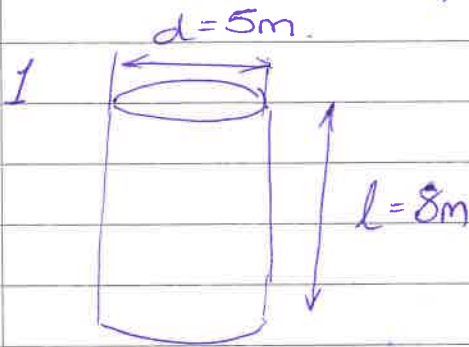


MAX 02192 HND/BSc Engineering Science Test 2.



$$\begin{aligned} \text{Surface Area} &= \pi d l \quad (1) \\ &= \pi \times 5 \times 8 \quad (1) \\ &= 125.66 m^2 \quad (1) \end{aligned}$$

$$Q = \frac{-kA(T_2 - T_1)}{x} + hA(T_2 - T_1) \quad (1)$$

$$Q = \left[\frac{-1.7 \times 125.66 (15 - 68)}{0.2} \right] + \left[12 \times 125.66 (68 - 15) \right] \quad (1)$$

$$Q = 136529.59 N \quad (1)$$

$$Q = 136.53 kW \quad (1)$$

2. $d = 12mm = 0.012m \quad (1)$

$$\tau = 304 \times 10^6 Pa \quad (1)$$

$$F = 165 \times 10^3 N \quad (1)$$

$$\tau = \frac{F}{A} \therefore A = \frac{F}{\tau} = \frac{165 \times 10^3}{304 \times 10^6} \quad (1)$$

$$A = 5.43 \times 10^{-4} m^2 \quad (1)$$

$$\text{Area of 1 bolt} = \frac{\pi d^2}{4} = \frac{\pi \times 0.012^2}{4} = 1.13 \times 10^{-4} m^2 \quad (1)$$

$$N^o \text{ of bolts} = \frac{5.43 \times 10^{-4}}{1.13 \times 10^{-4}} = 4.8 \dots 5 \text{ bolts} \quad (1)$$

$$3. \quad G = 78 \times 10^9 \text{ Pa} \quad J = \frac{5\sqrt{3}}{8} \cdot 0.005^4$$

$$l = 0.14 \text{ m} \quad T = 10 \text{ Nm}$$

$$J = 6.77 \times 10^{-10} \text{ m}^4$$

$$\frac{I}{J} = \frac{\tau}{r} = \frac{G\theta}{l} \quad \therefore \theta = \frac{Tl}{JG}$$

$$\theta = \frac{10 \times 0.14}{(6.77 \times 10^{-10} \times 78 \times 10^9)} = 0.03 \text{ radians.}$$

$$\theta = 0.03 \times \frac{360}{2\pi} = 1.52^\circ$$

$$4. \quad I = \frac{BD^3}{12} - \frac{bd^3}{12} = \left[\frac{0.065 \times 0.11^3}{12} \right] - \left[\frac{0.04 \times 0.08^3}{12} \right]$$

$$I = 5.5 \times 10^{-6} \text{ m}^4$$

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

$$\frac{M}{I} = \frac{\sigma}{y} \quad \therefore \sigma = \frac{My}{I} = \frac{6200 \times 0.055}{5.5 \times 10^{-6}} = 6.2 \times 10^6 \text{ N/m}^2$$

$$\frac{M}{I} = \frac{E}{R} \quad \therefore R = \frac{EI}{M} = \frac{210 \times 10^9 \times 5.5 \times 10^{-6}}{6200} = 186.29 \text{ m}$$