Assignment 4 (1)

(2) $P_i = 1.4 \times 10^3$ Watt P_o, full load = 150 KVA

$P_c = 1.6 \times 10^3$ Watt

(1) load corresponding to max η = $KVA \times \sqrt{\frac{P_i}{P_c}}$

$= 150 \times \sqrt{\frac{1.4}{1.6}}$

$= 140.312$ KVA

$\eta = \frac{140.312}{140.312 + 1.4 \times 2} \times 100 = 98.043\%$

(2) out put at half load and 0.8 Pf: $\frac{1}{2} \times 150 \times 0.8$

$= 60$

$$\eta = \frac{60}{60 + 1.4\cancel{\times 10^3} + \left(\frac{1}{2}\right)^2 \times 1.6 \cancel{\times 10^3}} \times 100$$

$= 97.08\%$

(3)

$V_1 = 6.6 \times 10^3$ V (2)

$V_2 = 440$ V $f = 50Hz$

$\frac{V_1}{N_1} = 12$ V

$\Rightarrow \frac{V_1}{V_2} = \frac{N_1}{N_2}$

$\Rightarrow \frac{V_1}{N_1} = \frac{V_2}{N_2}$

$\Rightarrow \frac{6.6\times10^3}{550} = \frac{440}{N_2}$

$\Rightarrow N_2 = 36.66 \approx 36$ turns

$\frac{V_1}{N_1} = 12$

$N_1 = \frac{V_1}{12} = \frac{6.6\times10^3}{12} = 550$ turns

$\phi_{max} = \frac{V_1}{4.44 f N_1} = \frac{12}{4.44\times50} = 0.054$

$B_{max} = \frac{\phi_{max}}{a}$

$a = \frac{\phi_{max}}{B_{max}} = \frac{0.054}{1.5T} = 0.036\ m^2$

(8) (3)

$E = \frac{PN\phi Z}{60A}$

E → Voltage

P → no: of poles

N → speed in rpm

ϕ → flux per pole

A → no: of ‖ path

Z → no: of armature conductor

$P = 6$ $r = 0.01\ \Omega$

$Z = 8 \times 150$

for lap winding $A = P$

$E = \frac{N\phi Z}{60}$

$I_c(\text{lap}) = \frac{IA}{A} = \frac{15}{6} = 2.5$ A

for wave winding $A = 2$

$I_c = \frac{IA}{2} = \frac{15}{2} = 7.5$A

(4)

(10) $V = 500\ V$

$N_1 = 700\ rpm$

$I_a = 50\ A$ $\quad N_2 = 600$

$r_a = 0.4$

$E_{b1} = V - I_{a1} R_{a1}$

$= 500 - (50 \times 0.4)$

$= 480$

In second case

$E_{b2} = V - I_{a1}(0.4 + r)$

$= 500 - 50(0.4 + r)$

$= 480 - 50R$

$\frac{E_{b2}}{E_{b1}} = \frac{N_2}{N_1}$ [as torque is constant]

$$\frac{480 - 50R}{480} = \frac{600}{700}$$

$288000 = 336000 - 35000R$

$R = 1.37143\ \Omega$