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Question 1

$$D = 5m$$

$$H = 8m$$

$$h = 12 W/m^2K$$

$$k = 1.7 W/mK$$

$$T_2 = 68 + 273 = 341K$$

$$T_1 = 15 + 273 = 288K$$

$$\text{Thickness} = 200mm = 0.2m$$

$$Q = \frac{-kA(T_2 - T_1)}{x} = \frac{-1.7 \times (5 \times 8) (341 - 288)}{0.2} = 18.08 \times 10^3 W$$

$$Q = hA(T_2 - T_1)$$

(1)

Q1	1	9
Q2	4	11
Q3	11	11
Q4	17	17
	33	48

surface area of cylinder.

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Question 2.

Formulas

$$A = \frac{165 \times 10^3}{304 \times 10^{-6}} = 542.76 \times 10^{-6} \text{ m}^2$$

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

$$A = \frac{\pi d^2}{4}$$

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

$$A = \frac{\pi d^2}{4} \quad (1)$$

$$1. \quad 4A = \pi d^2$$

$$2. \quad \frac{4A}{\pi} = d^2 \Rightarrow d = \sqrt{\frac{4A}{\pi}}$$

You were given the diameter.

$$d = \sqrt{\frac{4(542.76 \times 10^{-6})}{\pi}} = 26.28 \times 10^{-3} \text{ m}$$

$$\therefore \text{No of bolts} = \frac{d}{12 \times 10^{-3}} = \frac{26.28 \times 10^{-3}}{12 \times 10^{-3}}$$

x.

Shame!

$$= 2.19$$

$$\therefore = \underline{\underline{2 \text{ bolts}}}$$

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Question 3-

Formulas

$$\frac{T^2}{JG} = \frac{T}{r} = \frac{G\theta^2}{L}$$

$$G = 78 \times 10^9 \text{ Pa}$$

$$S = 5 \text{ mm} = 5 \times 10^{-3}$$

$$L = 140 \text{ mm} = 0.14$$

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

$$J = 5 \sqrt{\frac{3}{8}} \times 0.005^4 = 6.77 \times 10^{-10} \text{ m}^4$$

$$\theta = \frac{TL}{JG} = \frac{10 \times 0.14}{6.77 \times 10^{-10} \times 78 \times 10^9} = \frac{26.51}{6.77 \times 10^{-10} \times 78 \times 10^9} = 26.51 \times 10^{-3}$$

$$26.51 \times 10^{-3} \times \frac{360}{2\pi} = 1.52^\circ$$

Yay! ✓

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Question 4.

Formulas

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

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

$$E = 210 \times 10^9$$

$$y = \frac{D}{2} = \frac{110 \times 10^{-3}}{2} = 0.055 \text{ m} \checkmark$$

$$B = 65 \text{ mm} - 0.065 \text{ m}$$

$$D = 110 \text{ mm} - 0.11 \text{ m}$$

$$b = 40 \text{ mm} - 0.04 \text{ m}$$

$$d = 80 \text{ mm} - 0.08 \text{ m}$$

$$I = \frac{BD^3}{12} - \frac{bd^3}{12}$$

$$I = \frac{0.065 \times 0.11^3}{12} - \frac{0.04 \times 0.08^3}{12} = 5.5 \times 10^{-6} \text{ m}^4 \checkmark$$

$$R = \frac{EI}{M} \Rightarrow \frac{210 \times 10^9 \times 5.5 \times 10^{-6}}{6200} = 186.29 \text{ m} \checkmark$$

$$\sigma = \frac{Ey}{R} \Rightarrow \frac{210 \times 10^9 \times 0.055}{186.29} = 62 \times 10^6 \text{ N/m}^2 \checkmark$$

yay! $\checkmark$