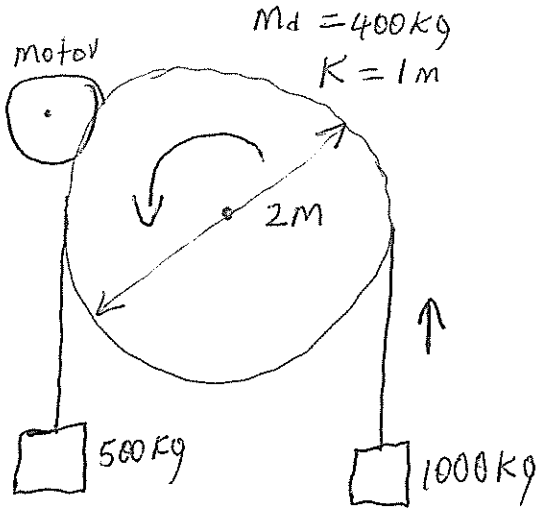
MOM 2601 Assg 2 Semester 1 2018

Q1



drum $T_1 = I\alpha = (mk^2)\left(\frac{a}{R}\right) = 400 \times 1^2 \times \frac{2}{1} = 800N$

weight $T_2 = m(g+a)R + m \times 0.5$

$= 1000(9.81+2) \times 1 + 1000 \times 0.5$

$= 12310\ N$

counter $T_3 = m(g-a) - m \times 0.5$

$= 500(9.81-2) \times 1 - 500 \times 0.5$

$= 3655\ N$

$T_{total\ drum} = T_1 + T_2 - T_3$

$= 800 + 12310 - 3655$

$= 9455\ N$

$T_{mot} = T_{total} \times \frac{1}{\eta} \times \frac{1}{R}$

$= 9455 \times \frac{1}{0.8} \times \frac{1}{4}$

$= 2954.68\ N$

Q2

2.1 $P = \frac{2\pi N T}{60} \Rightarrow T = \frac{30P}{\pi N}$

$= \frac{30 \times 1400\,000}{\pi \times 500}$

$= 26\,738.03\ Nm$

$T = \mu F \left(\frac{R+y}{2}\right) n$

$26\,738,03 = 0,3 \times 200\,000 \left(\frac{0,3+0,15}{2}\right) n$

$\therefore n = 1,98059 \simeq 2$

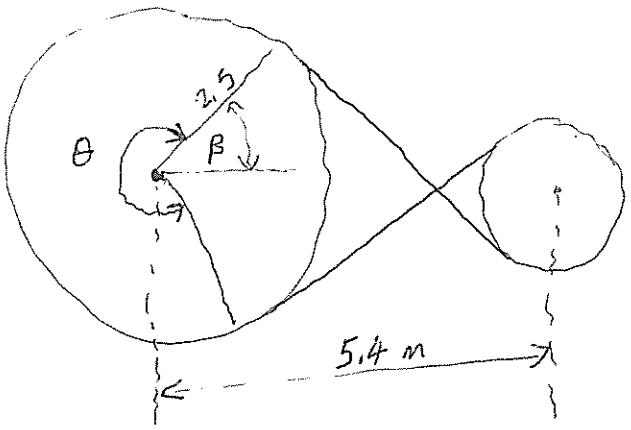
2.2 $T = \frac{2}{3} \mu F \left(\frac{R^3 - y^3}{R^2 - y^2}\right) n$

$26\,738,03 = \frac{2}{3} \times 93 \times 200\,000 \left(\frac{0,3^3 - 0,15^2}{0,3^2 - 0,15^2}\right) n$

$\therefore n = 1,9099 \simeq 2$

Q3

3.1



$\beta = \cos^{-1}\left(\frac{R+r}{c}\right) = \cos^{-1}\left(\frac{2,5+1,6}{5.4}\right)\ 40.6^\circ = 0,7086\ rad$

$\theta = 2\pi - 2\beta = 2\pi - 2X0,7086 = 4,866\ rad$

$\frac{T_1}{T_2} = e^{\mu\theta} = e^{0,26X4,866} = 3,5436$

$T_2 = \frac{T_1}{3,5436}$ but $T_1 = 1400N$

$= \frac{1400}{3,5436}$

$= 395,078\ N$

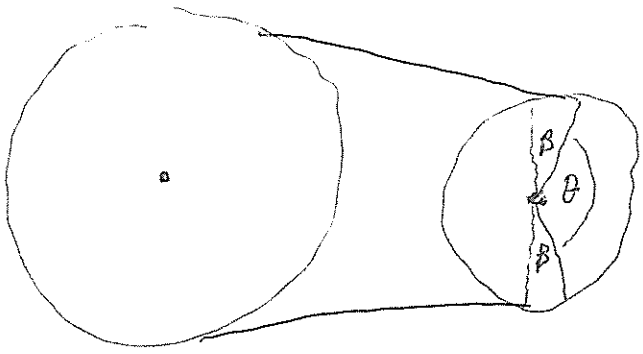
$V = \frac{2\pi N}{60} r = \frac{2\pi X400}{60} X\ 1,6 = 67.02\ m/s$

$P = (T_1 - T_2)\ v\ n$

$= (1400 - 395,078) X\ 67.02\ X\ 2$

$= 134,7\ KW$

3.2



$$\beta = \sin^{-1}\left(\frac{R-r}{C}\right) = \sin^{-1}\left(\frac{2.5-1.6}{2}\right) = 10.37° = 0.18099 \text{ rad}$$

$$\theta = \pi - 2\beta = \pi - 2 \times 0.18099 = 2.7796 \text{ rad}$$

$$\frac{T_1}{T_2} = e^{\mu\theta} = e^{0.26 \times 2.7796} = 2.06$$

$$T_2 = \frac{T_1}{2.06} = \frac{1400}{2.06} = 679.6 \text{ N}$$

$$P = (T_1 - T_2) v \, n$$

$$= (1400 \times 679.6) \times 67.02 \times 2$$

$$= 96.561 \text{ KW}$$

Q 4

4.1 $\frac{T_1}{T_2} = e^{\mu\theta} = e^{0,2 \times \frac{220\pi}{180}} = 2,1553$

$T_2 = \frac{T_1}{2,1553}$ ------ (1)

$T_1 \times 0,3 = mg \times 0,9$

$0,3T_1 = 5 \times 9,81 \times 0,9$

$T_1 = 147,15\ N$ ---- (2)

$T_2 = \frac{147,15}{2,1553}$ --- (2) in (1)

$= 68,273\ N$

$torque = (T_1 - T_2)\ R$

$= (147,15 - 68,273) \times 0\,3$

$= 23,663\ Nm$

4.2 $T_2 = 147,15$ (direction has changed)

$T_1 = 2,1553\ T_2$

$= 2,1553 \times 147,15$

$= 317,157$

$torque = (T_1 - T_2)\ R$

$= (317,157 - 147,15) \times 0,3$

$= 51,002\ Nm$