國立成功大學 106 學年度碩士班招生考試試題

系　所：系統及船舶機電工程學系

考試科目：電子學　　　　考試日期：0213，節次：2

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1、Choice question (20%)

(1) The low frequency response of an amplifier is determined in part by (a) the voltage fain, (b) the type of transistor, (c) the supply voltage, (d) the coupling capacitors.

(2) The Miller input capacitance of an amplifier is dependent, in part, on (a) the input coupling capacitor, (b) the voltage gain, (c) the bypass capacitor, (d) none of these.

(3) Ideally, the mid-range gain of an amplifier (a) increases with frequency, (b) decreases with freaquency, (c) remains constant with frequency, (d) depends on the coupling capacitors

(4) The purpose of a pentavalent impurity is to (a) reduce the conductivity of silicon (b) increase the number of holes (c) increase the number of free electrons (d) create minority carriers

(5) Which one is NOT true when a reverse bias is applied to P-N junction. (a) current flows from n-type to p-type region ; (b) depletion-layer width increases ; (c) diffusion capacitance dominates ; (d) breakdown may take place if the reverse voltage is too high

2、Sketch v_o versus time for the circuit in Figure 1(a) and (b) with the input shown. Assume $V_\gamma = 0$ and $r_f = 0$ for Figure 1(a)；$V_\gamma = 0.7$ and $r_f = 10\Omega$ for Figure 1(b). (10%)

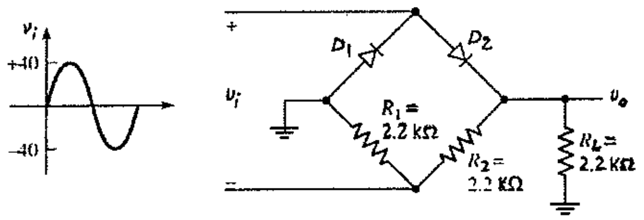

Figure 1 (a)

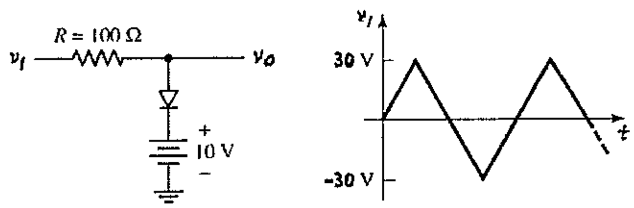

Figure 1 (b)

3、The bridge power amplifier is shown in Figure 2. This amplifier has a very high input resistance since the input is to the noninverting terminal of an op-amp. (a)Derive the expression for the voltage gain $A_v = v_L/v_I$. (b) Design the circuit to provide a gain of $Av=10$ so that the magnitudes of v_{01} and v_{02} are equal. Let $R_1 = 50k\Omega$. (c) If $R_L = 20\Omega$ and if the average power delivered to the load is 10W, determine the peak amplitude of v_{01} and v_{02} and the peak load current. (20%)

4. For each transistor in Figure 3, the parameters are $\beta=100$ and $V_A=\infty$. (a) Determine the Q-point values for both Q_1 and Q_2. (b) Draw the hybrid-π model of the amplifier circuit. (c) Determine the overall small-signal voltage gain $A_v = v_o/v_s$. (d) Determine the input and output resistances R_{is} and R_o. (20%)

國立成功大學 106 學年度碩士班招生考試試題

系　所：系統及船舶機電工程學系

考試科目：電子學

考試日期：0213，節次：2

5. The circuit in Figure 4 is a low-pass active filter. (a) Derive the voltage transfer function $A_v = v_O/v_I$ as a function of frequency. (b) At what frequency is the magnitude of the voltage gain a factor of $\sqrt{2}$ less than the dc value? (This is the -3dB frequency.) (c) Design the low-pass active filter, assume the input resistance is R_1=20 kΩ, the low frequency gain is -15, and the -3dB frequency is 5kHz. (15%)

6、Consider the basic MOSENT amplifier with active load in Figure 5. The transistor parameters are: V_{TN}=1V, V_{TP}= -1V, $(\frac{1}{2})\mu_n C_{ox}=20\mu A/V^2$, $(\frac{1}{2})\mu_p C_{ox}=10\mu A/V^2$ and $\lambda_n=\lambda_p=0.02\ V^{-1}$, (a) Design the circuit such that $I_{REF}=I_O$=0.1 mA. Assume M_1 and M_3 are matched, and the quiescent input voltage is V_{IQ}=2 V. The quiescent output voltage is to be V_{OQ}=2.5 V. (b) Determine the open-circuit small-signal voltage gain. (15%)

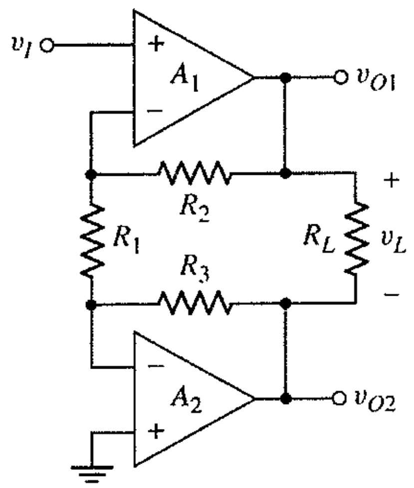

Figure 2

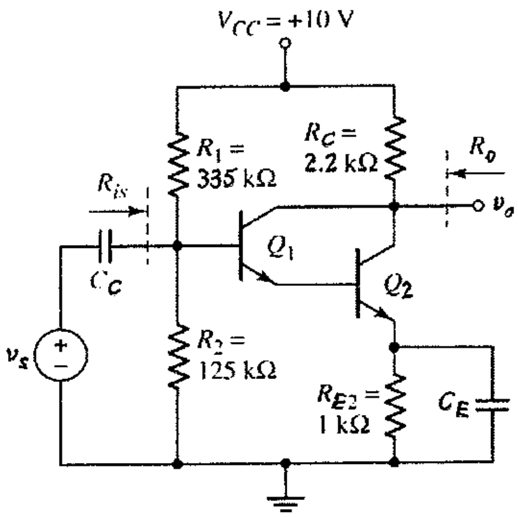

Figure 3

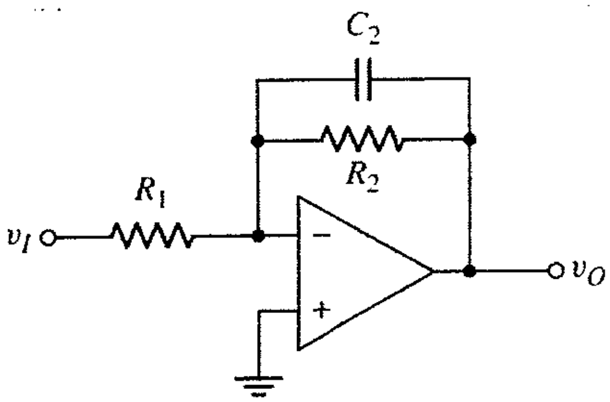

Figure 4

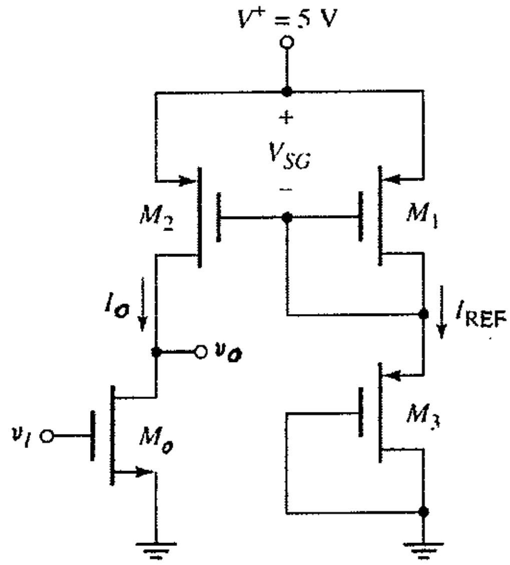

Figure 5