

Name William Wallace

1907566

Date 30/04/2020

Time 11am

Module ~~11~~ M4X02192

Engineering Science

i)

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

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

$$k = 1.7$$

$$A = 157.07$$

~~157~~

$$x = 200 \text{ mm}$$

$$\frac{\pi d^2}{4} = 19.63 \times 8 = 157.07$$

~~157.07~~

$$T_2 = 68 = 341 \text{ K}$$

$$T_1 = 15 = 288 \text{ K} \quad Q = \frac{-kA(T_2 - T_1)}{x}$$

$$Q = \frac{-1.7 \times 157.07 (68 - 15)}{0.2}$$

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

$$Q = 12 \times 157.07 (68 - 15)$$

$$Q = 99846.52 \text{ W}$$

$$= 99.84 \text{ kW}$$

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Module 44 x 02192 engineering Science

2)

$$\tau = 304 \times 10^6$$

$$F = 165 \text{ kN} = 165000 \text{ N}$$

$$D = 12 \text{ mm} = 0.012$$

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

$$A \times \tau = F$$

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

area of bolt

$$\frac{\pi \times 0.012^2}{4}$$

$$= 1.13 \times 10^{-4} \text{ m}^2$$

$$A = \frac{165000}{304 \times 10^6}$$

$$A = 5.42 \times 10^{-4} \text{ m}^2$$

$$\frac{5.42 \times 10^{-4}}{1.13 \times 10^{-4}} = 4.79$$

5 bolts needed

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Module M4x 02197 engineering Science

3)

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

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

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

$$J = \frac{5\sqrt{3}}{8} \times 0.05^4$$

$$J = 6.76 \times 10^{-10}$$

$$\frac{T \times l}{J} = \frac{G \theta}{1}$$

~~mm~~

$$\frac{\frac{T \times l}{J}}{G} = \theta$$

$$\frac{\frac{T \times l}{J}}{G} = \theta$$

$$\frac{10 \times 0.14}{6.76 \times 10^{-10}} \div (78 \times 10^9) = 0.026$$

$$\theta = 0.03^\circ \text{ radians}$$

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4)

$$M = 6200 \text{ N/m}$$

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

$$y = 11.2 \text{ mm} = 0.0112 \text{ m}$$

$$y = 0.055 \text{ m}$$

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

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

$$I = 2.77 \times 10^{-8} \text{ m}^4$$

$$\frac{M}{I} = \frac{F}{R}$$

$$\frac{R}{I} = \frac{F}{M}$$

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

$$R = \frac{2.77 \times 10^{-8} \times 210 \times 10^9}{6200} = 0.93$$

~~82938.22~~

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4)

$$R = 438.22 \times 10^{-3} \text{ m}$$

$$\frac{\mu}{I} = \frac{\sigma}{y}$$

$$\frac{\mu y}{I} = \sigma$$

$$\frac{6700 \times 0.055}{2.77 \times 10^{-8}} = 1.23 \times 10^{10} \text{ N/m}^2$$