Ans to the question NO: 01

Given that,

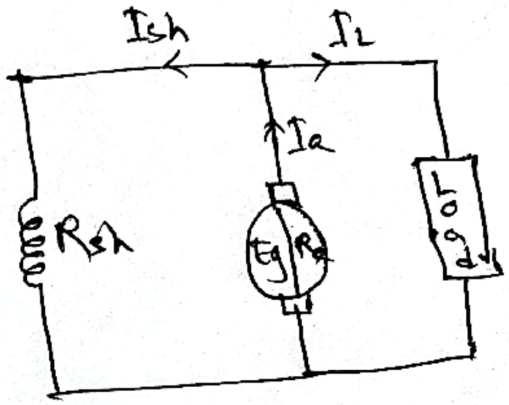
$I_L = 450\,A$

$V = 230\,V$

$R_{sh} = 50\,\Omega$

$R_a = 0.3\,\Omega$

$E_g = ?$



Shunt

Here,

$$I_{sh} = \frac{V}{R_{sh}} = \frac{230}{50} = 4.6\,A$$

$\therefore$ Armature current, $I_a = I_{sh} + I_L$

$= 4.6 + 450$

$= 454.6\,A$

∴ The generated emf,

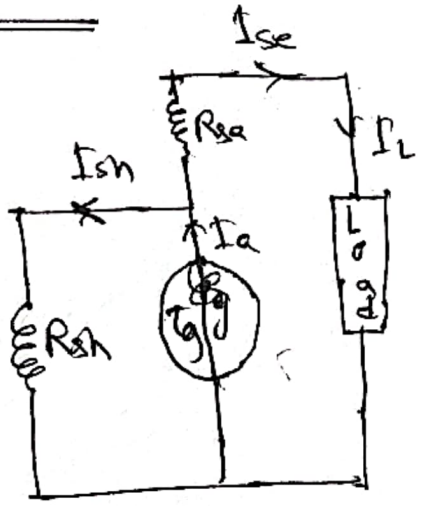
$$E_g = V + I_a R_a$$

$$= 230 + 454.6 \times 0.3$$

$$= 366.38 \text{ Volt}$$

∴ The generated emf is 366.38 volt.

Ans to the question NO:02



Short Shunt

Given that,

$I_L = 30A$

$V_T = 220V$

$R_a = 0.05\Omega$

$R_{se} = 0.30\Omega$

$R_{sh} = 250\Omega$

$V_b = 1V$

$E_g = ?$

$I_a = ?$

Here,

$$V_a = V_T + I_L R_{se} + \text{brush drop}$$

$$= 220 + 30 \times 0.30 + 2$$

$$= 231 \text{ volt}$$

$\therefore$ Shunt Current, $I_{sh} = \dfrac{V_a}{R_{sh}} = \dfrac{231}{200} = 1.155 A$

$\therefore$ Armature Current,

$$I_a = I_L + I_{sh} = 30 + 1.155 = 31.155 A$$

Induced emf, E_g

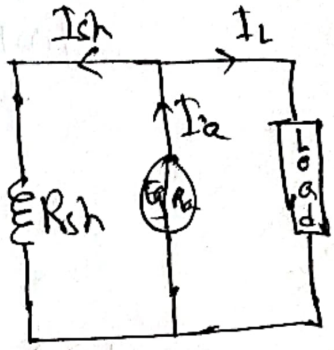
$$E_g = V_T + I_a (R_a + R_{se}) + 2V_b$$

$$= 220 + 31.155 (0.05 + 0.3) + 2 \times 1$$

$$= 232.9 V$$

$\therefore$ Armature Current $= 31.155 A$ and Induced emf $= 232.9 V$

Ans to the question No: 03



Shunt

Given that,

$I_L = 20A$

$R_L = 10\Omega$

$R_{sh} = 50\Omega$

$R_a = 0.5\Omega$

$E_g = ?$

Here, $V = I_L R_L = 20 \times 10 = 200$ Volt

and shunt current, $I_{sh} = \frac{V}{R_{sh}} = \frac{200}{50} = 4A$

Armature Current, $I_a = I_{sh} + I_L = 4 + 20 = 24A$

The generated emf

$E_g = V + I_a R_a = 200 + 24 \times 0.5 = 212$ volt

$\therefore E_g = 212$ volt

Ans to the question No: 04

Given that,

$P = 4$

$P = A = 4$ [lap wound]

$V_T = 500\,V$

$R_a = 0.03\,\Omega$

$R_{se} = 0.04\,\Omega$

$R_{sh} = 200\,\Omega$

$V_b = 1\,V$

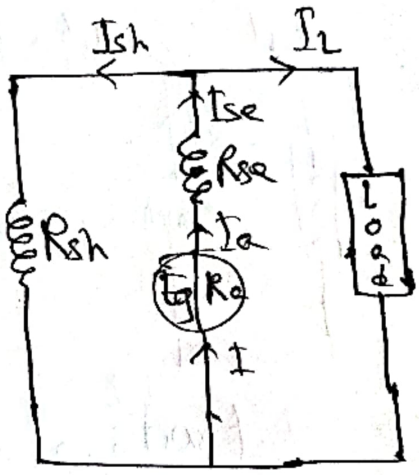
Power $= 25\,KW$

$N = 1200$ rpm

$\phi = 0.02$ wb

$E_g = ?$

$Z = ?$



Long shunt

Here,

$$\text{power} = V_T I_L$$

$$\Rightarrow I_L = \frac{\text{power}}{V_T}$$

$$\Rightarrow I_L = \frac{25000}{500}$$

$$\Rightarrow I_L = 50\,A$$

Now,

Shunt Current, $I_{sh} = \frac{V_T}{R_{sh}} = \frac{500}{200} = 2.5A$

Armature current, $I_a = I_L + I_{sh} = 50 + 2.5 = 52.5A$

$\therefore$ The generated emf

$$E_g = V_T + I_a(R_a + R_{se}) + 2V_b$$

$$= 500 + 52.5(0.03 + 0.04) + 2 \times 1$$

$$\therefore E_g = 505.675\ V$$

Now,

No. of Conductor, Z

$$E_g = \frac{\phi Z N}{60} \times \frac{P}{A}$$

$$\Rightarrow Z = \frac{E_g \times 60}{\phi N} = \frac{505.675 \times 60}{0.02 \times 1200} = 1264.19$$

$$\therefore Z = 1264$$

$\therefore$ The generated emf 505.675V and Conductor 1264.

Ans to the question No: 05

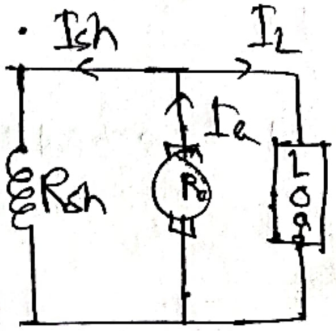
Given that,

$V = 220V$

$R_a = 0.05\Omega$

$R_{sh} = 110\Omega$

$I_L = 20A$



Shunt Generator

Here,

$$I_a = I_L + I_{sh} = I_L + \frac{V}{R_{sh}} = 20 + \frac{220}{110} = 22A$$

emf for generator,

$$E_g = V + I_a R_a = 220 + 22 \times 0.05 = 221.1 \text{ volt}$$

emf for motor,

$$E_g = V - I_a R_a$$
$$= 220 - 18 \times 0.05$$
$$= 219.1 \text{ volt}$$

Here,

$$I_a = I_L - I_{sh}$$
$$= I_L - \frac{V}{R_{sh}}$$
$$= 20 - \frac{220}{110}$$
$$= 18A$$

$\therefore E_g = 219.1$ volt in motor

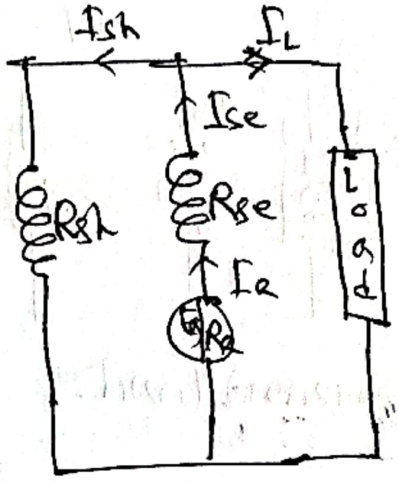
Ans to the question No: 06

Given that,

$P = 4$

$A = P = 4$ (lap wound)

$\phi = 0.07 Wb$



Long shunt

No. of turn in armature winding = 220

and Resistance per turn = 0.004 Ω

$Z = 220 \times 2 = 440$

$R_{sh} = 100 \Omega$

$R_{se} = 0.02$

$N = 900$ rpm and $I_a = 50 A$

Total Resistance of 220 turns or 440 conductor

$= 220 \times 0.004 = 0.88 \Omega$

$\therefore$ Resistance of each path $= \frac{0.88}{4} = 0.22 \Omega$

Here,

There are 4 such resistance in parallel

each of value 0.22Ω

$$\therefore R_a = \frac{0.22}{4} = 0.055\Omega$$

Now,

$$E_g = \frac{\phi Z N}{60} \times \frac{P}{A} = \frac{0.07 \times 440 \times 900}{60} \times \frac{4}{4}$$

$$= 462$$

$$E_g = 462 \text{ volt}$$

$\therefore$ Terminal voltage,

$$V_T = E_g - I_a (R_a + R_{se})$$

$$= 462 - 50 (0.055 + 0.02)$$

$$= 458.25 \text{ volt}$$

$\therefore$ Terminal voltage $= 458.25\,V$

Here,

$$I_{sh} = \frac{V_T}{R_{sh}} = \frac{458.25}{100} = 4.58\,A$$

$$\therefore\ I_L = I_a - I_{sh} = 50 - 4.58 = 45.42\,A$$

$$\therefore\ \text{power out} = V_T \times I_L$$

$$= 458.25 \times 45.42$$

$$= 20813.715\ W$$

$$= 20.81\,KW$$

$$\therefore\ V_T = 458.25\ \text{Volt}$$

$\therefore$ power output $= 20.81\,KW$