

# 國立臺灣科技大學答案卷

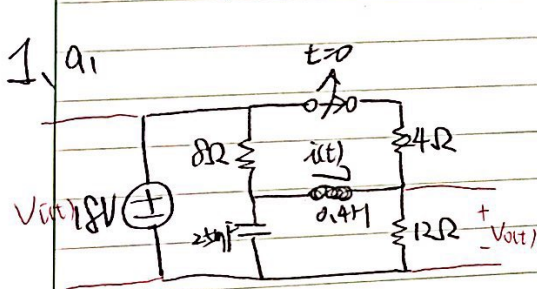
National Taiwan University of Science and Technology Answer Sheet

評 分 Score	教師簽章 Signature of Lecturer

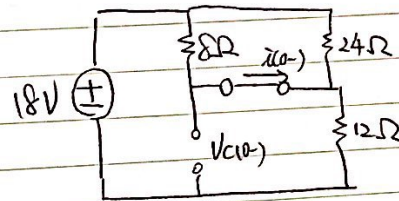
姓名/Name 107, 2 電路學 期中考 解答參考 學號/Student ID                      班級/Class                     

科目/Course title                      日期/Date                     

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.



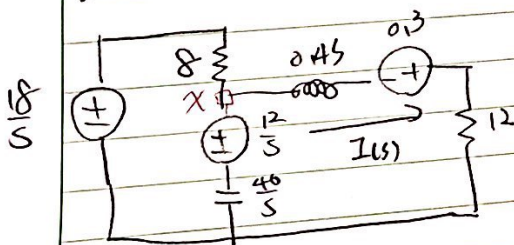
At  $t=0$



$$V_{c(0-)} = 18 \times \frac{12}{12 + (24/8)} = 12V$$

$$i(0-) = \frac{3}{4} A$$

6 L.T. at  $t=0$



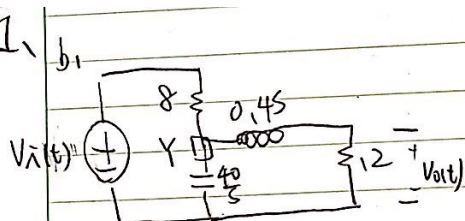
$$\frac{18/s - X}{8} = \frac{X - \frac{12}{s}}{4} + \frac{X + \frac{3}{s+10}}{\frac{2}{s+12}} \Rightarrow X = \frac{12s^2 + 420s + 2700}{s^3 + 35s^2 + 250s}, \quad I(s) = \frac{X + \frac{3}{s+10}}{\frac{2}{s+12}} = \frac{(10(X + 105s + 765))}{s(s+10)(s+25)(s+30)} + \frac{3}{s+30}$$

$$= \frac{k_0}{s} + \frac{k_1}{s+10} + \frac{k_2}{s+25} + \frac{k_3}{s+30} + \frac{3}{s+30}$$

$$k_0 = 0.9, k_1 = 0.25, k_2 = -0.4, k_3 = -0.175$$

$$i(t) = \mathcal{L}^{-1}[I(s)] = 0.9 + 0.25e^{-10t} - 0.4e^{-25t} - 0.175e^{-30t}$$

1、



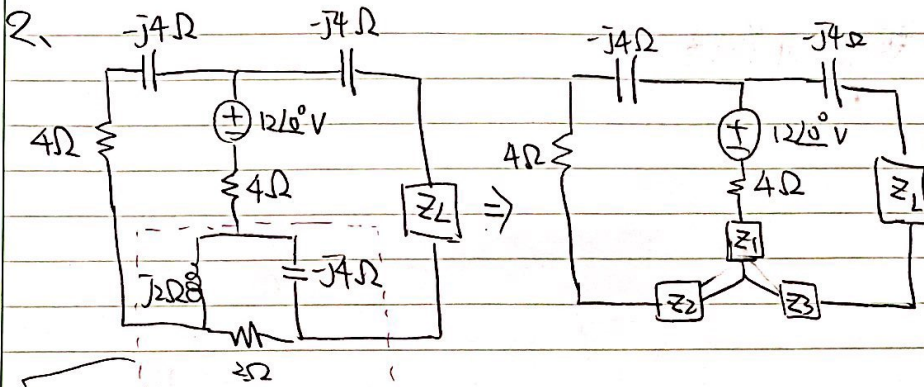
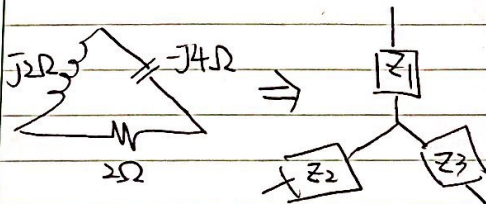
$$Y \times \frac{12}{0.45 + 12} = V_o(t)$$

$$V_i(t) \times \frac{\left(\frac{40}{s} \parallel (0.45 + 12)\right)}{8 + \left(\frac{40}{s} \parallel (0.45 + 12)\right)} = Y$$

$$\frac{V_o(t)}{V_i(t)} = \frac{192(s + 30)}{\frac{32}{25}s^3 + \frac{416}{5}s^2 + 1664s + 9600}$$

可轉頁再寫。

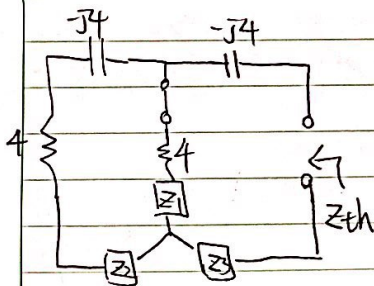
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進行  $\Delta \rightarrow Y$  轉換

$$Z_1 = \frac{j2 \cdot -j4}{2 - j2} = 2 + j2$$

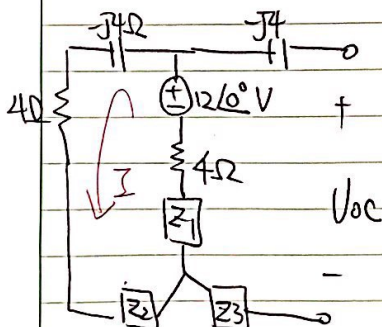
$$Z_2 = \frac{2 \cdot j2}{2 - j2} = j2 - 2$$

$$Z_3 = \frac{2 \cdot j4}{2 - j2} = j1 - 1$$

求  $Z_{th}$ 

$$\begin{aligned} Z_{th} &= [(4 - j4 + Z_3) \parallel (4 + Z_1)] + (-j4) + Z_2 \\ &= [(3 - j3) \parallel (6 + j2)] + 2 - j6 \\ &= 4.7804 - j1.0243 \end{aligned}$$

$$Z_L = 4.7804 + j1.0243$$

求  $V_{oc}$ 

$$12 = (4 - j4 + 4 + 2 + j2 - 1 + j1) \times I, \quad I = 1.31707 + j0.1463$$

$$V_{oc} = 12 - (6 + j2) \times I = 4.3902 - j3.51219$$



$$i = V_{oc} / (Z_{th} + Z_L) = 0.45918 \angle -38.16^\circ = 0.588 \angle -38.16^\circ$$

$$P_{max} = \frac{1}{2} \times 0.588^2 \times (4.7804) = 0.8263 \text{ W}$$



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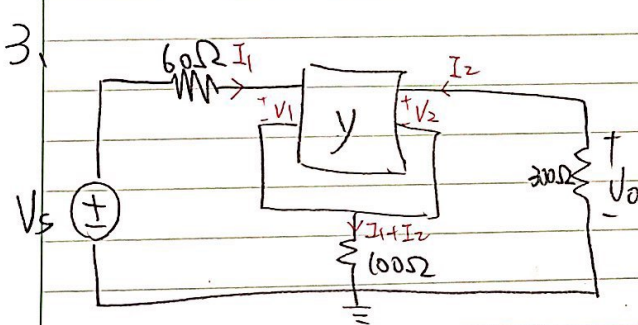
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$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 2m & 0 \\ 0 & 10m \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

$$I_1 = 2mV_1$$

$$I_2 = 10mV_2$$

$$V_0 = -300I_2 = -3V_2$$

$$V_s - 60I_1 - V_1 + V_2 - V_0 = 0 \Rightarrow V_s - V_0 = 120mV_1 + V_1 + V_2$$

$$V_s = 60I_1 + V_1 + 100I_1 + 100I_2 \Rightarrow V_s = 120mV_1 + V_1 + 200mV_1 + 1000mV_2 = -32V_2$$

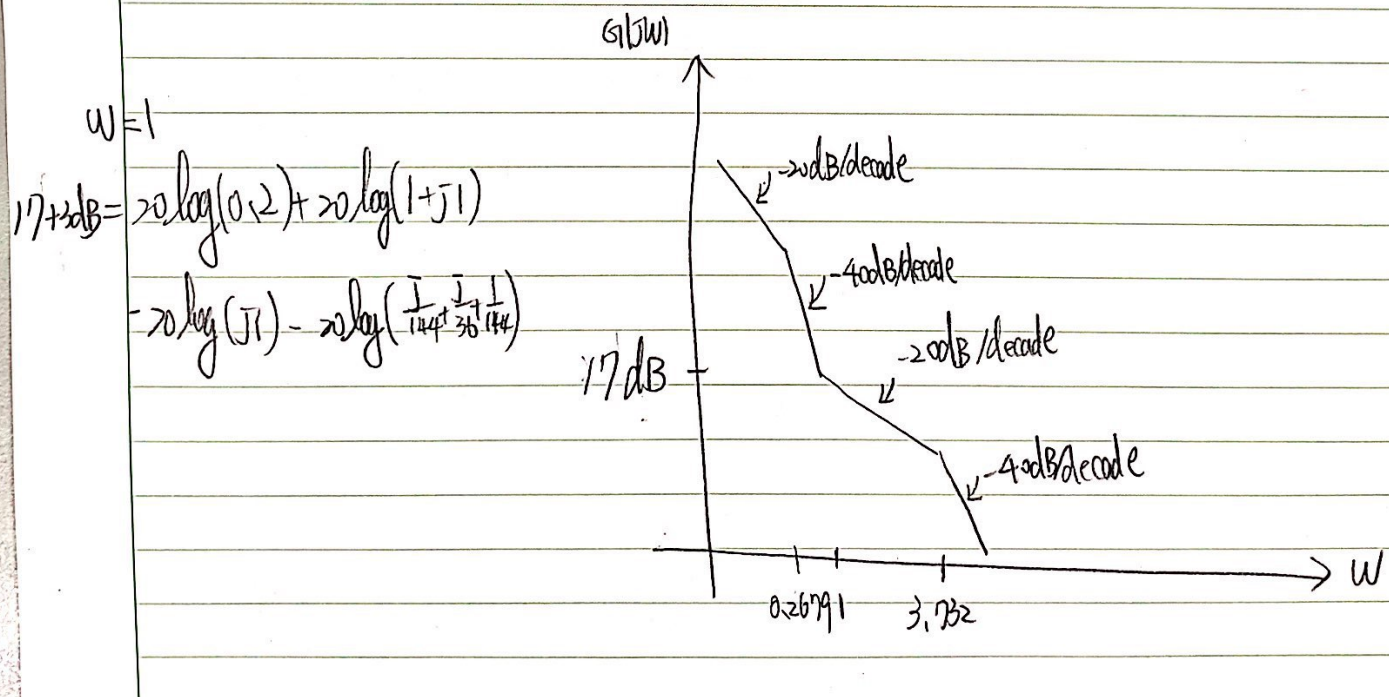
$$V_0 = V_2 + 100I_1 + 100I_2 \Rightarrow V_0 = V_2 + 200mV_1 + 1000mV_2 \Rightarrow 5V_2 = -0.2V_1$$

$$V_1 = -25V_2$$

$$\frac{V_0}{V_s} = \frac{-3V_2}{-32V_2} = \frac{3}{32}$$

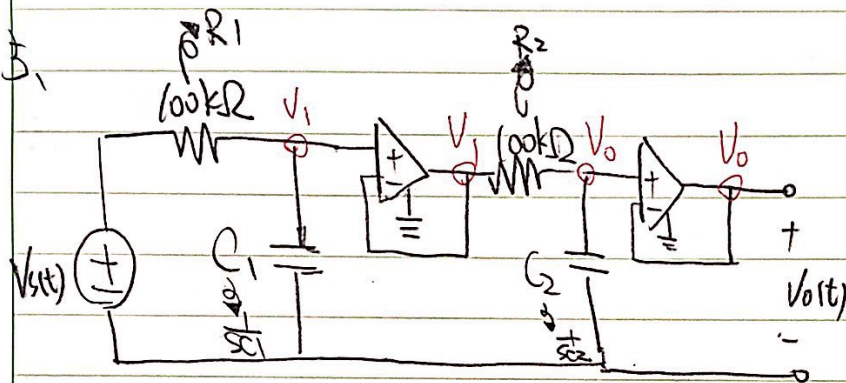
$$G(j\omega) = \frac{0.2(j\omega + 1)}{j\omega[(j\omega/12)^2 + (j\omega/36) + (1/144)]}$$

Zero: 1  
pole: 0, 0.2679, 3.732



記分欄

轉頁從此開始寫起。



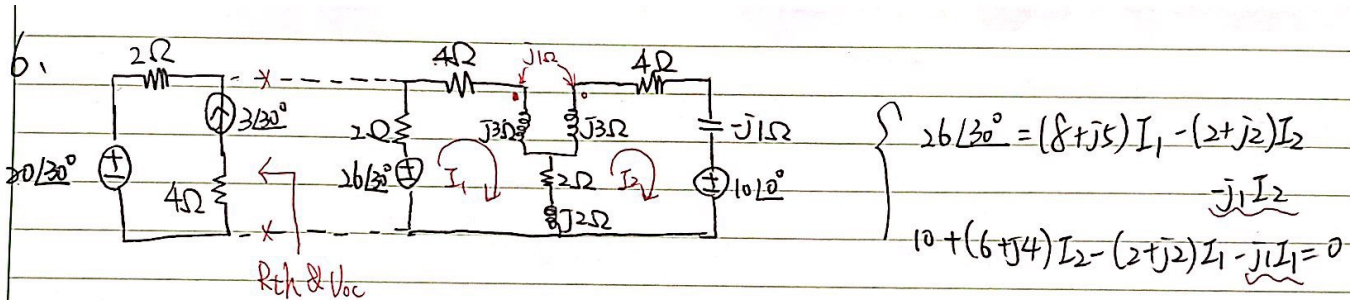
$$V_s \times \frac{\frac{1}{sC_1}}{R_1 + \frac{1}{sC_1}} = V_1, \quad V_1 \times \frac{\frac{1}{sC_2}}{R_2 + \frac{1}{sC_2}} = V_o$$

$$V_s \times \frac{1}{R_1 R_1 C_1 C_2 (s + \frac{1}{R_1 C_1})(s + \frac{1}{R_2 C_2})} = V_o$$

$\frac{1}{R_1 C_1} = 1$ 
 $\frac{1}{R_2 C_2} = 5$

$$C_1 = 10\mu F$$

$$\Rightarrow C_2 = 2\mu F$$



$$\begin{aligned}
 26\angle 30^\circ &= (8+j5)I_1 - (2+j2)I_2 \\
 10 + (6+j4)I_2 - (2+j2)I_1 - j1I_1 &= 0
 \end{aligned}$$

↓

$$R_{th} = 2\Omega, V_{oc} = 20\angle 30^\circ + 2 \times 3\angle 30^\circ = 26\angle 30^\circ$$

$$\begin{cases}
 (8+j5)I_1 + (-2-j3)I_2 = 26\angle 30^\circ \\
 (2+j3)I_1 + (-6-j4)I_2 = 10\angle 0^\circ
 \end{cases}$$

$$V_o = I_2(-j1) + 10\angle 0^\circ$$

$$= 11.43 + j0.0733$$

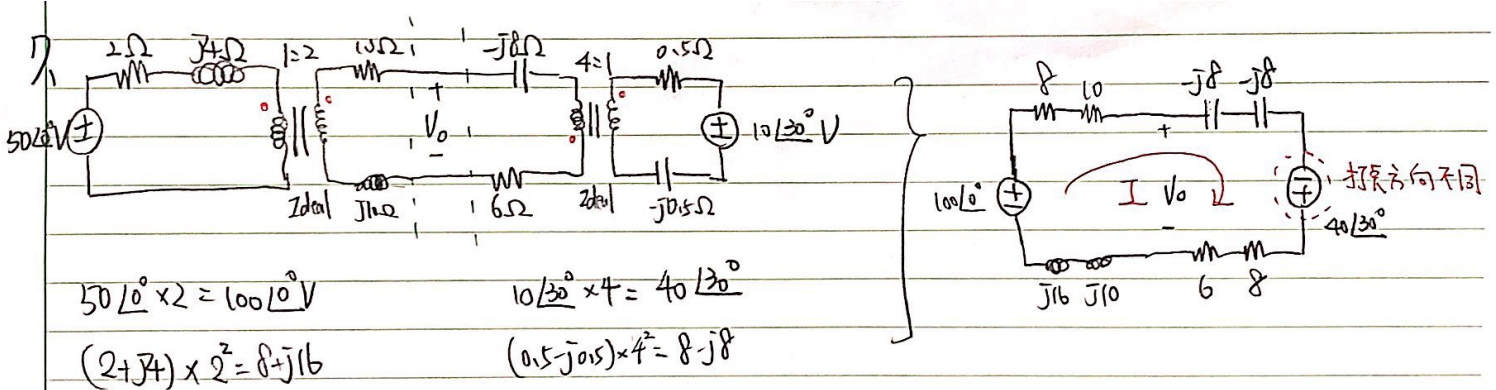
$$= 11.43\angle 0.367^\circ$$

$$I_2 = \frac{-0.0733}{+j1.43}$$

$$\Delta = \begin{vmatrix} 8+j5 & -2-j3 \\ 2+j3 & -6-j4 \end{vmatrix} = -33-j50$$

$$\Delta I_2 = \begin{vmatrix} 8+j5 & 26\angle 30^\circ \\ 2+j3 & 10 \end{vmatrix} = 73.96 - j43.55$$





$$I = \frac{100\angle 0^\circ + 40\angle 30^\circ}{32+j10} = 4.01 - j0.629$$

$$V_0 = 100\angle 0^\circ - (8+10+j16+j10) \times I$$

$$= 11.47 - j92.94$$

$$= 93.65\angle -83^\circ$$