

30/04/2020 - 11:00 am

Engineering Science - M4X02192

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Question 1

Surface area of a cylinder.

$d = 5m$

$A = (8 \times 5)m^2$

$Q = \frac{-KA(T_2 - T_1)}{x}$

$Q = ?$

$K = 1.7W/mK$

$x = 200mm = 200 \times 10^{-3} = 0.2m$

$h = 12W/m^2K$

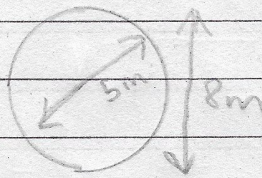
$T_1 = 68^\circ C$

$T_2 = 15^\circ C$

$H = 8m$

$u = ?$

$u = \frac{K}{x} = \frac{1.7}{0.2} = 8.5W/m^2K$



Q1	2	9
Q2	5.5	11
Q3	5	11
Q4	17	17
	29.5	48

$Q = \frac{-1.7 \times (8 \times 5) \times (15 - 68)}{0.2} = 18.02KW \times 10^3$

what about $Q = hA\Delta T$?

Question 2

$F = 165KN$

$T = 304MPa = 304 \times 10^6 N/m^2$

$d = 12mm = 12 \times 10^{-3} = 0.012m$

$A = ?$

$\tau = \frac{F}{A} \Rightarrow \frac{F}{\tau} = A$

$\frac{165}{304} = 0.5427m^2$

Area of 1 bolt = $\frac{\pi d^2}{4} = \frac{\pi \times 0.012^2}{4} = 1.2 \times 10^{-4}$

2.5

units?
Rounding?

$\frac{165}{304 \times 10^6} = \frac{5.43 \times 10^{-7}}{5.43 \times 10^{-7}} = 1$

Number of bolts needed

$\frac{1}{1.2 \times 10^{-4}} = 8.33 \times 10^3$ or 5 bolt's
4.525 $\times 10^3$ or 4.5 bolt's

Shame!

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Question 3

$$J = \frac{5\sqrt{3}}{8} \times 50^4 = 676.58 \text{ m}^4$$

$$T = 10 \text{ Nm}$$

$$L = 140 \text{ mm} \times 10^{-3} = 0.14 \text{ m}$$

$$\theta = ?$$

$$G = 78 \text{ GPa} \Rightarrow 78 \times 10^9 \text{ N/m}^2$$

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$$

$$\frac{TL}{JG} = \theta$$

$$\frac{10 \times 0.14}{876.85 \times 10^3 \times 78 \times 10^9} = 2.05 \times 10^{-17}$$

$$= 2.05 \times 10^{-17} \text{ radians}$$

$$2.05 \times 10^{-17} \times \frac{360}{2\pi} = 1.17 \times 10^{-15}$$

Shame!

Question 4

$$M = 6200 \text{ Nm}$$

$$E = 210 \text{ GN/m}^2 \Rightarrow 210 \times 10^9 \text{ N/m}^2$$

$$R = ?$$

$$\sigma = ?$$

$$y = \frac{D}{2} = \frac{0.11}{2} = 0.055 \text{ m}$$

$$D = 0.11 \text{ m}$$

$$B = 0.065 \text{ m}$$

$$b = 0.04 \text{ m}$$

$$D = 0.08 \text{ m}$$

$$I = \frac{(0.065 \times 0.11^3)}{12} - \frac{(0.04 \times 0.08^3)}{12}$$

$$I = 5.50 \times 10^{-6} \text{ m}^4$$

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

$$\frac{M}{I} \times \frac{\sigma}{y} = \sigma = \frac{My}{I} = \frac{6200 \times 0.055}{5.50 \times 10^{-6}} = 62 \times 10^6 \text{ N/m}^2$$

$$\frac{M}{I} = \frac{E}{R} \Rightarrow \frac{R}{I} = \frac{E}{M} \Rightarrow R = \frac{IE}{M} = \frac{5.50 \times 10^{-6} \times 210 \times 10^9}{6200}$$

$$= 186.29 \text{ m}$$

yay! Saved it!