國立中央大學108學年度碩士班考試入學試題

所別： 光電類

科目： 電子學

本科考試可使用計算器，廠牌、功能不拘

本試題共四大題計算題。 計算題需計算過程，無計算過程者不予計分

1. Design an active filter. According to Fig. 1, please answer the following questions.

2% (a) Please give the types of filter corresponding to the circuits shown in Fig. 1(a) and 1(b).

10% (b) If $R_1=R_2=R_3=R_4=100\,\Omega$ and $C_1=C_2=1\,\mu$F, please give the transfer functions $\mathbf{H}_1(\omega)$ and $\mathbf{H}_2(\omega)$ for Fig. 1(a) and 1(b) and draw the corresponding magnitude Bode plots for each transfer function.

6% (c) Design task 1: Design an active band-pass filter with central frequency at 1000 rad/s and a maximum gain of 5 at the central frequency. Please give the circuit of this band-pass filter and the value of each element.

3% (d) According to the circuit designed in (c), please give its transfer function and explain why this circuit can match the goal in (c).

6% (e) Design task 2: Design an active non-inverting low-pass filter with corner frequency at 1000 rad/s and a gain of 5 within the passband. Please give the circuit of this band-pass filter and the value of each element.

3% (f) What are the differences between passive and active filter? Please list the differences as more as possible

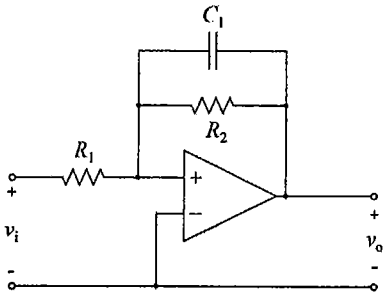

Fig. 1(a)

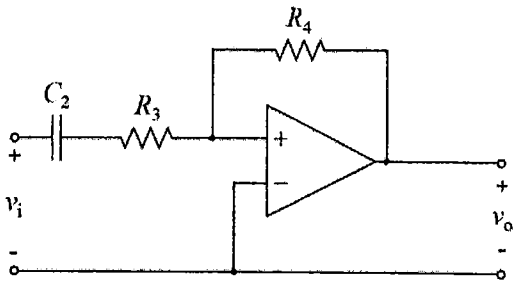

Fig. 1(b)

5% 2. Please give the reason why close-loop gain is preferred rather than open-loop gain for using Op Amp?

15% 3. Use Op Amp circuit to synthesize a signal $s(t)=4\cos(1000t)-5\cos(500t)-2\cos(100t)$ with three given signal sources $\cos(1000t)$, $\cos(500t)$ and $\cos(100t)$. According to the circuit in Fig. 2, please give the values of R_1, R_2 and R_3, and three inputs of $v_1(t)$, $v_2(t)$ and $v_3(t)$ to achieve the output of s.

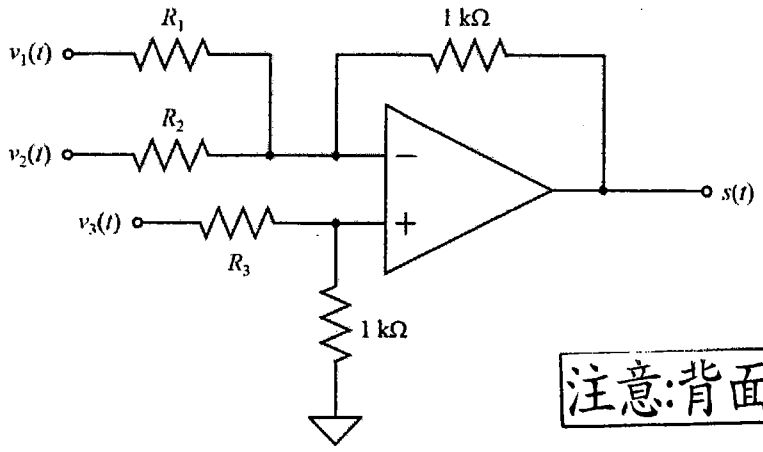

Fig. 2:

注意:背面有試題

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4. Consider the circuit shown in Fig. 3. The parameters are $\beta = 180$,, and the Early voltage $V_A = \infty$, $\upsilon_{o1} = \upsilon_{o2} = 2$ V and $\upsilon_{o4} = 6$ V when $\upsilon_1 = \upsilon_2 = 0$ V.

5% (a) Determine the values of V_1 and V_2;

5% (b) Determine the value of I_R;

5% (c) Determine the values of I_1 and I_2, and explain the reason in details;

5% (d) Determine the value of R_{C1};

5% (e) Determine the value of R_{C2};

5% (f) Determine the voltage gain $A_v \equiv \dfrac{\upsilon_{o4}}{\upsilon_2}$;

10% (g) Determine the differential-mode voltage gain $A_{d1} \equiv \dfrac{(\upsilon_{o1} - \upsilon_{o2})}{(\upsilon_1 - \upsilon_2)}$;

10% (h) Determine the differential-mode voltage gain $A_d \equiv \dfrac{\upsilon_{o4}}{(\upsilon_1 - \upsilon_2)}$.

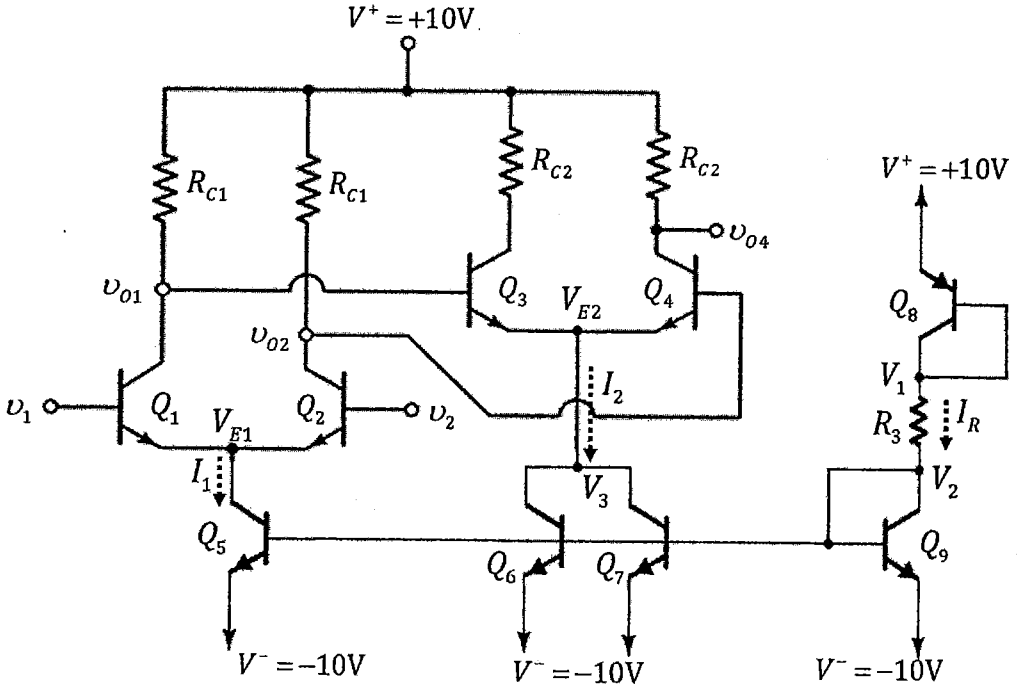

Fig. 3:

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