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MUX02192

Q2)

$Q = ?$

$k = 1.7 \text{ W/mK}$

$u_h = 12 \text{ W/m}^2\text{K}$

$x = 200 \text{ mm} \rightarrow 0.20 \text{ m}$

$T_1 = 68^\circ\text{C} + 273 \text{ (341 K)}$

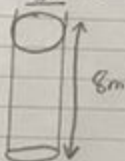
$T_2 = 15^\circ\text{C} + 273 \text{ (288 K)}$

A_{ext}

Q1	2	9
Q2	11	11
Q3	6	11
Q4	17	17

36 / 48

75%



$$5 - 0.2 = 4.8 \text{ m}$$

$$A = 8 \times 5 = 40 \text{ m}^2 \quad \pi d h.$$

$$\left(Q = \frac{-kA(T_2 - T_1)}{x} \right) \left(Q = \frac{-1.7 + 40(288 - 341)}{0.2} \right) \quad (1)$$

$$Q = 18020 \text{ W}$$

$$Q = 18.02 \text{ Kw}$$

x what about convection?

$$Q2) \quad \tau = 304 \text{ MPa} = 304 \times 10^6 \text{ N/m}^2$$

$$d = 0.012 \text{ m}$$

$$F = 165 \times 10^3 \text{ N}$$

$$\text{Area of 1 bolt} = \frac{\pi d^2}{4}$$

$$\left(\frac{\pi \times 0.012^2}{4} \right) = 1.13 \times 10^{-4} \text{ m}^2$$

$$\tau = \frac{F}{A} \leftarrow \text{Make subject}$$

$$\left(A = \frac{F}{\tau} \right) = \left(\frac{165 \times 10^3}{304 \times 10^6} \right) \quad A = 542.76 \times 10^{-6} \text{ m}^2$$

$$\text{Number of bolts} = \frac{542.76 \times 10^{-6}}{1.13 \times 10^{-4}}$$

$$\text{Number of bolts} = \frac{4.8}{= 5 \text{ bolts Total}}$$

yay!



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Q3)

$$\begin{aligned} G &= 78 \text{ GPa} > 78 \times 10^9 \text{ N/m}^2 \quad \checkmark \textcircled{6} \\ l &= 0.14 \text{ m} \\ T &= 10 \text{ Nm} \\ \theta &=? \quad \checkmark \textcircled{1} \end{aligned}$$

$$J = \frac{5\sqrt{3}}{8} \times 0.05^4 \quad 0.005. \quad \textcircled{1}$$

$$J = 6.77 \times 10^{-6} \text{ m}^4 \quad \text{Shame!}$$

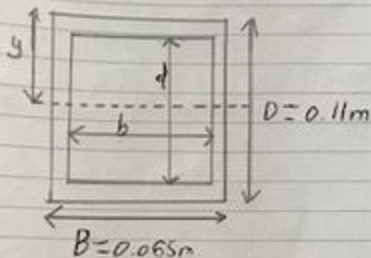
$$\left(\frac{T}{J} \right) = \frac{\gamma}{r} = \left(\frac{G\theta}{l} \right) \quad \textcircled{2}$$

$$\left(\frac{\sigma = T \times l}{J \times G} \right) \left(\theta = \frac{10 \times 0.14}{6.77 \times 10^{-6} \times 78 \times 10^9} \right) \quad \textcircled{1}$$

$$\sigma = \frac{2.65 \times 10^{-6}}{\text{radians}} \times \frac{360}{2\pi} = \text{Degrees}$$

x Carried error

Q4) $M = 6200 \text{ Nm}$
 $E = 2100 \text{ N/m}^2 \rightarrow 210 \times 10^9 \text{ N/m}^2$



$b = 0.04 \text{ m}$
 $d = 0.06 \text{ m}$
 $y = \frac{D-d}{2} = \frac{0.11-0.06}{2} = 0.025 \text{ m}$

$$I = \frac{BD^3}{12} - \frac{bd^3}{12} \left(\frac{0.065 \times 0.11^3}{12} - \frac{0.04 \times 0.06^3}{12} \right)$$

$I = 5.5 \times 10^{-6}$

$$\frac{M}{I} = \frac{\sigma}{y} \rightarrow \frac{E}{R}$$

Maximum stress $= \frac{M}{I} = \frac{\sigma}{y}$ ← Make subject

$$\left(\sigma = \frac{M \times y}{I} \right) \left(\frac{6200 \times 0.025}{5.5 \times 10^{-6}} \right)$$

$\sigma = 6.2 \times 10^6 \text{ N/m}^2$

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$$\frac{M'}{I'} = \frac{E'}{R}$$

← Make subject

$$\left(R = \frac{EI}{M} \right) \left(\frac{26 \times 10^9 \times 5.5 \times 10^{-6}}{600} \right)$$

$$\underline{R = 186.29 \text{ m}}$$



young!