國　立　清　華　大　學　命　題　紙

98 學年度工程與系統科學系乙組碩士班入學考試

科目工程力學(含靜力學、材料力學) 科目代碼 2705 共 3 頁第 1 頁 *請在【答案卷卡】內作答

1. A circular sea wall is made of concrete. (20%)

(1) Determine the total weight of the wall if the concrete has a specific weight of $\gamma_c = 24 \frac{\text{kN}}{\text{m}^3}$

(2) Determine the magnitude of the resultant hydrostatic force acting on this sea wall

Given:

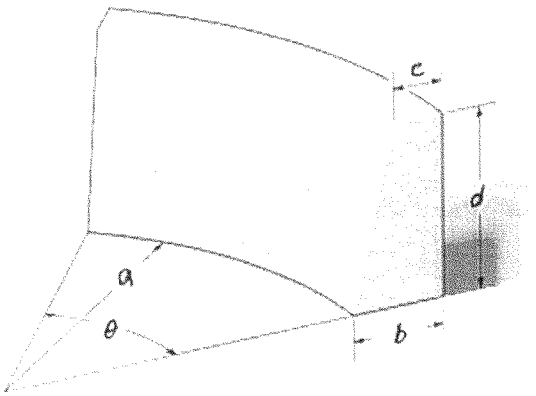
$a = 20$ m

$b = 5$ m

$c = 2.5$ m

$d = 10$ m

$\theta = 50$ deg



2. The *double-collar bearing* is subjected to an axial force **P**. Assuming that collar *A* supports *kP* and collar *B* supports (1–*k*)*P*, both with a uniform distribution of pressure, determine the maximum frictional moment *M* that may be resisted by the bearing. (20%)

Given:

$P = 4$ kN

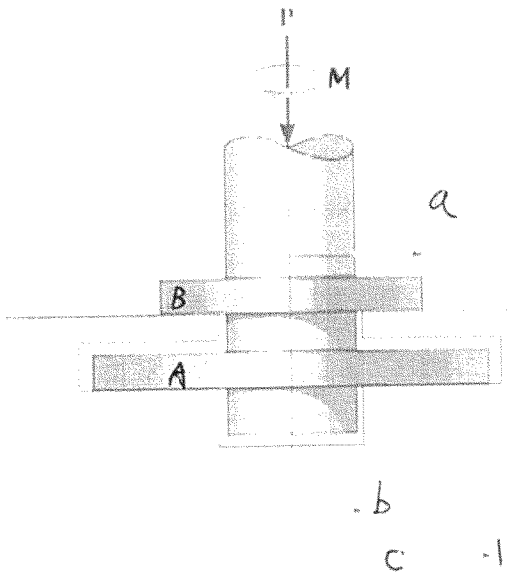
$a = 20$ mm

$b = 10$ mm

$c = 30$ mm

$\mu_s = 0.2$

$k = 0.75$



3. The cable is subjected to the parabolic loading $w = w_0\left(1-\left[\frac{2x}{a}\right]^2\right)$. Determine the equation $y = f(x)$ which defines the cable shape AB and the maximum tension in the cable. (20%)

Units used:

$\underset{\sim}{\text{kN}} = 10^3$ N

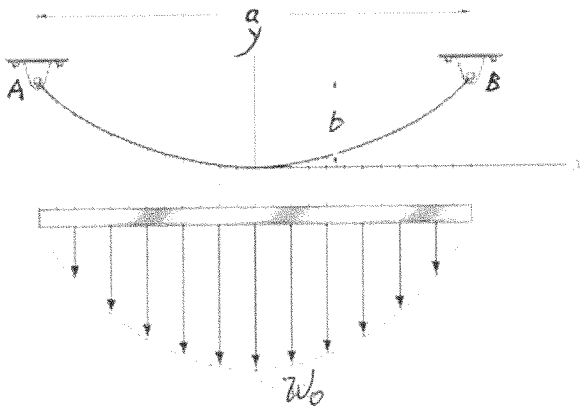
Given:

$w = w_0\left[1-\left(\frac{2x}{a}\right)^2\right]$

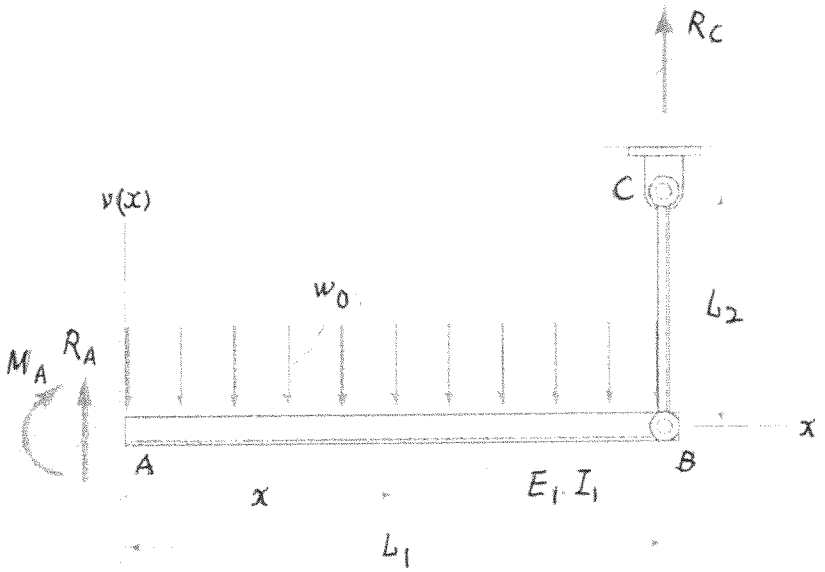
$a = 30$ m

$w_0 = 2.5\ \frac{\text{kN}}{\text{m}}$

$b = 6$ m



4. At end B, the cantilever beam is pinned to a uniform rod whose cross-section area is A_2, whose length is L_2, and whose modulus of elasticity is E_2. The beam supports a uniformly distributed load of intensity w_0; its flexural rigidity is E_1I_1, and its length is L_1. (a) Use the second-order integration method to determine the reactions R_A and M_A at A, and the tension, F_2, in the rod. (b) Determine an expression for the deflection curve, $v(x)$, of the beam. (20%)



5. The state of plane stress at a point can be described by a known tensile stress σ_x = 70 MPa, an unknown tensile stress σ, and an unknown shear stress τ, as indicated in the figure. At this point the maximum in-plane shear stress is 78 MPa, and one of the two in-plane principal stresses is 22 MPa(T). Determine the values of the two unknown stresses, labeled σ and τ on the figure, and determine the second in-plane principal stress. The stresses act in the directions shown, that is, $\sigma_y = \sigma$ and $\tau_{xy} = -\tau$. (20%)