1. A rigid bar ABCD is pinned at point B and supported by two springs at A and D. The springs at A and D have stiffness $k_1 = 15$ KN/m and $k_2 = 35$ KN/m, respectively. A load P acts at point C. If the angle of rotation of the bar due to the action of the load P is limited to $2°$, what is the maximum permissible load $P_{max}$? (20%)
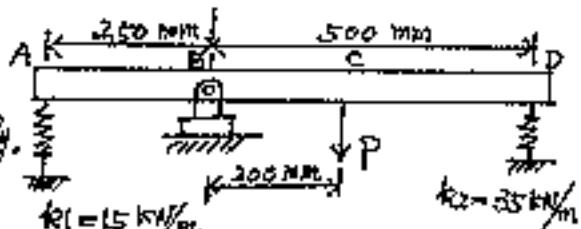


2. A box beam of wood is constructed of two 250 mm×40mm boards and two 250 mm×25 mm boards. The boards are nailed at a longitudinal spacing $s = 100$ mm. If each nail has an allowable shear force $F = 750$ N, what is the maximum allowable shear force $V_{max}$? (20%)
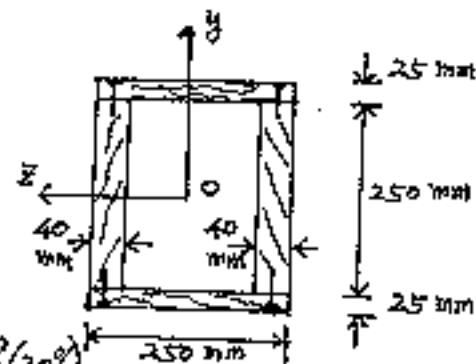


3. An overhanging beam ABC of rectangular cross section (b×h) supported a concentrated load P at the free end (see figure). Knowing that the maximum tensile stress (principal stress) at point D is $\sigma_T = 490$ MPa, determine the maximum magnitude of the load P. Data for the beam are as follows $L = 1.25$ m, $b = 25$ mm, $h = 150$ mm, and $d = 25$ mm. (20%)
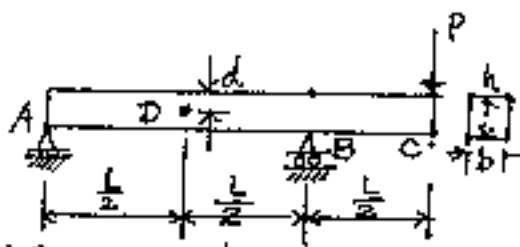


4. Derive the equation of the deflection curve for a simple beam AB loaded by a couple $M_0$ at the left-hand support. Also, determine the maximum deflection $\delta_{max}$. (20%)
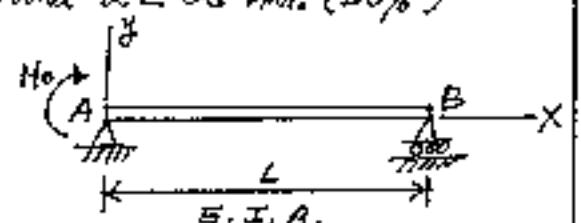


5. A slender bar AB with pinned ends and length L is held between immovable supports. what increase $\Delta T$ in the temperature of the bar will produce buckling at the Euler load? material property: Elastic modulus E, coefficient of thermal expansion $\alpha$. (20%)