Quiz 03 Soln

Q1

(a) $E = V_t - I_a R_a$, $V_t = 100\,V$

$= 200 - 20 \times 1 = 180\,V$

$E = K\phi N$ — (1 mark)

(b) $E_1 = K\phi_1 N_1$ $(E_1 = 180V,\ N_1 = 900\ rpm)$

for Case 2, $I_a = 10A$, $V_t = 200\,V$,

$E_2 = 200 - 10 \times 1 = 190\,V$. → 0.5 mark

$E_2 = K\phi_2 N_2$

$\Rightarrow \dfrac{E_2}{E_1} = \dfrac{\phi_2 N_2}{\phi_1 N_1} = \dfrac{V_{f_2}}{V_{f_1}} \cdot \dfrac{N_2}{N_1}$ } → 0.5 mark

$\Rightarrow N_2 = \left(\dfrac{E_2}{E_1}\right) \times N_1 \times \left(\dfrac{V_{f_1}}{V_{f_2}}\right) = \left(\dfrac{190}{180}\right) \times 900 \times \dfrac{100}{85} = 1117.65$

~ 1118 rpm

$1115 \Leftrightarrow 1120$ rpm

Q2 $N_r = 485$ rpm,

poles ?? $N_s \simeq 500$ rpm ✳

using. $N_s = \dfrac{120f}{P} \Rightarrow P = \dfrac{120 \times 50}{500} = 12$ poles

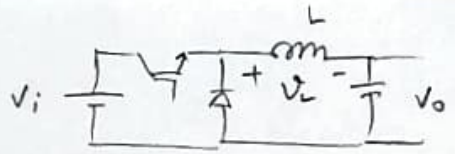
(a). Speed of stator field w.r.t rotor = 15 rpm (or −15 rpm)

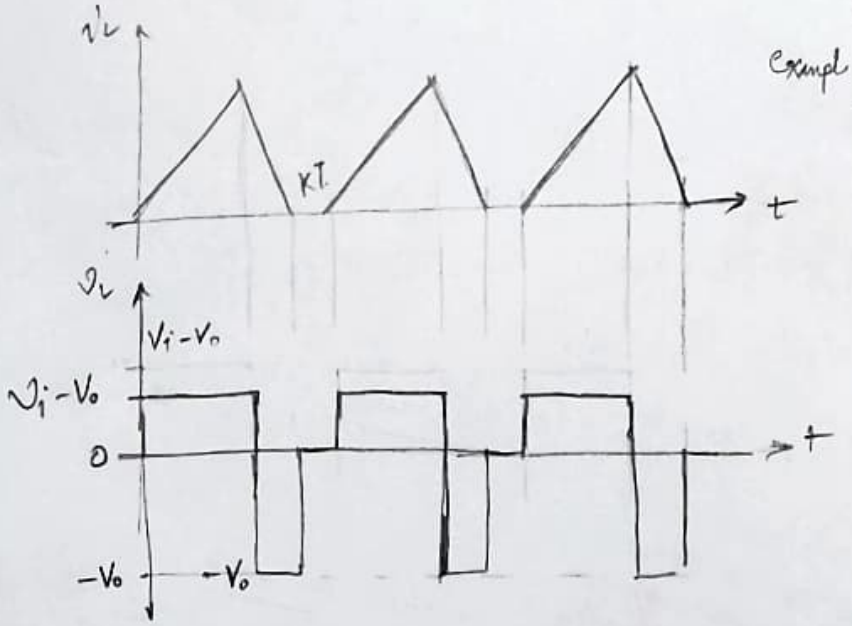
(b) Speed of rotor field w.r.t rotor = 15 rpm (or −15 rpm).

(c). Speed of rotor field w.r.t stator is zero.

* These two magnetic field must be stationary w.r.t each other to develop steady torque.

Q3





Example 12 V 10.

} 0.5 marks for waveform.

(b) Using volt-second balance:

$(V_i - V_o)\,DT = (V_o)(T - DT - KT)$ → 1 mark

$\therefore V_i DT = (V_o)(T - DT - KT + DT)$

$\therefore \frac{V_o}{V_i} = \frac{DT}{T - KT} = \frac{D}{1-K}$ 0.5 mark

Q4

(a) double-layer, distributed winding → 0.5
(b) double-layer, concentrated winding → 0.5
(c) single-layer, concentrated windig. → 0.5

} give (1 mark) if distributed & concentrated are identified correctly

Q5 (a). 2-pole, 10-pole & 14-pole PM rotors are suitable for this kind of winding arrangements.

(b) fundamental component (f_1) → clockwise

10-pole rotor (f_5) → direction would be opposite to fundamental, i.e. counter-clockwise

14-pole rotor (f_7) → direction would be same as that of fundamental, i.e. - clockwise