Q1)

$0 < t < \frac{1}{60}$ sec

$e = N\frac{d\Phi}{dt} = 400 \times \frac{1.2 \times 10^{-3}}{\frac{1}{60}} = 28.8$ V

$\frac{1}{60} < t < \frac{2}{60}$ sec

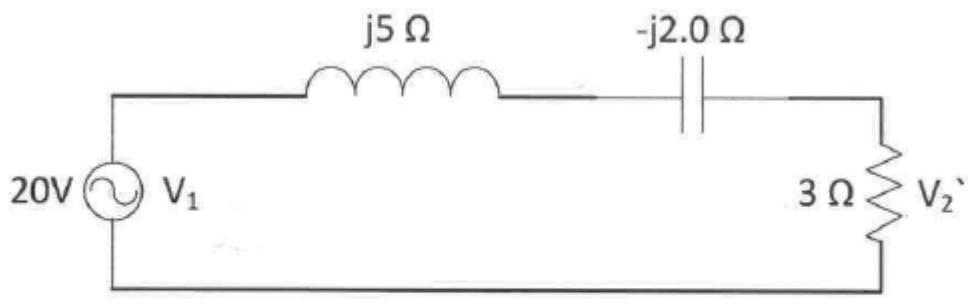
$e = N \times 0 = 0$

$\frac{2}{60} < t < \frac{4}{60}$ sec

$e = -400 \times \frac{2 \times 1.2 \times 10^{-3}}{\frac{2}{60}} = -28.8$ V

Q2)

The equivalent circuit referred to the primary side is:



Impedance of the circuit,

$Z = 3 + j5 - j20 = 3 + j3 = 4.24\ \Omega$

$I_1 = \frac{20}{4.24} = 4.72$ A

$V_2' = 4.72 \times 3 = 14.15$ V

Actual load voltage $V_2 = 100 \times 14.15 = 1415$ V

Q3)

(a) $V_{H(rated)} = 1000V$, $I_{H(rated)} = \frac{100\times10^3}{1000} = 100A.$

$V_{L(rated)} = 100V$, $I_{L(rated)} = \frac{100\times10^3}{100} = 1000A$

(b) From open circuit test,

$R_{cL} = \frac{100^2}{400} = 25\Omega.$

$I_{cL} = \frac{100}{25} = 4A.$

$I_{mL} = \sqrt{6^2 - 4^2} = 4.47A$

$X_{mL} = \frac{100}{4.47} = 22.37\Omega$

Turns ratio $a = \frac{1000}{100} = 10$

Refer to high ~~voltage~~ side,

$R_{cH} = 25\times10^2 = 2500\Omega$, $X_{mH} = 2237\Omega$

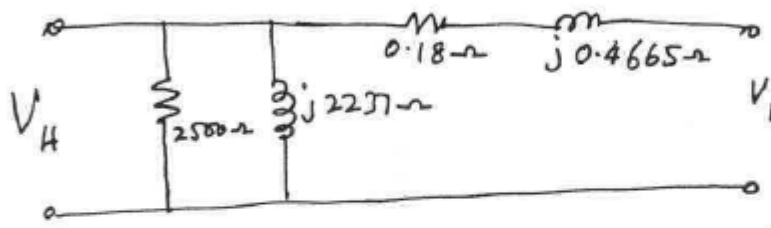
From short circuit test,

$R_{eqH} = \frac{1800}{100^2} = 0.18\Omega.$

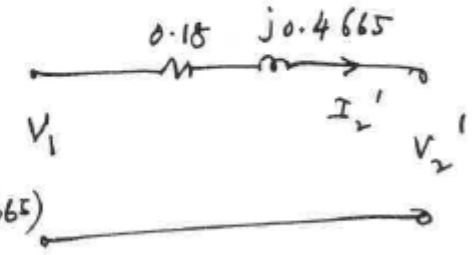
$$Z_{eq\,H} = \frac{50}{100} = 0.5\,\Omega$$

$$X_{eq\,H} = \sqrt{0.5^2 - 0.18^2} = 0.4665\,\Omega$$

Equivalent circuit referred to H.V. side



(C) $V_1 = V_2' + I_2' Z_{eq\,H}$

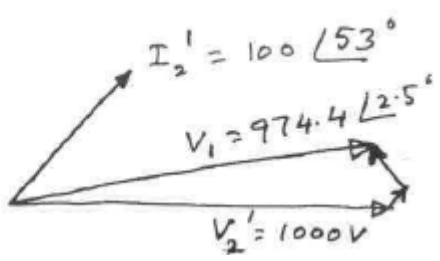


$= 1000\angle 0^\circ + 100\angle 53^\circ (0.18 + j0.4665)$

$= 974.4\angle 2.5$

$V.R = \frac{974.4 - 1000}{1000} \times 100\,\% = -2.56\,\%$

(d)



Q4)

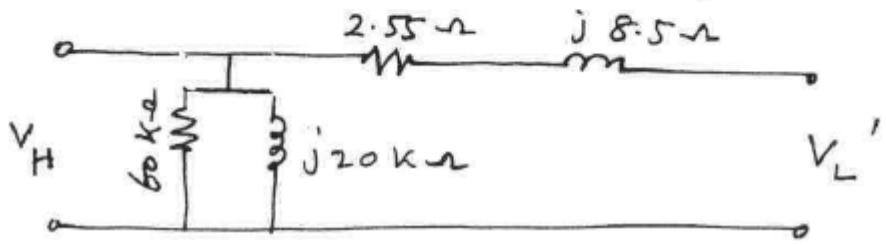
(a) $n = \frac{11}{2.2} = 5$

$R_{HV} = 1.3\,\Omega$, $R'_{LV} = 0.05 \times 5^2 = 1.25\,\Omega$

$X_{HV} = 4.5\,\Omega$, $X'_{LV} = 0.16 \times 5^2 = 4.0\,\Omega$

$R_{eq(HV)} = 1.3 + 1.25 = 2.55\,\Omega$, $X_{eq(HV)} = 4.5 + 4 = 8.5\,\Omega$

$R_{c(HV)} = 2.4 \times 5^2 = 60\,k\Omega$, $X_{m(HV)} = 0.8 \times 5^2 = 20\,k\Omega$



(b) $I_{o(HV)} = \frac{11000}{60\,000} + \frac{11000}{j\,20\,000} = 0.5797\,A.$

$I_{HV(rated)} = \frac{250 \times 10^3}{11 \times 10^3} = 22.73\,A$

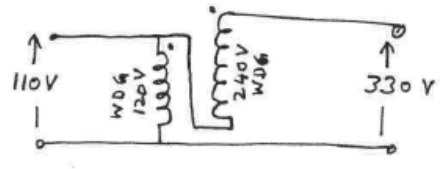
$I_{o(HV)} = \frac{0.5797}{22.73}\,pu = 0.0255\,pu.$

(c) $Z_{eq(HV)} = 2.55 + j\,8.5 = 8.8743\,\Omega$

$V_{HV} = 22.73 \times 8.8743 = 201.7\,V.$

Q5)

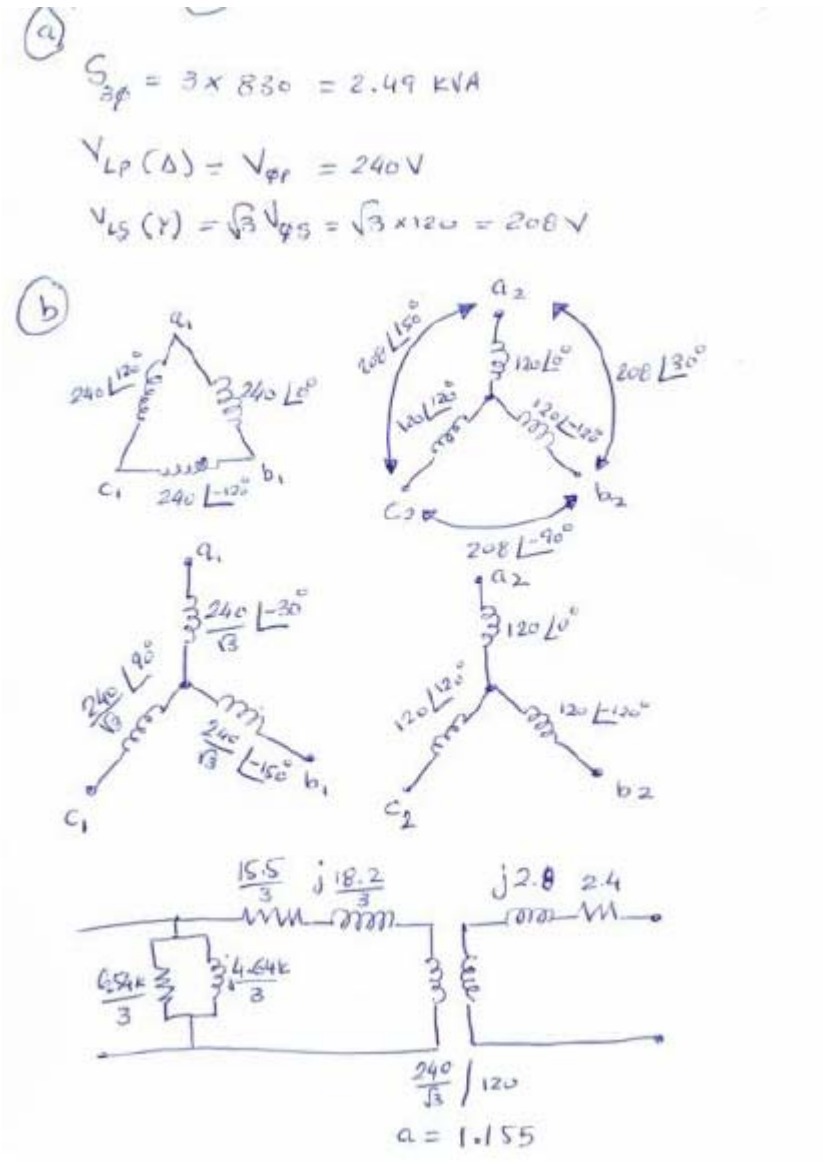
(a)



(b) $I_{HV} = \frac{3000}{240} = 12.5\,A$

Rating $= (120 + 240) \times 12.5 = 4500\,VA = 4.5\,KVA$

Q6)


a
$S_{3\phi} = 3 \times 830 = 2.49$ KVA
$V_{LP}(\Delta) = V_{\phi P} = 240$V
$V_{LS}(Y) = \sqrt{3} V_{\phi S} = \sqrt{3} \times 120 = 208$V
b
a_1
$240\angle 120°$
$240\angle 0°$
b_1
c_1
$240\angle -120°$
a_2
$208\angle 150°$
$120\angle 0°$
$208\angle 30°$
$120\angle 120°$
$120\angle -120°$
b_2
c_2
$208\angle -90°$
a_1
$\frac{240}{\sqrt{3}}\angle -30°$
$\frac{240}{\sqrt{3}}\angle 90°$
$\frac{240}{\sqrt{3}}\angle -150°$
b_1
c_1
a_2
$120\angle 0°$
$120\angle 120°$
$120\angle -120°$
b_2
c_2
$\frac{15.5}{3}$ $j\frac{18.2}{3}$
$j2.8$ 2.4
$\frac{6.5k}{3}$
$-j\frac{4.64k}{3}$
$\frac{240}{\sqrt{3}} \angle 120$
a = 1.155