

Student Number: 1901219

Time: 11:00

Name: Danielle Leslie Haynes

Date: 30/04/20

Module code: MHX02192

1. $d = 5\text{m}$

$$T_1 = 68 + 273 = 341\text{K}$$

$$x = 200\text{mm} = 0.2\text{m} \quad T_2 = 15 + 273 = 288\text{K}$$

$$H = 8\text{m}$$

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

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

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

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

$$Q = \frac{-1.7 \times 157 \times (288 - 341)}{0.2}$$

$$Q = 70746.52$$

$$Q = 70.75 \times 10^3\text{ kW}$$

$$T_2 = 341\text{K}$$

$$T_1 = 288\text{K}$$

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

$$Q = 12 \times 157 \times (341 - 288)$$

$$Q = 99852$$

$$Q = 99.85\text{ kW}$$

~~30/04~~

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

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

$$d = 12 \text{ mm} = 0.012 \text{ m}$$

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

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

$$\text{No of bolts} = \frac{1.13 \times 10^{-4}}{542.76 \times 10^{-6}} = \frac{542.76 \times 10^{-6}}{1.13 \times 10^{-4}} = 4.8 = 5 \text{ bolts}$$

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

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

$$\theta = ?$$

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

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

$$J = \frac{\sqrt{3}}{8} \times S^4 = J = \frac{\sqrt{3}}{8} \times 0.005^4$$

$$J = 9.73 \times 10^{-11} \text{ m}^4$$

$$\frac{T}{J} = \frac{T}{r} = \frac{G\theta}{L} \rightarrow \frac{TL}{JG} = \theta$$

$$\theta = \frac{10 \times 0.14}{9.73 \times 10^{-11} \times 78 \times 10^9}$$

$$\theta = 184.47 \times 10^{-3} \text{ radians}$$

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

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

$$\sigma = ?$$

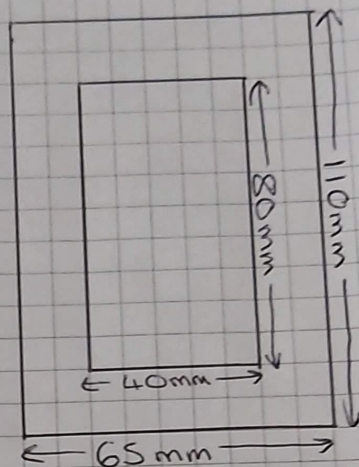
$$R = ?$$

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

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

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

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



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

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

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

$$\frac{My}{I} = \frac{6200 \times 0.055}{5.5 \times 10^{-6}} = \sigma = 62 \times 10^6 \text{ N/m}^2$$

$$\frac{M}{I} = \frac{\sigma^2}{y} = \frac{E}{R}$$

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