Q. A 220V dc machine has an Armature resistance of 1Ω, if full load current is 20 Amp. the diff. of induced voltage, when the machine is running as a motor and generator is—

Soln

as motor

$E = V - I_a R_a$

$= 220 - 20 \cdot 1$

$= 200\ V$

as Generator

$E = V + I_a R_a$

$= 220 + 20 \cdot 1$

$= 240\ V$

diff. of induced voltage is → (40V)

Q. the current drawn by 220V dc motor of $R_a = 0.5\Omega$ & back emf 200V is → ?

Soln

In motor

$E_b = V - I_a R_a$

$I_a = \frac{-E_b + V}{R_a} = \frac{V - E_b}{R_a}$

$= \frac{220V - 200}{0.5} = \frac{200}{5}$

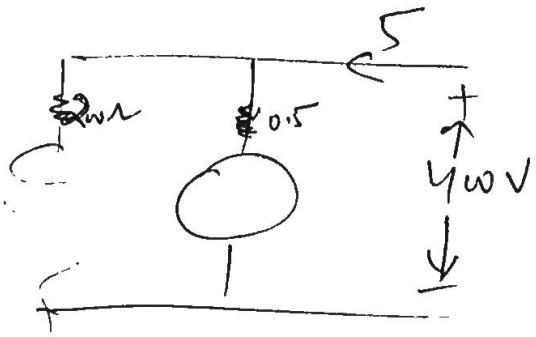
$I_a = 40$ Amp.

Q A 400V dc shunt motor takes 5 A at no load $R_a = 0.5$, $R_f = 200\ \Omega$, what is ratio of Speed from full load to no-load when dc shunt motor takes 50 Amp. on full load)

Sol^n

$$I_{sh} = \frac{400}{200} = 2 \text{ Amp}$$

$$\therefore I_a = 3$$



$$E_1 = V - I_a R_a$$

$$= 400 - 3 \times 0.5$$

$$= 400 - 1.5$$

$$= 398.5 \text{ V}$$

at full load

$I_a = 48$ amp.

$$E_2 = 400 - 48 \times 0.5$$

$$= 376 \text{ volt}$$

$\therefore$ ratio of Speed from No load to full load.

$$\left\{ N \propto \frac{E_b}{\phi} \right\} \text{ Const.}$$

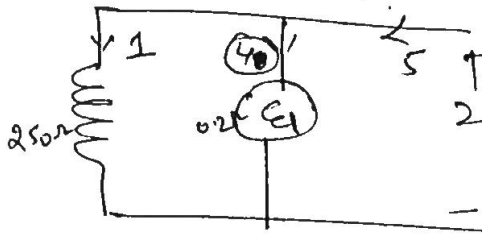
$$\frac{N_1}{N_2} = \frac{E_1}{E_2}$$

$$\frac{N_{NL}}{N_{FL}} = \frac{398.5}{376} \Rightarrow \boxed{\frac{N_{FL}}{N_{NL}} = 0.94}$$

Q.2. A 250 V, shunt motor on no-load run at 1000 rpm and take 5 amp. the total armature & shunt resistance are resp. 0.2Ω + 250Ω Calculate Speed when loaded & taking a current of 50 amp., if the armature reaction reduce the field by 3%.

Sol^n

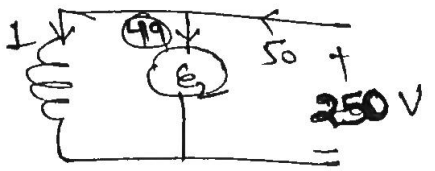
$$I_{sh} = \frac{V}{R_{sh}} = \frac{250}{250} = 1 \text{ Amp}$$



at no-load

$$E_1 = V - I_a R_a$$
$$= 250 - 4 \times 0.2$$
$$= 250 - .8$$
$$= 249.2 \text{ V}$$

$$E_2 = V - I_a R_a$$
$$= 250 - (49 \times 0.2)$$
$$= 240.2 \text{ volt.}$$



at On-load

By formula

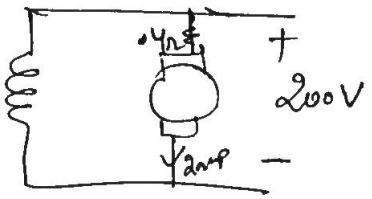
$$\frac{E_1}{E_2} = \frac{N_1 \phi_1}{N_2 \phi_2}$$

$$= \frac{249.2}{240.2} = \frac{1000 \times \phi}{N_2 \times .97 \phi}$$

$$N_2 = 993.69 \text{ rpm}$$

Q. The armature resistance of a 200 V shunt motor is 0.4 Ω & no-load armature current is 2 amps. when loaded & taking an armature current of 50 Amp, the speed is 1200 rpm find the approx. no-load speed.

Soln :- $\because \left(\frac{\mathcal{E}_1}{\mathcal{E}_2} = \frac{N_{1_{FL}}}{N_{2_{NL}}}\right)$



(at no-load)

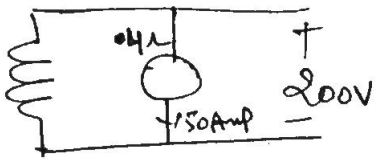
$\left\{ \begin{aligned} \mathcal{E}_1 &= K_n \phi N_1 \\ \mathcal{E}_2 &= K_n \phi N_2 \end{aligned} \right\}$

$\mathcal{E}_1 = V - I_a R_{a_{NL}}$

$= 200 - 2 \times 0.4$

$= 200 - .8$

$= \underline{199.2 \text{ V}}$



$\mathcal{E}_2 = V - I_a R_{a_{FL}}$

$= 200 - (50 \times 0.4) = \underline{180 \text{ V}}$

$\therefore \left(\frac{199.2}{180} = \frac{N_{1_{NL}}}{1200}\right)$

$\therefore \boxed{N_{1_{NL}} = 1328 \text{ Rpm}}$