

Exam 2

11/05/20

1) $N = 1800 \text{ RPM}$

$d_2 = 0.12$

$d_1 = 0.04$

$\mu = 0.45$

$\omega = 900 \text{ rad/s}$

Q1 | 9

Q2 | 10

Q3 | 0

Q4 | 4

Q5 | 0

23/50

46%

$$T = \frac{2}{3} \mu W \frac{(r_2^3 - r_1^3)}{(r_2^2 - r_1^2)}$$

i) $r_2 = d_2/2 = 0.06 \text{ m}$

$r_1 = d_1/2 = 0.02 \text{ m}$

$$T = \frac{2}{3} \mu W \frac{(r_2^3 - r_1^3)}{(r_2^2 - r_1^2)} = \frac{2}{3} \times 0.45 \times 900 \times \frac{(0.06^3 - 0.02^3)}{(0.06^2 - 0.02^2)}$$

$T = \cancel{28.08 \text{ Nm}} \quad 17.55 \text{ Nm}$

$$P = T \times \frac{2\pi\omega}{60}$$

$$P = 17.55 \times \frac{2\pi \times 1800}{60}$$

$$P = 3308.04 \text{ W}$$

ii) $\omega' = \omega - (x \times k \times n) = 900 - (1.55 \times 25 \times 6)$

$\omega' = 667.5 \text{ rad/s}$

 $\checkmark$ correct eqn.

$$T = 0.45 \times 667.5 \times \frac{(0.06 + 0.02)}{2}$$

$T = 12.015 \text{ Nm}$

9/10

... power? X

$$2) P = 5000 \text{ W}$$

$$N = 2500 \text{ RPM}$$

$$\mu = 0.4$$

$$F_1 = 250 \text{ N}$$

$$d = 0.13 \text{ m}$$

$$\theta = 128^\circ \times \frac{\pi}{180} = 2.23 \text{ rad/s}$$

$$i) F_1 + F_2 = \text{constant} \quad P = V(F_1 - F_2) \quad \frac{F_1}{F_2} = e^{\mu \theta}$$

$$V = \omega r = \frac{2\pi N}{60} \times \frac{d}{2} = \frac{2\pi \times 2500}{60} \times \frac{0.13}{2} = 17.01 \text{ m/s}$$

ii) When Stationary

$$F_1 = f$$

$$F_1 + F_2 = \text{constant}$$

$$F_2 = f$$

$$f + f = \text{constant}$$

$$250 + 250 = \text{constant}$$

$$\text{constant} = 500 \text{ N} = F_1 + F_2$$

When under power

$$F_1 = e^{\mu \theta} = e^{0.4 \times 2.23} = 2.4400$$

$$F_2$$

$$F_1 = 2.4400 \rightarrow F_1 = 2.4400 F_2$$

$$F_2$$

$$F_1 + F_2 = 500$$

$$2.4400 F_2 + F_2 = 500$$

$$3.4400 F_2 = 500$$

$$F_2 (2.4400 + 1) = 500$$

$$F_2 (3.4400) = 500$$

$$F_2 = \frac{500}{3.4400} = 145.34 \text{ N}$$

$$3.4400$$

$$F_1 = 2.4400 F_2$$

$$F_1 = 2.4400 \times 145.34$$

$$F_1 = 354.62 \text{ N}$$

$$354.62 \text{ N}$$

$$iii) P = V(F_1 - F_2) = 17.01 (354.62 - 145.34)$$

$$P = 3559.85 \text{ W}$$

iv) $n = \frac{\text{Total power}}{\text{power / belt}}$

$$n = 5000$$

$$3559.85$$

$$= 1.40$$

* requires 2 belts

Excellent!

10/10

$$4) I = \frac{B\omega}{\omega_m^2 \phi} \quad \phi = \frac{\omega_2 - \omega_1}{\omega_m} \quad \omega_m = \frac{\omega_1 + \omega_2}{2}$$

$$I = mk^2 \quad I = \frac{mr^2}{2}$$

$$i) N_2 = 2500 \text{ RPM}$$

$$N_1 = 2400 \text{ RPM}$$

$$\omega_2 = \frac{2\pi N_2}{60} = \frac{2\pi \cdot 2500}{60} = 261.79 \text{ rad/s}$$

$$\omega_1 = \frac{2\pi N_1}{60} = \frac{2\pi \cdot 2400}{60} = 251.32 \text{ rad/s}$$

$$\omega_m = \frac{\omega_1 + \omega_2}{2} = \frac{251.32 + 261.79}{2}$$

$$\omega_m = 256.55 \text{ rad/s}$$

$$\phi = \frac{\omega_2 - \omega_1}{\omega_m} = \frac{261.79 - 251.32}{256.55} = 0.0408$$

ii)	Energy	EA
A	EA	EA
B	EA + 526j	EA + 526 Max
C	EA + 526 - 205	EA + 321
D	EA + 526 - 205 + 45	EA + 366
E	EA + 526 - 205 + 45 - 185	EA + 181
F	EA + 526 - 205 + 45 - 185 + 48	EA + 229
G	EA + 526 - 205 + 45 - 185 + 48 - 197	EA + 32
H	EA + 526 - 205 + 45 - 185 + 48 - 197 + 10	EA + 42
I	EA + 526 - 205 + 45 - 185 + 48 - 197 + 10 - 42	EA
~~J~~	~~EA + 526 - 205 + 45 - 185 + 48 - 197 + 10 - 42~~	

$$B\omega = \text{max} - \text{min} = (EA \dots \text{Shame you didn't complete question. } 4/10)$$