Ref. No. Ex/Arch/CE/T/123/2022

B. ARCH. FIRST YEAR SECOND SEMESTER – 2022

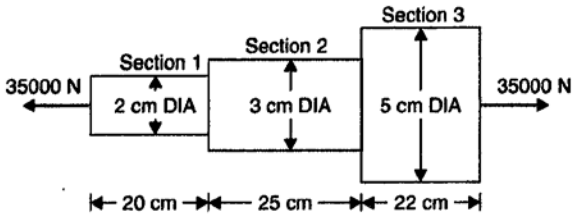
Sub: Structural Mechanics - II

Total Time: Three Hours | **Answer All Questions** | Full Marks: 100

1. (a) Distinguish between the following, giving due explanation: (10)
(i) Stress and strain, (ii) Pressure and stress, (iii) Tensile stress and compressive stress, and
(iv) Normal stress and shear stress,

(b) A bar of length L and uniformly tapering from a diameter D_1 at one end to a diameter D_2 at the other end is subjected to an axial tensile load P. If E is Young's modulus of the bar. Prove that the total extension of the bar under load P is $\frac{4PL}{\pi E D_1 D_2}$ (10)

(c) An axial pull of 35000 N is acting on a bar consisting of three lengths as shown in figure. If the Young's modulus = 2.1×10^5 N/mm^2, determine: (10)
(i) stresses in each section and
(ii) total extension of the bar

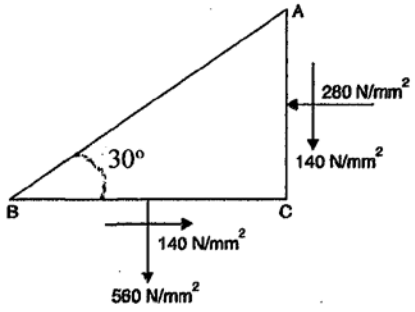


2. (a) (i) Define Poisson's ratio and Bulk Modulus. (10)
(ii) Derive the relationship between Young's Modulus and Bulk Modulus.

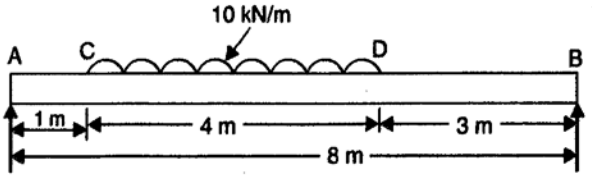
(b) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Calculate: (10)
(i) Lateral strain, (ii) Young's modulus, (iii) Poisson's ratio, and (iv) Bulk modulus

3. (a) Write short note on (10)
(i) Principal planes, (ii) Principal stresses, (ii) Mohr's circle, and (iv) Plane of maximum shear

(b) At a point in a strained material, on plane BC there are normal and shear stresses of 560 N/mm^2 and 140 N/mm^2 respectively. On plane AC, which is perpendicular to plane BC, there are normal and shear stresses of 280 N/mm^2 and 140 N/mm^2 respectively as shown in figure. If angle ABC is 30°. Determine the followings: (20)
(i) shear stress and normal stress on plane AB,
(ii) principal stresses and location of the planes on which they act,
(iii) maximum shear stress and the plane on which it acts.



4. (a) Draw the shear force and bending moment diagrams for a simply supported beam of length 8 m and carrying a uniformly distributed load of 10 kN/m for a distance of 4 m as shown in figure. (10)



(b) Prove that: $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$; where M = Bending moment, I = Moment of inertia, σ = Bending stress, y = Distance from neutral axis, E = Young's modulus, and R = Radius of curvature. (10)