphere is same for both drum material.

$E = 207000$ N/mm², $\mu = 0.3$, $W = 2100$ N/mm².

OR

A compound cylinder is to be made by shrinking one tube onto another so that the radial compressive stress at the junction is 28.5 N/mm². If the outside diameter is 26.5 cm and the bore 12.5 cm, calculate the allowance for shrinkage at common diameter which is 20 cm. $E = 210000$ N/mm².

5. Locate the shear centre with sketch for the section as shown below :



OR

Derive the equation to find the position of neutral axis for the following cross-section of curved beam :

(i) Rectangular X-section

(ii) Circular X-section.

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1263 Roll No.

B. Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2013-14

STRENGTH OF MATERIALS AND MACHINE DRAWING—I

Time : 3 Hours *Total Marks : 100*

SECTION—A

Attempt all questions :

1. (i) Define principal plane and principal stress.

(ii) Explain complementary shear stress.

(iii) Draw the Mohr's circle for pure shear.

(iv) Define neutral axis.

(v) What do you understand by section modulus ?

(vi) Explain point of contraflexure in a beam.

(vii) What do you understand by effective length of the column ?

(viii) Explain Torsional stiffness and Torsional flexibility.

(ix) Differentiate between thin cylinder and thick cylinder.

(x) Define shear centre.

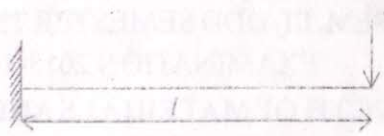
SECTION—B

Attempt any three questions :

1. Derive an expression for deformation of conical bar hung to a ceiling having diameter 'D' and height 'L', weight density of bar ρ and Young's modulus is E.

2. (a) Write the assumption for pure bending and also derive the bending equation.

(b) Find the deflection of cantilever of l at free end by Area Moment Method.



3. What are leaf spring ? Find maximum deflection and maximum bending stress in semielliptical type leaf spring.

4. Write the assumptions for Lami's equation and also derive the expression for Lami's equation.

5. What do you understand by unsymmetrical bending ? Prove that the sum of moment of inertia about any rectangular axis is constant.

SECTION—C

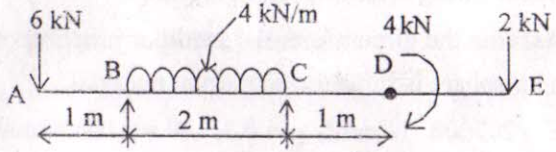
Attempt all questions :

1. Show that if E is assumed correct an error of 1% in the determination of G will involve an error of about 5% in the calculation of Poisson's ratio when its correct value is 0.25.

OR

A point in a strained material is subjected to a tensile stress 65 N/mm² and compressive stress of 45 N/mm², acting on two mutually perpendicular planes and shear stress of 10 N/mm² are acting on these planes. Find the normal stress, tangential stress and resultant stresses on a plane inclined 30° with the plane of compressive stress.

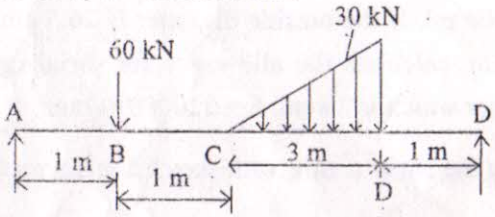
2. Draw the shear force and bending moment diagram for the beam given below.



OR

Find deflection at point B and C of beam given below.

E = 200 GPa, I = 19802.8 cm⁴.



3. Deduce an expression for the extension of an open coiled helical spring carrying an axial load W. Take 'α' as the inclination of coils, d as the diameter of the wire and 'R' as mass radius of the coil. Find by what percentage the axial deflection of the coil is neglected for spring in which $\alpha = 25°$. Assume n and R remain const.

OR

(i) Write the assumption for Euler's Theory and derive the expression for critical load for column having both end fixed.

(ii) A hollow C.I. column whose outside diameter is 200 mm has a thickness of 20 mm. It is 4.5 m long and is fixed at both end. Calculate the safe load of Rankine formula using F.O.S. 4. $\sigma_c = 550$ MPa, $\alpha = \frac{1}{1600}$.