EMC-I (Electronics & Electrical)

Sem - IV   Q.P. code: 39128

Q3 (b)

Given $V = 440V$,

$I_{NL} = 2.5\ A$

$R_{sh} = 550\ \Omega$

$R_a = 1.2$

$I_{FL} = 32$.

$$I_{sh} = \frac{V_s}{R_{sh}} = \frac{440}{550} = 0.8\ A$$

$\therefore I_{aNL} = I_{NL} - I_{sh} = 2.5 - 0.8 = 1.7\ A$

$\therefore P_{cu_{NL}} = I_{aNL}^2 R_a = 3.468\ W$

$\therefore$ Constant losses $= P_{in} - P_{cuNL}$

$= VI_{NL} - P_{cuNL}$

$= (440 \times 2.5) - (3.468) = 1096.532\ W$

at Full load

$I_{aFL} = I_{FL} - I_{sh} = 32 - 0.8$

$= 31.2$

$\therefore P_{cuFL} = I_{aFL}^2 R_a = 1168.128$

$\therefore$ Total loss $=$ Constant losses $+ P_{cuFL}$

$= 1096.532 + 1168.128 = 2264.66\ W$

$P_{in} = VI_{FL} = VI_{FL} = 440 \times 32 = 14080\ W$

$P_{out} = P_{in} -$ Total loss $= 14080 - 2264.66$

$= 11815.34\ W$

$$\therefore \eta = \frac{P_{out}}{P_{in}} = 83.91\%.$$

Q6 (a) 25 KVA,

$V_1 = 2200$, $V_2 = 110\,V$

$R_1 = 1.75\,\Omega$ $R_2 = 0.0045\,\Omega$

$X_1 = 2.6\,\Omega$ $X_2 = 0.0075\,\Omega$

$\therefore\ K = \frac{V_2}{V_1} = \frac{110}{2200} = 0.05$

(a) $R_{01} = R_1 + R_2'$

$= R_1 + R_2/K^2 = 1.75 + \frac{0.0045}{(0.05)^2} = 3.55\,\Omega$

(b) $R_{02} = R_1' + R_2$

$= K^2 R_1 + R_2 = (0.05)^2 \times 1.75 + 0.0045$

$= 8.875 \times 10^{-3}\,\Omega$

$= 0.00887\,\Omega$

(c) $X_{01} = X_1 + X_2'$

$= X_1 + X_2/K^2 = 5.6\,\Omega$

(d) $X_{02} = X_1' + X_2$

$= K^2 X_1 + X_2 = 0.05^2 \times 2.6 + 0.0075 = 0.014$

(e) $Z_{01} = \sqrt{R_{01}^2 + X_{01}^2} = 6.63\,\Omega$

(f) $Z_{02} = \sqrt{R_{02}^2 + X_{02}^2} = 0.0165\,\Omega$

(g) $I_{1FL} = \frac{25 \times 1000}{V_1} = 11.36\,A$

$\therefore\ W_{cuFL} = I_{1FL}^2 R_{01} = 11.36^2 \times 3.55$

$= 458.126\,W$