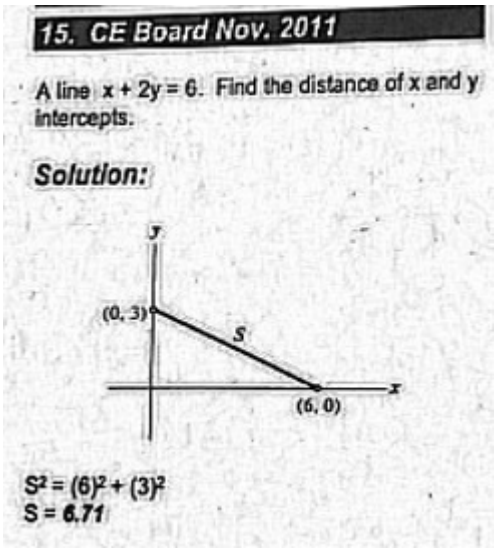
CE Habagat Cup 2020 Questions

Eliminations

Q1: A line x + 2y = 0. Find the distance of x and y intercepts.

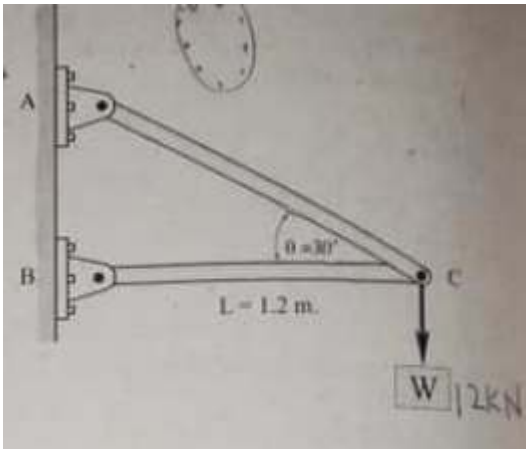
SOLUTION:



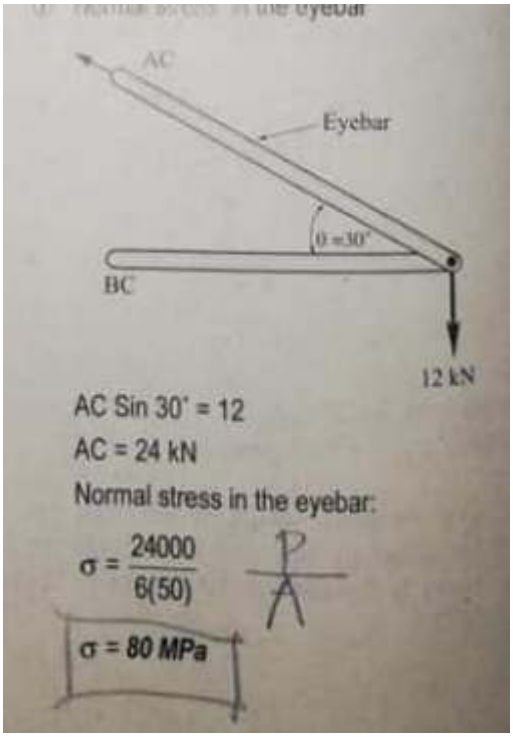
Q2: A weight W is supported by an eyebar AC and horizontal strut BC. The eyebar and the strut are pin connected at all joints. Their cross-sectional dimensions are 6 x 50 mm and their modulus of elasticity is 200 GPa.

Given: L = 1.2 n , ∅ = 30° W = 12 kN

Calculate the normal stress in the eyebar.

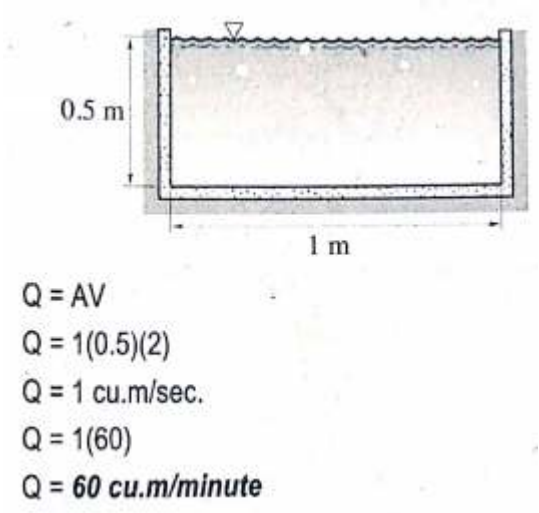


SOLUTION:



Q3: Water flows through a rectangular irrigation canal, 500 mm deep by 1 m wide, with a mean velocity of 2 m/s. Determine the rate of flow in cubic meter per minute.

SOLUTION:



KNOCKOUTS ROUND

R16-1 (Four Brackets)

The average number of degrees in the angles of a convex polygon is 150. How many sides does it have?

SOLUTION:

360/(180-150) = 12

R16-2 (Four Brackets)

The number of sides in a polygon is 20. Find the number of diagonals in this polygon.

SOLUTION:

20(20-3)/2 = 170

Quarterfinals Question:

A soil sample has a unit weight of 1.9 gm/cc and a water content of l2%.If the specific gravity of solids be 2.65, determine the dry density.

SOLUTION:

The value of γ_d can be determined from :

$$\gamma_d = \frac{\gamma}{1 + w}$$

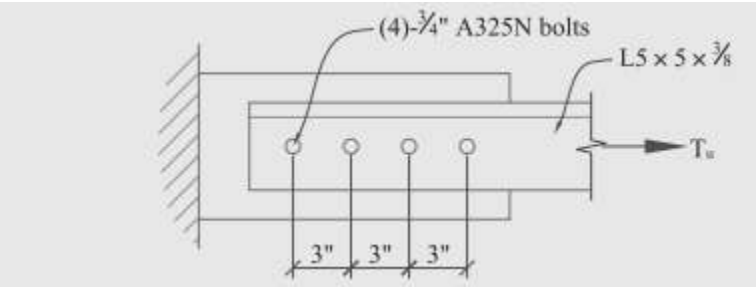
Here, γ = unit weight of the soil = 1.9 gm/cc

w = water content = 12% = 0.12

$$\therefore \quad \gamma_d = \frac{1.9}{1 + 0.12} = 1.696 \text{ gm/cc}$$

Semifinals Question:

For the bolted tension member shown, determine the effective area Ae using NSCP 2015. (Nearest answer will advance to finals)



SOLUTION:

$$U = 1 - \frac{\bar{x}}{\ell}$$
$$= 1 - \frac{1.37 \text{ in.}}{9 \text{ in.}} = 0.848$$

Alternatively, $U = 0.80$ from Table 4-1. The larger value of $U = 0.848$ can be used.

Net Area of the Angle:

$$A_n = A_g - A_{\text{holes}}$$
$$= (3.61) - \left(\frac{3}{4} + \frac{1}{8}\right)(0.375) = 3.28 \text{ in.}^2$$

Effective Area:

$$A_e = A_n U$$
$$= (3.28)(0.848) = 2.78 \text{ in.}^2$$

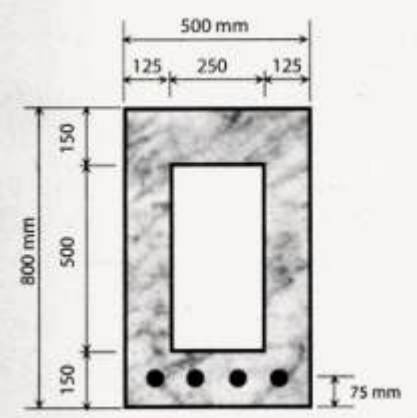
Battle for 3rd Question:

According to NBC Code , this such as reviewing stands and other miscellaneous structures conforming to the requirements of this Code, and sheds, canopies and fences used for the protection of the public around and in conjunction with construction work, may be erected in the fire zones by special permit from the Building Official for a limited period of time, and such buildings or structures shall be-completely removed upon the expiration of the time limit stated in such permits. What is referring to?

ANSWER: Temporary Buildings

CHAMPIONSHIP BEST OF 7

Q1: A hollow beam is shown in the Figure. Assume f'c = 28 MPa and fy = 345 MPa. Calculate the required tension area when Mu = 800 kN m.



SOLUTION:

$d = 800 - 75 = 725$ mm

$\phi M_n = \phi C_c (d - a/2)$ $\quad \phi M_n = 0.90 \times 0.85(28)(150)(500)(725 - 150/2)$

$\phi M_n = 1044.225$ kN-m

a) $M_u = 800$ kN-m

Since the required $M_u = 800$ kN-m < 1044.225 kN-m, a < 150 mm.

Assuming tension steel yields:

$M_u = \phi M_n$ $\quad M_u = \phi C_c (d - a/2)$

$M_u = \phi\, 0.85 f'_c\, a\, b\, (d - a/2)$

$800 \times 10^6 = 0.90 \times 0.85(28)\, a\, (500)](725 - 0.5a)$

$a = 111.6$ mm < 150 mm

Check if steel yields:

$f_s = 600 \dfrac{d-c}{c}$ where $c = a/\beta_1 = 131.3$ mm

$f_s = 600 \dfrac{725-131.2}{131.3} = 2{,}712$ MPa > f_y steel yields

$T = C_c$ $\quad A_s f_y = 0.85 f'_c\, a\, b$

$A_s(345) = 0.85(28)(111.6)(500)$

$A_s = \mathbf{3{,}850\ mm^2}$

Q2: An equipment cost P 100000 and has a salvage value of 5% of its cost at the end of its life of 30000 operating hours in a period of 5 years. In the first year, it was used for 7,000 hours. If at the end of 2nd year, it was used for 8,000 hours, find the depreciation at the end of second year.

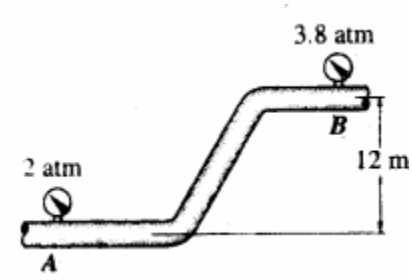
SOLUTION:

SV = 0.05(100000) = P 5,000

Annual dep/hr = (100000-5000)/30000 = 3.166667

Depreciation for second year = 3.166667(8000) = P 25,333.33

Q3: An 80 mm diameter pipe as shown contains glycerine (γ = 1258 kg/m^3) at 8.5 m^3/hr. Compute the head loss for these pressures. (Use gamma water = 9.807. and 1 atm = 101.400 kPa)



SOLUTION:

3. Headloss for these pressures.

$$\frac{V_B}{2g} + \frac{P_B}{\gamma_w} + Z_B = \frac{V_A^2}{2g} + \frac{P_A}{\gamma_w} + HL$$

$$\frac{(3.8)(101400)}{1258(9.807)} + 12 = \frac{2(101400)}{1258(9.807)} + HL$$

$$HL = \mathbf{26.79\ m}$$

Q4: A hockey puck on a frozen pond is given an initial speed of 20.0 m/s. If the puck always remains on the ice and slides 115 m before coming to rest, determine the coefficient of kinetic friction between the puck and ice.

SOLUTION:

$$(1) \qquad \sum F_x = -f_k = ma_x$$

$$(2) \qquad \sum F_y = n - mg = 0 \qquad (a_y = 0)$$

But $f_k = \mu_k n$, and from (2) we see that $n = mg$. Therefore, (1) becomes

$$-\mu_k n = -\mu_k mg = ma_x$$

$$a_x = -\mu_k g$$

The negative sign means the acceleration is to the left in Figure 5.20; because the velocity of the puck is to the right, this means that the puck is slowing down. The acceleration is independent of the mass of the puck and is constant because we assume that μ_k remains constant.

Because the acceleration is constant, we can use Equation 2.13, $v_{xf}^2 = v_{xi}^2 + 2a_x(x_f - x_i)$, with $x_i = 0$ and $v_f = 0$:

$$0 = v_{xi}^2 + 2a_x x_f = v_{xi}^2 - 2\mu_k g x_f$$

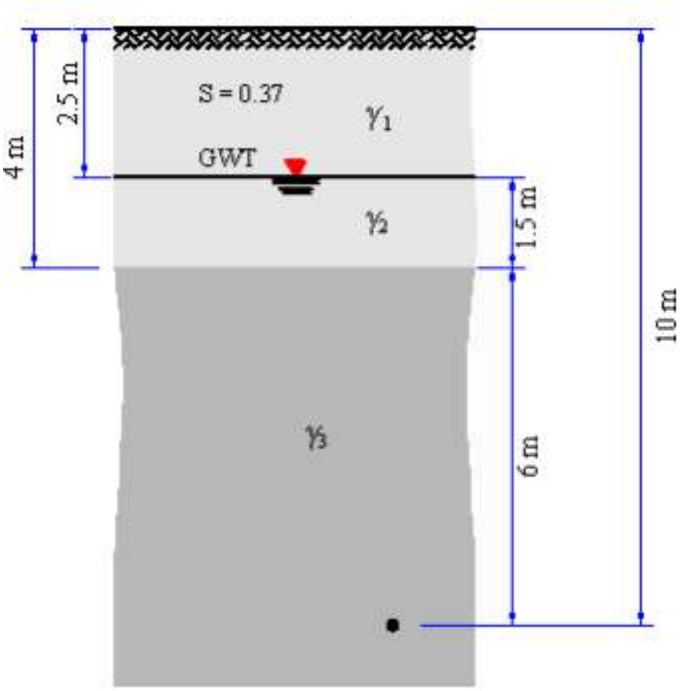
$$\mu_k = \frac{v_{xi}^2}{2gx_f}$$

$$\mu_k = \frac{(20.0\ \text{m/s})^2}{2(9.80\ \text{m/s}^2)(115\ \text{m})} = 0.117$$

Q5: This refers to prepare a plan/ map of a region which includes natural as well as and man-made features including elevation. What classification of surveying is this?

ANSWER: Topographic Surveys

Q6: A 4-meter thick sand layer is overlying a very thick dense clay layer. The water table is 2.5 m below the ground (sand) surface. The sand have void ratio of 52% and the degree of saturation above water table is 37%. The clay has moisture content of 42%. Assume specific gravity of solids for both sand and clay equal to 2.65. Determine the effective stress at 10 m depth from the ground surface.



SOLUTION:

Sand above water table :

$$\left[\gamma_1 = \frac{G + Se}{1+e}\gamma_w\right] \qquad \gamma_1 = \frac{2.65 + 0.37(0.52)}{1+0.52}(9.81)$$

$$\gamma_1 = 18.345\ kN/m^3$$

Sand below water table : (*saturated*)

$$\left[\gamma_1 = \frac{G + e}{1+e}\gamma_w\right] \qquad \gamma_2 = \frac{2.65 + 0.37(0.52)}{1+0.52}(9.81)$$

$$\gamma_2 = 20.46\ kN/m^3$$

Clay : $(saturated)$

$[GMC = Se]$ $\quad 2.65(0.42) = 1(e)$

$e = 1.113$

$\left[\gamma_3 = \frac{G+e}{1+e}\gamma_w\right]$ $\quad \gamma_3 = \frac{2.65+1.113}{1+1.113}(9.81)$

$\gamma_3 = 17.47\ kN/m^3$

Total stress, $p_T = \gamma_1(2.5) + \gamma_2(1.5) + \gamma_3(6) = 181.37\,kPa$

Neutral stress, $p_w = \gamma_w h_w = 9.81(7.5) = 73.575\,kPa$

Effective stress, $p_E = p_T - p_w = 107.8\,kPa$

Q7: These are solid grains or particles of uniform and controlled sizes in which are generally insoluble in the vehicle of the coating.

ANSWER: Pigments or Paint Pigments