1. $R_a = \frac{12}{2} = 6\ \Omega$.

iii) $V_e = 12 - \frac{1}{3}(16)$

$= 8\ V$

$V_e = k_t \omega$

$k_t = 0.019$.

$T_e = k_t \cdot I_a$

$= 0.012$

$= 12.7\ mNm$.

4. $V_e = 120 - 50(0.1)$

$= 115\ V$.

$V_e = k_e \omega$

$k_e = 1.05$.

$V_{e\,new} = 120 - 90(0.1)$

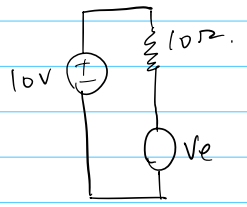
$= 111\ V$.

$\omega = \frac{111}{1.05}$

$= 105.6\ rad/s$

$\approx 1009\ RPM$.

3. $k_t = .05\ Nm/A$.



$\omega = 0$. $V_e = 0$.

$\omega \uparrow$ $V_e \uparrow$.

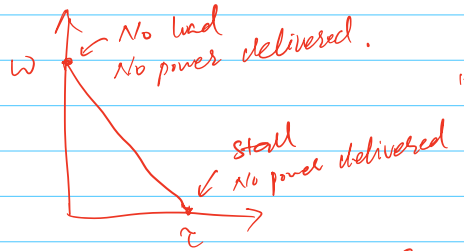
5. $230 - 200(0.2) = 190\ V$.

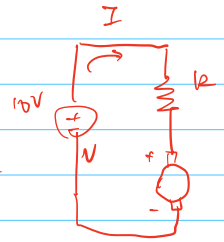
$k_e = 1.51$

$T_e = k_t I_a$

$= 302$.

$P_{dep} = 302\ W$.





$k_e \omega = V - IR$

$\omega = \frac{V}{k_e} - \frac{\tau}{k_t k_e} R$

$\omega = \frac{V}{k_e} - \frac{R}{k_e k_t} \tau$.

$\mathcal{E} = V - IR$

$\begin{cases} \tau = k_t I \\ \mathcal{E} = k_e \omega \end{cases}$

$V \quad R$

$$\text{Power} = \tau\omega = \tau\left(\frac{V}{k_e} - \frac{k_t k_e \tau}{k}\right)$$

$$= \frac{V}{k_e}\tau - \frac{k}{k_t k_e}\tau^2$$

求出其 maximum mechanical power.

$$\frac{dP}{d\tau} = 0 \qquad \frac{V}{k_e} - \frac{2k}{k_t k_e}\tau = 0$$

$$\frac{V}{k_e} = \frac{2k}{k_t k_e}$$

$$V = \frac{2k}{k_t}\tau$$

$$\tau = \frac{V k_t}{2k}$$

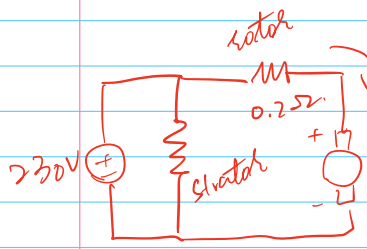
$$= \frac{10(0.05)}{2(10)}$$

$$= 0.025\ \text{Nm}$$

$$\omega = 100$$

$$\text{Power} = 2.5\ \text{W}$$

5. Shunt-connected.



$$\mathcal{E} = 230 - 2R = 190\ \text{V}$$

Electrical Power developed $= \mathcal{E}I$

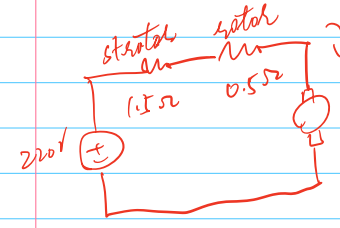
$= 190(200) = 38000\ \text{W}$

Mechanical power developed

$= 38000 - 500 = 37500\ \text{W}$

$$\tau = \frac{P}{\omega} = \frac{37500}{\frac{1200}{60}2\pi} = 298.4\ \text{Nm}$$

6. Series Connected DC motor.



$\mathcal{E} = 180\ \text{V}$.

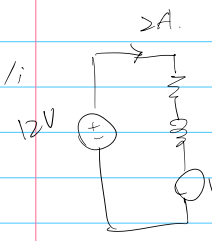
$P = \mathcal{E}I$

$= 3600\ \text{W}$.

$P_{out} = 3450$.

$\eta = 78.4\%$

1.



$R = 6\Omega$.

$V_e = 12 - 6(\frac{1}{3})$

$\omega = 0 \quad = 8V$.

$V_e = k_e \cdot \omega$

$k_e = 0.019$.

$T_e = k_t \cdot I_a$

$= 12.7 \ mNm$.

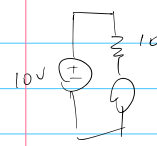
2. $V_e = k_e \cdot \omega$

$= 0.019 \cdot 2\pi \frac{200\pi}{60}$

$= 4V$.

$\frac{12-4}{6} = 1.33A. = \frac{4}{3}A.$

3.



$T_e = 50mNm$

$V_e = V - I_a R$

$k_e \omega = V - \frac{T_e}{k_t} R$

$\omega = \frac{V}{k_e} - \frac{T_e}{k_t k_e} R$

$P = T_e \omega$.

$= T_e \left(\frac{V}{k_e} - \frac{T_e}{k_t k_e} R \right)$

$= \frac{V}{k_e} T_e - \frac{R}{k_t k_e} T_e^2$

$\frac{dP}{dT_e} = \frac{V}{k_e} - \frac{2R}{k_t k_e} T_e = 0$.

$\frac{V}{k_e} = \frac{2R}{k_t k_e} T_e$.

torque at maximum power.

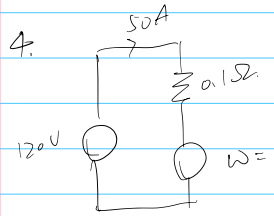
$T_e = \frac{V k_t}{2R}$

$= \frac{10 (50 \times 10^3)}{2(10)}$

$= 0.025 \ Nm$.

$\omega = \frac{V}{k_e} - \frac{T_e}{k_t k_e} R \qquad P = T_e \cdot \omega$.

4.



$\omega = 2\pi \frac{1045}{60}$

$V_e = k_e \cdot \omega$

$120 - 50(0.1) = k_e \cdot 2\pi \frac{1045}{60}$

$k_e = 1.05$

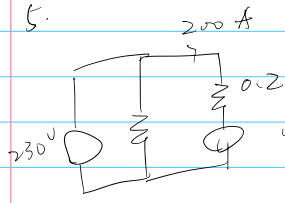
$V_e = k_e \omega$

$\omega = \frac{120 - 50(0.1)}{1.05}$

$= 105.6$

$= 1\omega$ } RPM.

5.



$\omega = 2\pi \frac{1209}{60}$.

$= 40\pi$.

Electrical Power $= [230 - 200(0.2)](200)$

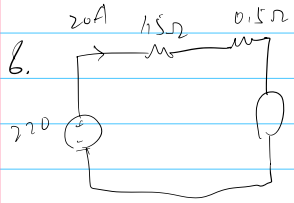
$= 38000$.

Mechanical Power $= 38000 - 500$

$T_e = \frac{P_m}{\omega}$

$= 298.4$ Nm.

6.



$V_e = 220 - 20(2)$

$= 180V$.

$V_e = k_e \cdot \omega$

$180 = k_e \cdot 2\pi \frac{1209}{60}$

$k_e = 1.43$

$T_e = k_t \cdot I_a$

$= 1.43(20)$

$= 28.64$ Nm.

$P_{dev} = T_e \cdot \omega$

$= 3600W$.

$P_{out} = 3600 - 150$

$= 3450$ Watt.

$\frac{3450}{220 \cdot 20} \times 100\% = 78.4\%$.