

國立臺北科技大學

九十四學年度光電與通訊產業研發碩士專班入學考試

電子學試題

填准考證號碼

第一頁 共三頁

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注意事項：

1. 本試題共 6 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

Problem 1: (10%)

Given an ideal OP Amp shown in Fig. 1 as follows:

(a) Find the transfer function $H(s) = \frac{V_o(s)}{V_i(s)}$ (5%)(b) Show that $H(s) = \frac{k\omega_0 s}{s^2\omega_0^2 + \frac{1}{Q}\omega_0 s + 1}$, where the Z's is place of RC, and find k , ω_0 , Q .

(5%)

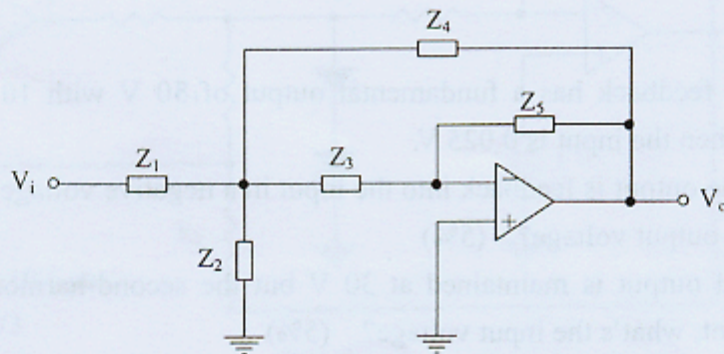


Fig. 1

3-2

Problem 2: (30%)

Assume all the OP Amps. are ideal.

- (a) For the circuit shown in Fig. 2(a), assume $R_1=R_1'$, $R_2=R_2'$ and $R_3=R_3'$, find the difference mode gain. (10%)

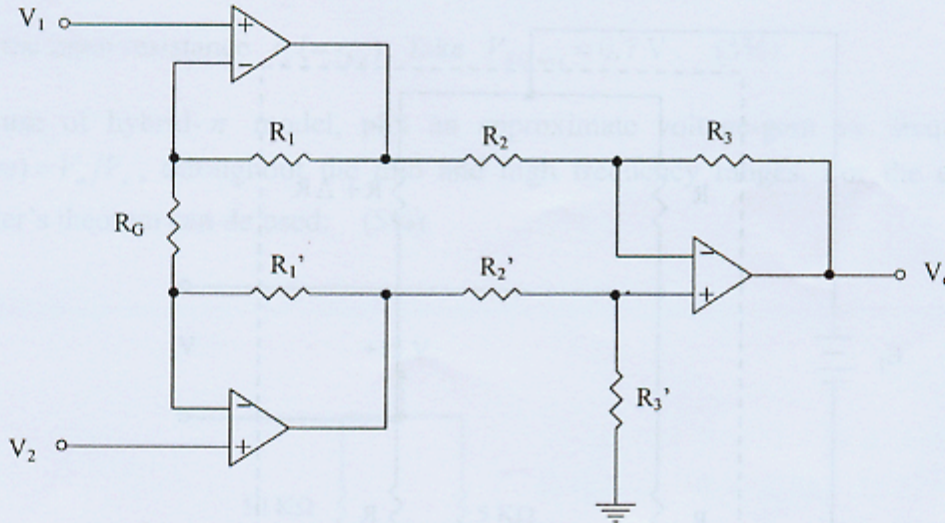


Fig. 2(a)

- (b) If $R_1 \neq R_1'$, $R_2 \neq R_2'$ and $R_3 \neq R_3'$, but R_3 is adjustable. By deriving the equation of V_o , show how to achieve the excellent common mode rejection in Fig. 2(a). (5%)
- (c) For the circuit show in Fig. 2(b), find V_o . (5%)

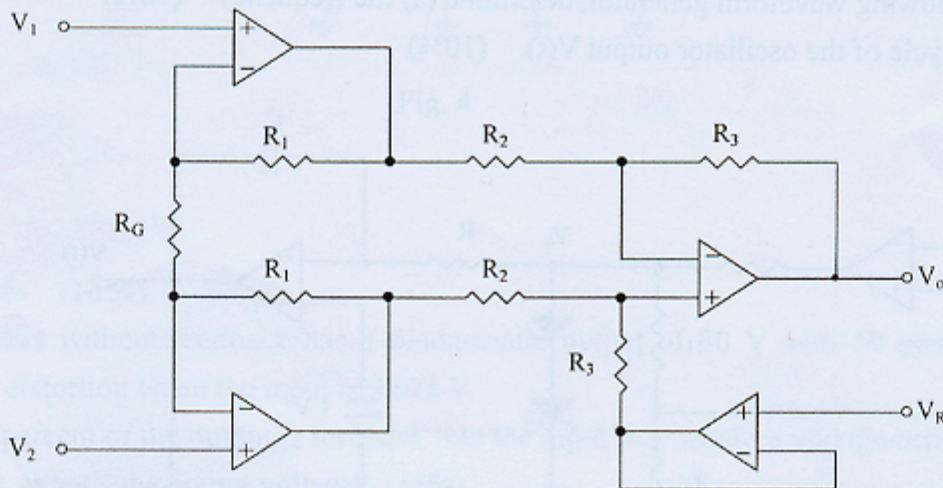


Fig. 2(b)

注意：背面尚有試題

(d) A bridge type transducer is used to detect the sound wave in water as shown in Fig. 2(c). It is found that the difference signal $V_s = V_{DC} + V_{ac}$ where $|V_{DC}| \gg |V_{ac}|$, V_{ac} is a small signal. Our interest is to make good amplification of V_{ac} only. Show how to handle this problem by using Fig. 2(b). Assume R_G is an externally connected component. (10%)

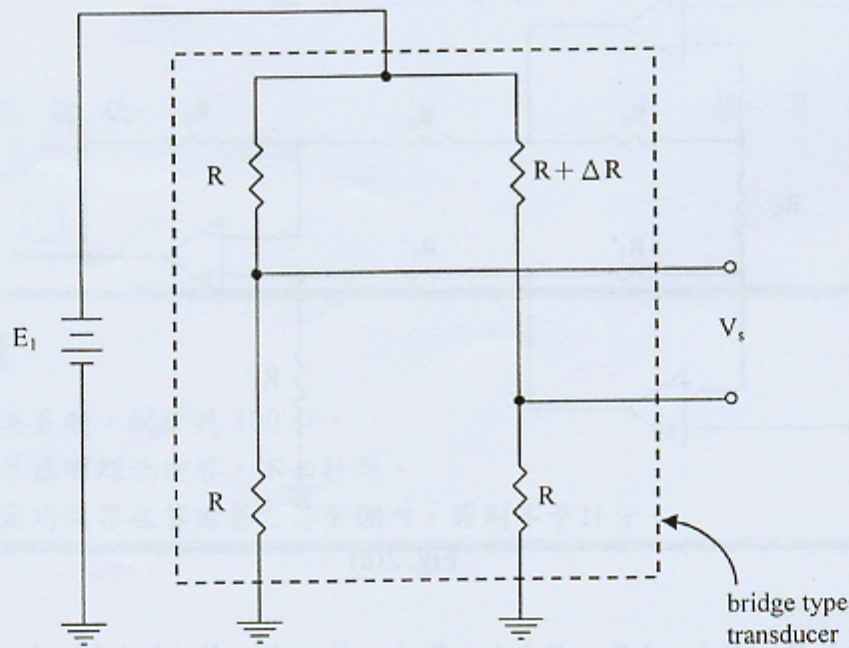
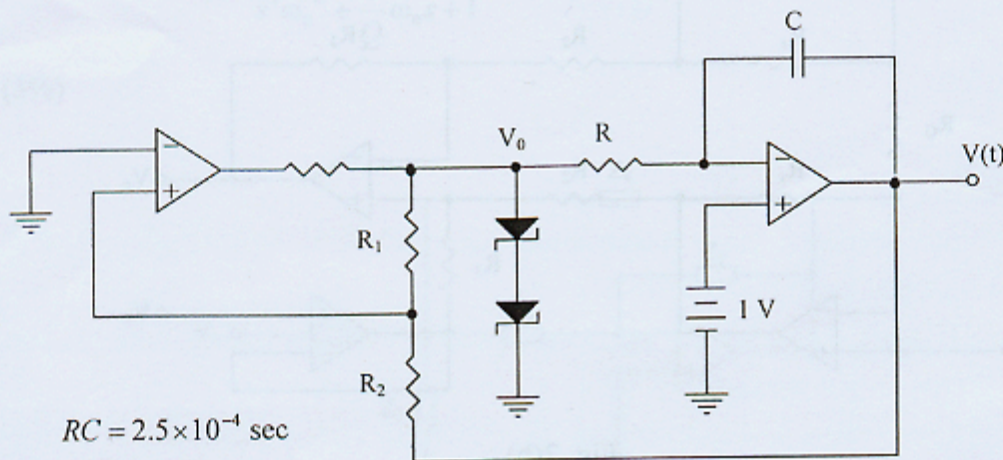


Fig. 2(c)

Problem 3: (20%)

Given the following waveform generator, determine (a) the frequency (10%)

(b) the duty cycle of the oscillator output $V(t)$. (10%)



$RC = 2.5 \times 10^{-4} \text{ sec}$
 $R_1/R_2 = 4/3$
 $|V_0| = 2 \text{ V}$

Fig. 3.

3-4

Problem 4: (10%)

Fig. 4 shows a single-stage high-frequency amplifier, using a silicon transistor.

Form data sheets the device parameters are found to be: h_{FE} = dc current gain = 300,

h_{fe} = small-signal current gain = 350, $C_N = (C_e)$ = emitter-base capacitance = 1.8 PF.

- (a) First, calculate the dc collector current I_c , and then specify the transconductance g_m , and the input resistance $r_{\pi} (= r_{b'e})$. Take $V_{BE(on)} = 0.7$ V. (5%)
- (b) By use of hybrid- π model, plot an approximate voltage-gain vs. frequency curve, $A_v(\omega) = V_o/V_s$, throughout the mid and high frequency ranges. For the effect of C_c , Miller's theorem can be used. (5%)

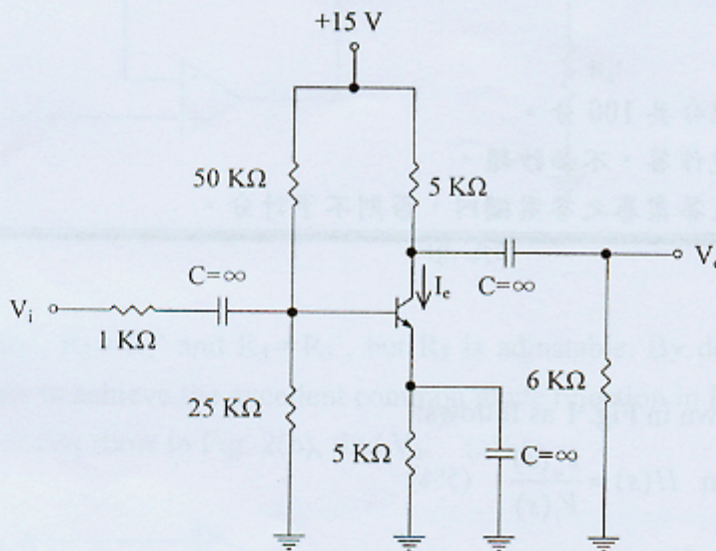


Fig. 4

Problem 5: (10%)

An amplifier without feedback has a fundamental output of 30 V with 10 percent second harmonic distortion when the input is 0.025 V.

- (a) If 1.5 percent of the output is feedback into the input in a negative voltage-series feedback circuit. What's the output voltage? (5%)
- (b) If the fundamental output is maintained at 30 V but the second-harmonic distortion is reduced to 1 percent, what's the input voltage? (5%)

Problem 6 (20%)

Consider a class-B output stage shown in Fig. 6. If the output voltage V_o is a 10-volt-peak sinusoidal voltage, neglecting the crossover distortion, find the following:

- (a) The power take form the supplies (5%)
- (b) The a-c output power delivered to the load resistor R_L (5%)
- (c) The maximum instantaneous power dissipation in Q_1 (5%)
- (d) The efficiency (5%)

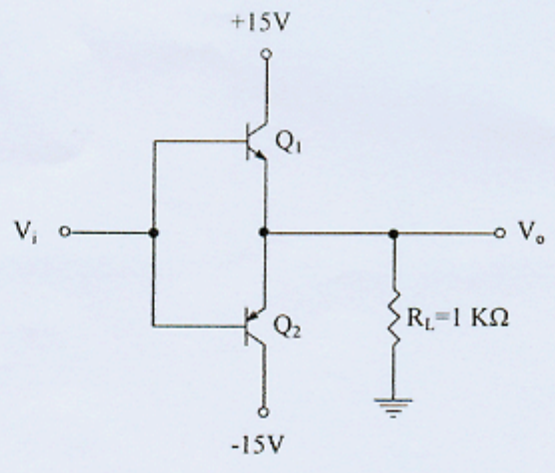


Fig. 6