

國立虎尾科技大學 100 學年度研究所（碩士班）考試入學試題

所別：航空與電子科技研究所乙組

科目：專業科目（電子學、電路學、控制系統、通訊系統）

注意事項：

- (1) 共十六大題，任選其中四大題作答，每大題二十五分，共一百分。
 (2) 請於答案卷上註明選答題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。

一、如圖 1 所示，電晶體參數為 $R_L = \infty$, $\beta = \infty$, $R_{B1} = 10 \text{ k}\Omega$, $R_{B2} = 5 \text{ k}\Omega$, $R_E = 8.6 \text{ k}\Omega$, $R_C = 16 \text{ k}\Omega$, $V_{cc} = 15 \text{ V}$, $R_S = 50 \Omega$ 。

- (a) 直流電壓 $V_{CE} = ?$
 (b) 電壓增益 $v_o/v_s = ?$

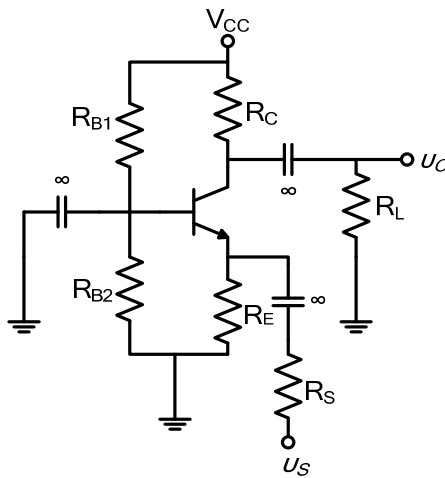


圖 1

二、如圖 2 所示， $\beta = 100$, $R_B = 100 \text{ k}\Omega$, $R_C = 10 \text{ k}\Omega$, $V_{cc} = 10 \text{ V}$ 。

- (a) $I_C = ?$
 (b) $V_{CE} = ?$

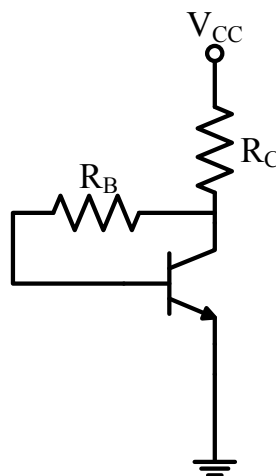


圖 2

三、下圖電路之運算放大器視為理想運算放大器，依據此電路回答下列問題：

- (a) 假設 $V_1 \neq 0, V_2 = 0$ ，試求運算放大器之輸出 V_o ？
- (b) 假設 $V_1 = 0, V_2 \neq 0$ ，試求運算放大器之輸出 V_o ？
- (c) 假設 $V_1 \neq 0, V_2 \neq 0$ ，試求運算放大器之輸出 V_o ？若以此電路實現差動放大器，則其條件與放大增益為何？

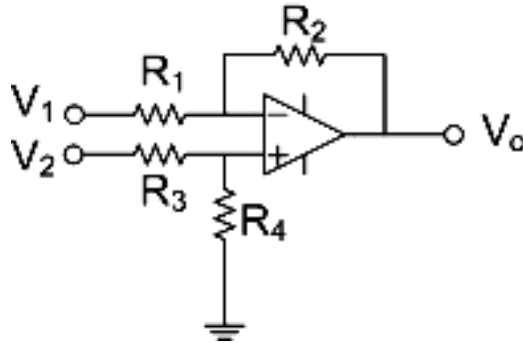
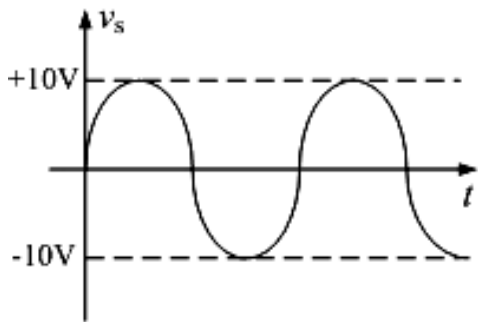
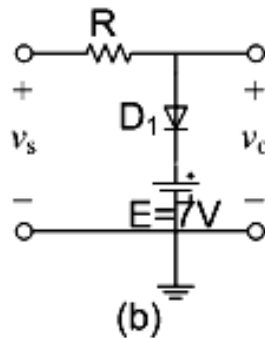


圖 3

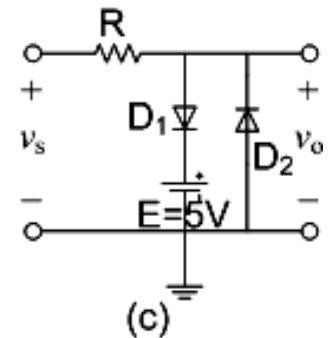
四、下圖電路中，假設二極體皆為理想元件，當輸入信號 v_s 如下圖 4(a) 波形時，試描繪出圖 4(b) 與圖 4(c) 電路之 v_o 輸出波形並詳細說明之。



(a)



(b)



(c)

圖 4

五、脈波函數 $f(t) = \text{rect}(t/2)$ ，假設訊號 $c(t) = f(t) * f(t)$ (其中 * 表示 convolution)。試求 $c(t)$ 的傅立葉轉換。

六、試求下列函數之希伯特轉換 (Hilbert transform)

- (a) $x(t) = \sin(2\pi t)$
- (b) $y(t) = \exp(j2\pi t)$

已知 $1/(\pi)$ 的傅立葉轉換為 $-j \text{sgn}(f)$ 。

七、An frequency-modulated (FM) signal with carrier frequency $f_c = 10\text{MHz}$ is expressed as:

$$s_{FM}(t) = 40 \cos(2\pi f_c t - 4 \cos 2000\pi t + 6 \sin 4000\pi t)$$

where the frequency sensitivity $k_f = 2000 \text{ Hz/volt}$.

- Find the power of the modulated signal.
- Find the maximum frequency deviation Δf .
- Estimate the bandwidth of $s_{FM}(t)$ by using Carson's rule.
- Find the input message signal (the modulating signal) $m(t)$.

八、The message signal is given by $m(t) = 2 \cos(400\pi t)$, and the message signal is **ideally sampled**,

- If the message signal is sampled at a rate of 600Hz, plot the spectrum of the ideally sampled version of this signal (-1.2KHz~+1.2KHz).
- Find the range of permissible cutoff frequency of the ideal LPF filter which is used to reconstruct message signal, $m(t)$, correctly.
- If the message signal is sampled at a rate of 300Hz, plot the spectrum of the ideally sampled version of this signal (-0.8KHz~+0.8KHz).
- Assume the sample signal (from (b)) is passed through an ideal low-pass filter of bandwidth 150Hz. Find the signals (time domain) of the LPF filter's output.

九、請計算出並且畫出圖 5 之電路 a、b 兩端的戴維寧等效電路。

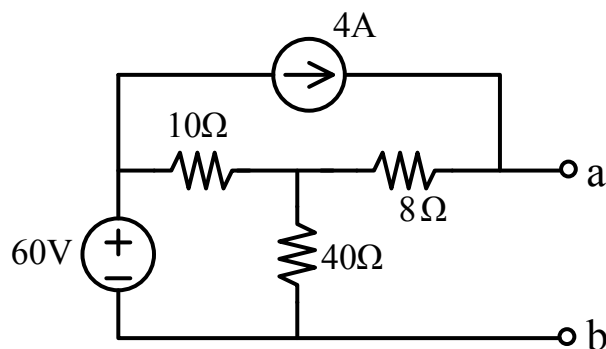


圖 5

十、如圖 6 所示之電路，請計算出電壓 v_o 值。

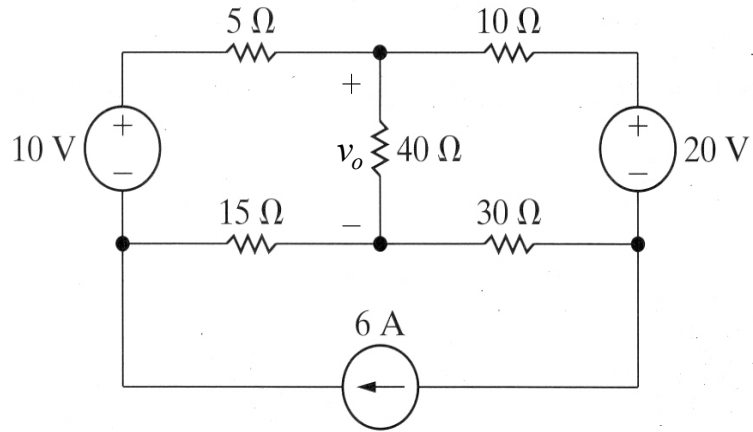
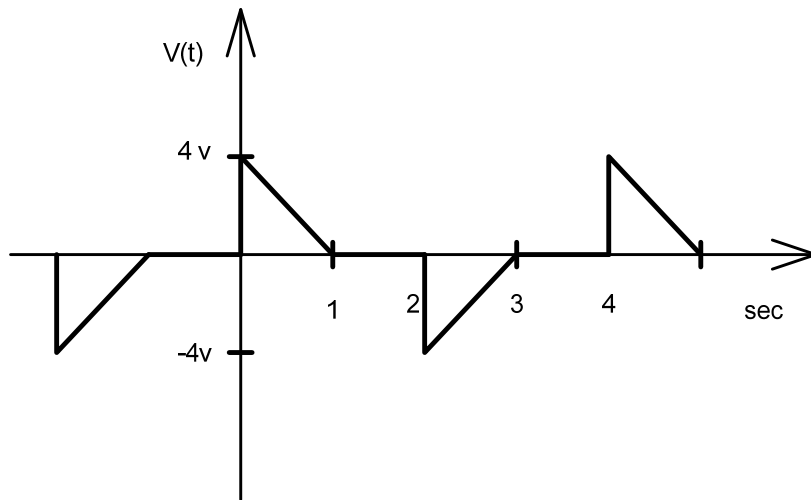
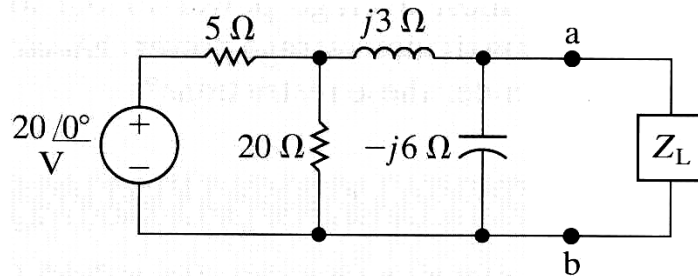


圖 6

十一、試求電壓的均方根值(V_{rms})為何？



十二、試求最大傳送功率的平均功率為何？最大傳送功率時的負載阻抗 Z_L 為何？



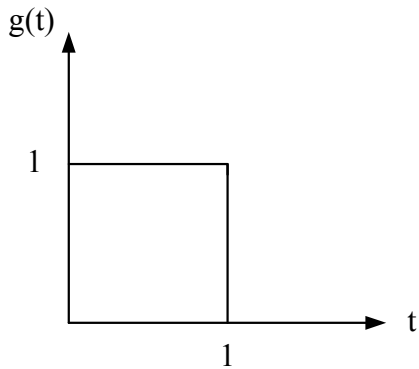
十三、一線性控制系統的狀態方程式為

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & a \\ 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ b \\ 1 \end{bmatrix} u$$

(a) 試求此系統的特徵值(eigenvalues)

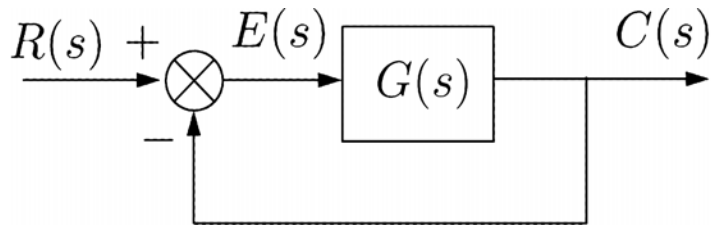
(b) 為使系統為完全可控，a, b 參數間應不具何種關係？

十四、求下圖之拉氏轉換 $G(s)$



十五、Using the Routh-Hurwitz criterion, find the value of K that will yield oscillations for the unity

feedback system: $G(s) = \frac{K}{(s+15)(s+27)(s+38)}$, and calculate the value of oscillation frequency.



十六、The asymptotic logarithmic magnitude curve for a transfer function is given as the following figure. Determine the transfer function which is of the minimum phase with the damping ratio of 0.5

