Charlotte Stroud STR19849035 **52%**

Prifysgol Cymru
Y Drindod Dewi Sant
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LOCATION: SWANSEA **LLEOLIAD: ABERTAWE**

LEVEL 4 **LEFEL 4**

EXAMINATION PERIOD **CYFNOD ARHOLIADAU**
MAY 2020 **MAI 2020**

MODULE CODE: M4X00385
ENGINEERING SCIENCE 1

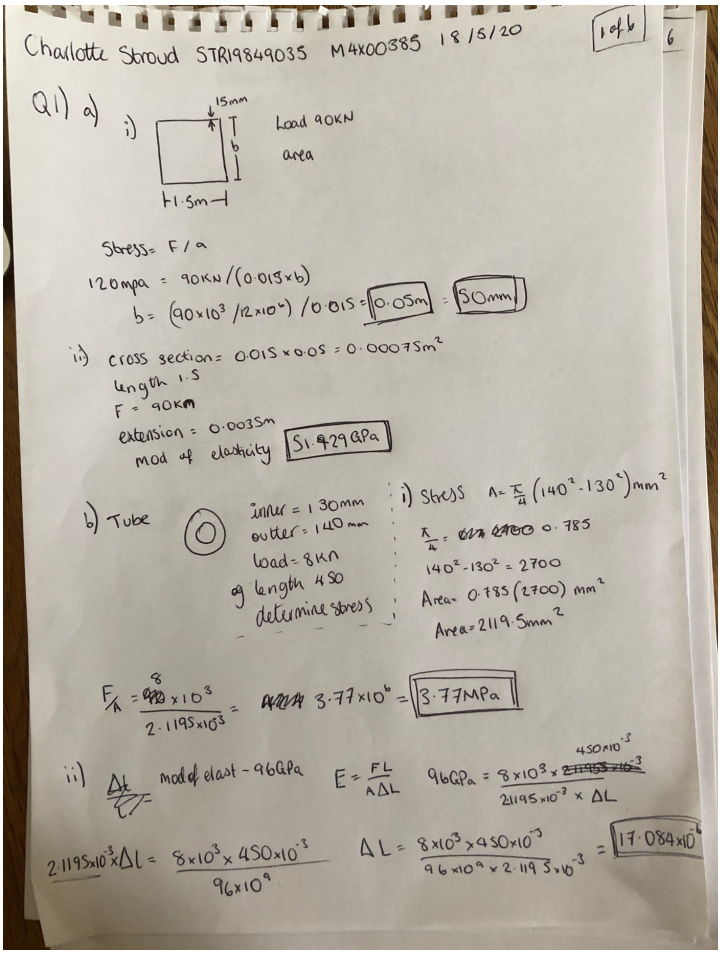
TIME: 2 HOURS

ANSWER ALL QUESTIONS IN SECTION

Equipment or materials required – Scientific Calculator + Formula Booklet

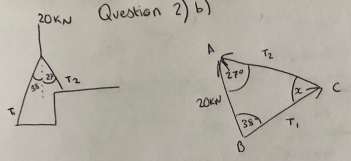
Adnoddau neu ddefnyddiau sydd eu hangen -Scientific Calculator + Formula Booklet

Charlie Stroud	Q1 [20]	Q2 [20] Did not answer part a	Q3 [20]	Q4 [15]	Q5 [25]
	ai. 5	a.i 0	0	a.5	a.i 4 no normal reaction
	ii. 5	ii. 0		b.5	ii. 2
	b.i. 5	iii. 0		c.5	iii. 5
	ii. 4 (no units)	b. 5			b.i 2
					ii. 0
					Total 52



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Question 2) b)



$x = 180 - 27 - 38$

$= 115°$

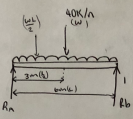
$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad \frac{T_1}{\sin 27°} = \frac{T_2}{\sin 38°} = \frac{20kN}{\sin 115°}$

$T_1 = \frac{20 \sin 27° kN}{\sin 115°} =$ **10KN**

$T_2 = \frac{20 \sin 38°}{\sin 115} =$ **13.59 kN**

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Q3



$WL = 2Ra$

$Ra = \frac{WL}{2}$

$FA = Ft$

$40 = 2R$

$R = 20KN$

$\hat{M}: R \times \frac{L}{2} - \frac{WL}{2} \times \frac{L}{4} = \frac{WL}{2} \times \frac{L}{2} - \frac{WL}{2} \times \frac{L}{4} = \frac{WL^2}{8}$

$\hat{M}: (20 \times 10^3) \times 3 - \frac{80 \times 10^3}{2} \times \frac{20 \times 3}{2} \times \frac{6}{4}$

$\hat{M}: 20 \times 10^3 \times 3 - 10.000 \times 30000 \times 1.5$ no

$1.5N \times 9.81$ (acc to grav)

$\hat{M} = 14.715 Nm$

Second moment of area

$I = \frac{BH^3}{12} - \frac{bh^3}{12} \left[\frac{0.1 \times 0.2^3}{12} - \frac{0.06 \times 0.16^3}{12}\right]$

$I = 4.619 \times 10^{-5} m^4$

$\hat{y} = \frac{0.2}{2} = 0.1m$

$\frac{\hat{\sigma}}{\hat{y}} = \frac{M}{I}$ $\quad \sigma = \frac{M\hat{y}}{I} = \frac{14.715 Nm \times 0.1}{4.619 \times 10^{-5}}$

Max stress = 31857544.92

= 31.858 mpa

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Q3

WL = 2Ra

Ra = WL/2

FA = Ft

40 = 2R

R = 20KN

$\hat{M}: R \times \frac{L}{2} - \frac{WL}{2} \times \frac{L}{4} = \frac{WL}{2} \times \frac{L}{2} - \frac{WL}{2} \times \frac{L}{4} = \frac{WL^2}{8}$

$\hat{M}: (20 \times 10^3) \times 3 - \frac{80 \times 10^3}{2} \times \frac{20 \times 3}{2} \times \frac{6}{4}$

$\hat{M}: 20 \times 10^3 \times 3 - 10.000 \times 30000 \times 1.5$ no

$1.5N \times 9.81$ (acc to grav)

$\hat{M} = 14.715 Nm$

Second moment of area

$I = \frac{BH^3}{12} - \frac{bh^3}{12} \left[\frac{0.1 \times 0.2^3}{12} - \frac{0.06 \times 0.16^3}{12}\right]$

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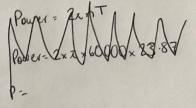
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Q4) a) Speed 1000 rev/m

$= 1000 \div 60$ rev/s

$= 16.6667$ rev/s

Torque = 23.87N



Power = $2\pi nT$

Power = $2\pi (16.6667) \times 23.87$

Power = 2499.67

Power = 2.5KW

b) HP → watts

$5 \times 745.7 = 3728.5$ watts

Power = $2\pi nT$

Speed = $\frac{P}{2\pi T}$

Torque = 14.5N/m

Speed - N: $\frac{3728.5}{2\pi (14.5)} = 40.92$ rev/s

rotation speed of motor = $40.92 \times 60 =$ 2455 rev/min

c) $\theta = \frac{\text{work done}}{\text{torque}}$ $\quad$ Work done = 10MJ = 10×10^6 J

Torque = 4KN/m = 4000NM

Angular displacement

$\theta = \frac{10 \times 10^6}{4000} = 2500$ rad $\quad$ 2π rad = 1 rev

$\frac{2500}{2\pi} =$ 397.89 revs

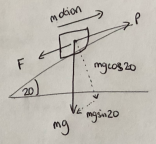
Question 5

a)

$g = 9.81 m/s^2$

mass = 30kg

$\mu = 0.3$



Forces ↑ = forces ↓

$30 \times 9.81 \cos 20 = N$

$N = 276.55N$

$F = \mu N$

$F = 0.3 \times 276.55$

$F = 82.965$

$F = P + mg\sin 20$

$P = F - mg\sin 20$

$P = 82.965 - (30 \times 9.81)\sin 20$

$P = -17.692N$

Question 5 b)

i) mass = 2ton = 2000kg $2000 \times 9.81 =$ 19620

$V_1 = 60KM/h = (60 \times 1000)/3600 = 16.666 m/s$

$V_2 = 25km/h (25 \times 1000)/3600 = 6.944 m/s$

Kinetic Energy = $(\frac{1}{2} \times 2000 \times 16.66^2) - (\frac{1}{2} \times 2000 \times 6.944^2)$

= 229336.5 Joules

ii) Force = w/T

if F=ma Acceleration = 2500/19620 = $0.127 m/s^2$

Work done = Time → 16.66 − 6.94 / 0.127 = 76.55 sec

Force = 229336.5/76.55 = 2998.9

= 2.996 KN

= 3KN (1dp)