1、

I_1 迴路：$50 = I_1(j40+j80) - I_2(j80) - I_3(j40) + (I_3-I_2)j20$ 　　$j100 I_1 - j60 I_2$

$- (I_1-I_3)j10 \Rightarrow -j40 I_3 = 50$

$- (I_3-I_1)j30$

$+ (I_2-I_1)j10$

I_2 迴路：$0 = (100+j60+j80)I_2 - j60 I_3 - j80 I_1 - (I_1-I_3)j20$ 　　$100 I_2 + j80 I_2$

$+ (I_1-I_3)j10 \Rightarrow -j20 I_3 - j60 I_1 = 0$

$- (I_2-I_3)j30$

$- (I_2-I_1)j30$

I_3 迴路：$0 = (-j50+j100)I_3 - j40 I_1 - j60 I_2 - (I_2-I_1)j10$ 　　$j10 I_3 - j40 I_1$

$+ (I_2-I_1)j30 \Rightarrow -j20 I_2 = 0$

$+ (I_1-I_3)j70$

$- (I_3-I_2)j20$

$\Delta = \begin{vmatrix} j100 & -j60 & j40 \\ -j40 & j20 & j10 \\ j60 & 100+j80 & j20 \end{vmatrix} = -60000 - j220000$ ，$\Delta I_3 = \begin{vmatrix} j100 & -j60 & 50 \\ -j40 & j20 & 0 \\ -j60 & 100+j80 & 0 \end{vmatrix} = 220000 - j200000$

$$I_0 = I_3 = \frac{\Delta I_3}{\Delta} = 0.592 + j1.1615 = 1.3 \angle 62.98°$$

Scanned with CamScanner

2、(a)

for Δ =
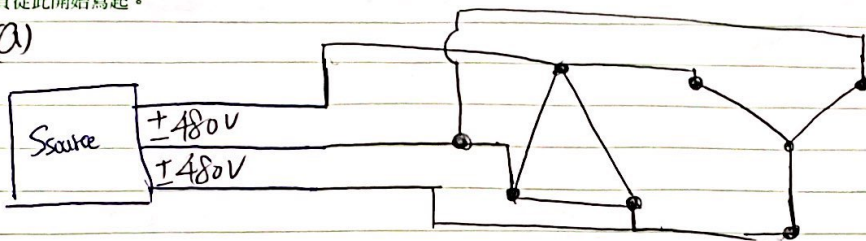
$$480 = V_{\Delta P} = V_{\Delta L}$$

$$I_{\Delta P}^* = \frac{480\angle 0°}{25\angle -40°} = 19.2\angle -40°$$

$$I_{\Delta L}^* = \sqrt{3} I_{\Delta P} = 33.25\angle 40°$$

$$|S_{3\phi \to \Delta}| \Rightarrow \sqrt{3} V_{\Delta L} I_{\Delta L} = 27643 \angle \theta_V - \theta_i \ (其中\theta_V = 0°, \theta_i = 40°)$$

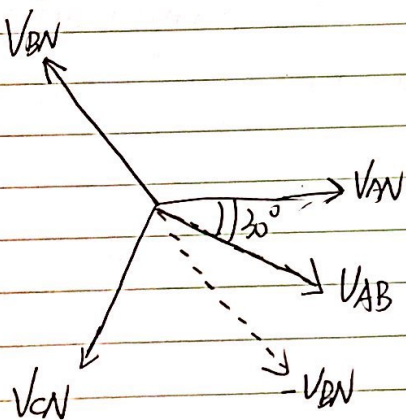$$S_{1\phi \to \Delta} = \frac{S_{3\phi \to \Delta}}{3} = 7058.7 - j5922.9$$

for Y =

$$480 = V_{YL} \Rightarrow V_{YP} = \frac{480}{\sqrt{3}}$$

$$I_{YP} = \frac{V_{YP}}{R_Y} = \frac{\frac{480}{\sqrt{3}}}{15\angle 20°} = 18.47\angle -20° = I_{YL}$$

$$|S_{3\phi \to Y}| = \sqrt{3} V_{YL} I_{YL} = 15355\angle \theta_V - \theta_i \ (其中\theta_V = 0°, \theta_i = -20°)$$

$$S_{1\phi \to Y} = \frac{S_{3\phi \to Y}}{3} = 4809.86 + j1750.6$$

(b)

for Y = $V_{AN} = \frac{480}{\sqrt{3}}\angle 30° = 277.1\angle 30°$, $I_{AN} = \frac{V_{AN}}{R_Y} = 18.47\angle 10°$

$V_{BN} = 277.1\angle 150°$, $I_{BN} = 18.47\angle 130°$

$V_{CN} = 277.1\angle -90°$, $I_{CN} = 18.47\angle -110°$

for Δ = $V_{AB} = 480\angle 0°$, $I_{AB} = 19.2\angle 40°$

$V_{BC} = 480\angle 120°$, $I_{BC} = 19.2\angle 160°$

$V_{CA} = 480\angle -120°$, $I_{CA} = 19.2\angle -80°$

國立臺灣科技大學答案卷
National Taiwan University of Science and Technology Answer Sheet

姓名/Name＿＿＿＿＿＿ 學號/Student ID＿＿＿＿＿＿ 班級/Class＿＿＿＿＿＿

科目/Course title＿＿＿＿＿＿ 日期/Date＿＿＿＿＿＿

評　分 Score　　教師簽章 Signature of Lectu

記分欄　從此處開始寫起。試卷用紙務須節用，非經主試認可不得續用其他紙張作答。/Please write from here.

3.

上節點: $\dfrac{12+V_x-V_y}{-j1} + \dfrac{12+V_x-6}{1} - 2 + \dfrac{V_x-V_y}{1} + \dfrac{V_x}{1} = 0$ —— ①

V_y 節點: $\dfrac{V_x-V_y}{1} + \dfrac{12+V_x-V_y}{1} + 2I_x = \dfrac{V_y-6}{1}$ —— ②

$6-2I_x$ 節點: $I_x = 2 + \dfrac{6-2I_x}{j1} \Rightarrow I_x = \dfrac{(64+j18)}{221}$ 代入 ② 整理

$$\begin{cases} (3+j1)V_x + (-1-j1)V_y = (-4-j12) & \text{——③ (由①整理)} \\ (-1-j1)V_x + (2+j1)V_y = \dfrac{(1454+j2688)}{221} & \text{——④} \end{cases}$$

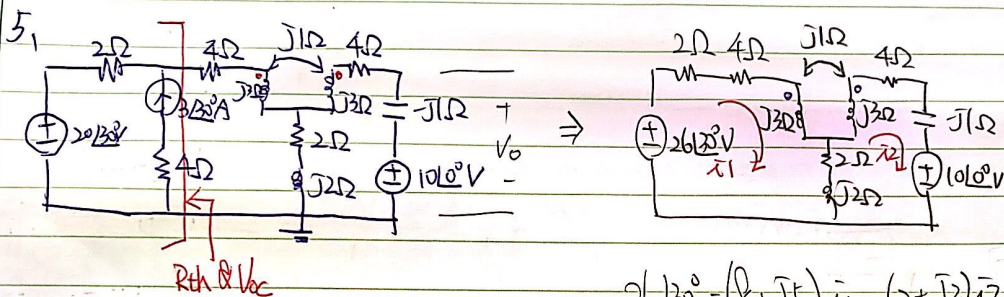$V_y = \dfrac{(1034+j596)}{221}$, $I_0 = \dfrac{V_y-6}{1} = 2.922\angle 116.88°\,A$

4.

$$S_1 = \frac{36k}{0.8} \angle \cos^{-1}(0.8) = 45k \angle 36.86° = 35985.8 - j27018.9$$

$$S_2 = 10000$$

$$+) \; S_3 = \boxed{4414.2} + j\boxed{59574} = 59737.39 \angle 85.76°$$

$$S_3 \Rightarrow PF \Rightarrow \cos(85.76°)$$
$$= 0.073 \; lagging$$

$$S_T = S_1 + S_2 + S_3 = 60k \angle \cos^{-1}(0.84) = 50400 + j32555$$

$5.$

$R_{th} = 2\Omega$

$V_{oc} = 20\underline{|30^\circ} + 2 \times 3\underline{|30^\circ} = 26\underline{|30^\circ}\,V$

$26\underline{|30^\circ} = (8+j5)\bar{i}_1 - (2+j2)\bar{i}_2 - j1\bar{i}_2 \quad\text{————} \textcircled{1}$

$10\underline{|0^\circ} + (6+j4)\bar{i}_2 - (2+j2)\bar{i}_1 - j1\bar{i}_1 = 0 \quad\text{————} \textcircled{2}$
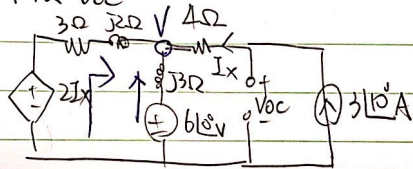
由 ①、② 整理可得

$\bar{i}_2 = \dfrac{\Delta i_2}{\Delta} = \dfrac{73.96 - j43.55}{-33 - j50} = -0.0733 + j1.43$

$V_o = \bar{i}_2 \times (-j1) + 10\underline{|0^\circ} = 11.43 + j0.0733 = 11.43\underline{|0.367^\circ}$
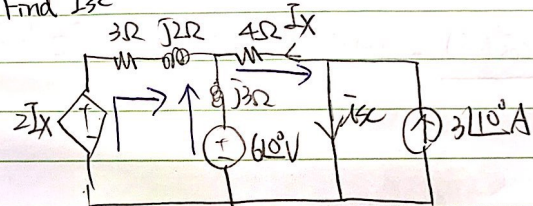
6.

3Ω $J2\Omega$ 4Ω I_x

$8J3\Omega$

$2I_x$ $6\angle0°V$ Z_L $3\angle10°A$

Find V_{oc}

3Ω $J2\Omega$ V 4Ω

$8J3\Omega$ I_x

$2I_x$ $6\angle0°V$ V_{oc} $3\angle10°A$

$$\frac{2I_x-V}{3+J2}+\frac{6-V}{J3}+3\angle0°=0 \quad (其中3\angle0°=I_x)$$

$$\Rightarrow V=7.145+J58$$

$$V_{oc}=V+4\times3\angle0°$$

$$=18.96+J288$$

$$=20.535\angle22.56°$$

Find I_{sc}

3Ω $J2\Omega$ 4Ω I_x

$8J3\Omega$

$2I_x$ $60°V$ I_{sc} $3\angle10°A$
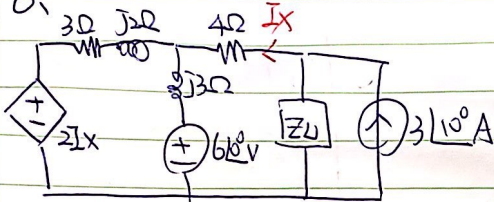
$$\frac{2I_x-V}{3+J2}+\frac{6-V}{J3}=\frac{V}{4}\quad\left(其中\ I_x=\frac{V}{4}\right)$$

$$V=1.68+J1.725$$

$$I_{sc}=\frac{V}{4}+3\angle10°A=3.375+J0.078$$

$$R_{th}=\frac{V_{oc}}{I_{sc}}=5.66-J2.2,\quad Z_L^{共轭}\sqrt{R_{th}^2}=6.07\Omega$$

V_{oc} | R_{th} | $\dot{i}$ | Z_L
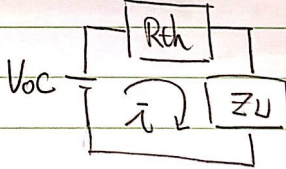
$$\dot{i}=\frac{V_{oc}}{R_{th}+Z_L}=1.72\angle11.9°$$

$$P_{Z_L}=\left(\frac{1.72}{\sqrt{2}}\right)^2\times6.07=8.9789W$$