國立臺北科技大學

九十三學年度電腦通訊與控制研究所入學考試

電子學（丙組）試題

填准考證號碼

注意事項：

1. 本試題共【六】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。

1. For the circuit shown in Fig. P1
   (a) Derive an expression for the transfer function V_o/V_i. (6%)
   (b) Find its input impedance. (6%)
   (c) Find V_o(t) as V_i(t)=Acos(ωt). (3%)

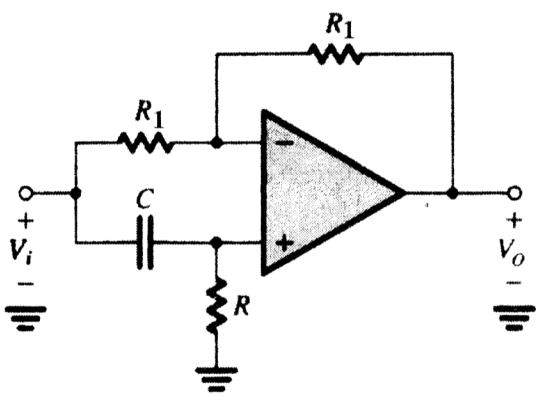

Fig. P1

2. An amplifier has the gain transfer function

$$A(s) = 10^2 \frac{s}{s + 2\pi \times 10^2} \frac{1}{1 + s/(2\pi \times 10^5)}$$

   (a) Sketch a Bode plot for its magnitude, (8%)
   (b) Find the midband gain, (2%)
   (c) Find the lower 3-dB frequency f_L, and the upper 3-dB frequency f_H. (4%)
   (d) Find approximate values for the frequencies at which the gain decreases to unity. (6%)

3. Fig. P3.1 is a voltage follower connected by using the general purpose operational amplifier as shown in Fig. P3.2. But the circuit oscillates, i.e., there is a sinusoidal output signal as zero input.
   (a) What is the cause of the oscillation? (6%)
   (b) Propose a method to stop the oscillation and explain the reason. (6%)

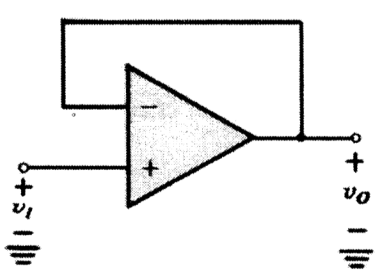

Fig. P3.1

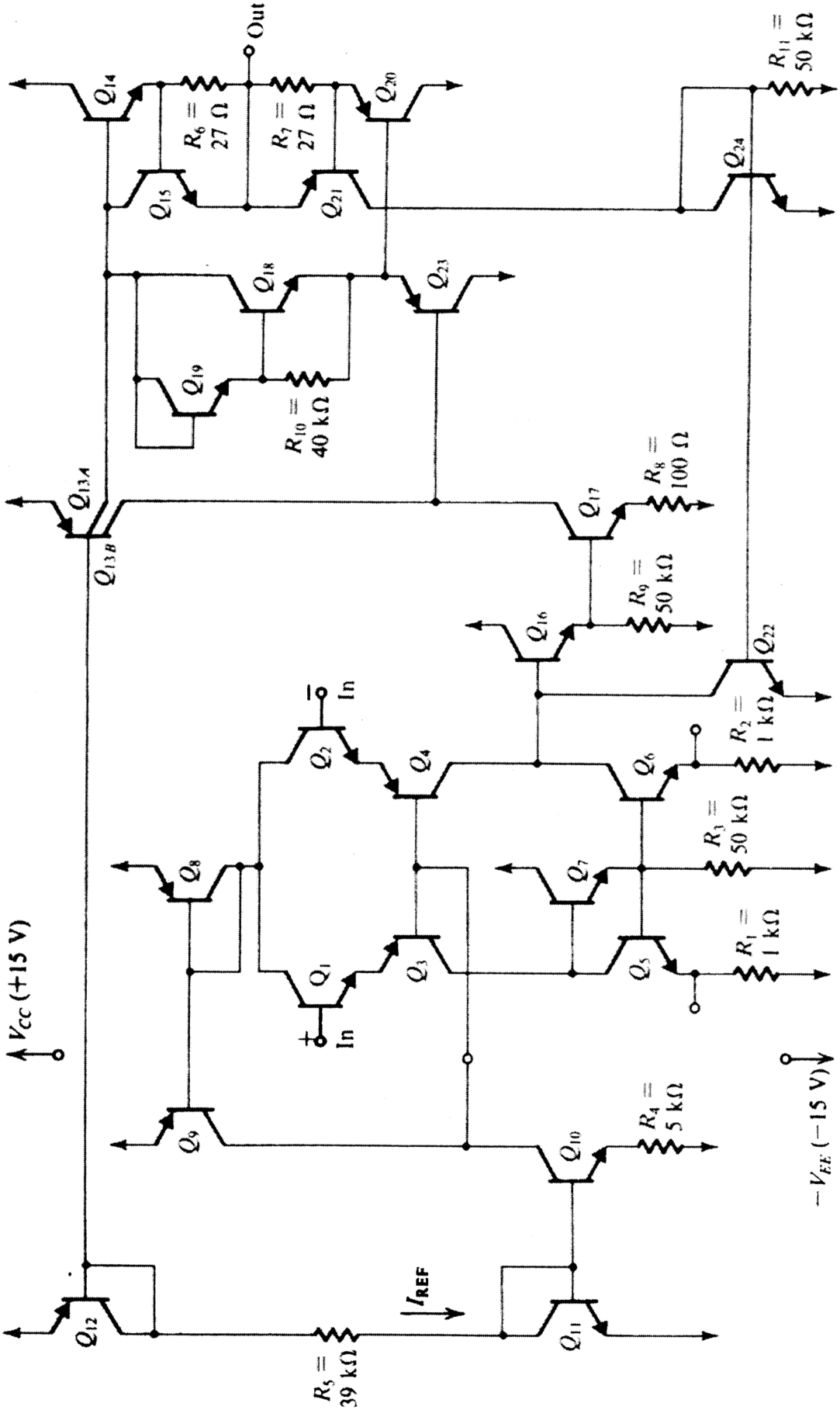

Fig. P3.2

注意：背面尚有試題

4. For the circuit shown in Fig. P4.1, the diodes are assumed to be ideal.
   (a) Describe the transfer characteristic of the circuit. (8%)
   (b) The circuit is driven by the signal as shown in Fig. P4.2, sketch and label the output waveform. (4%)

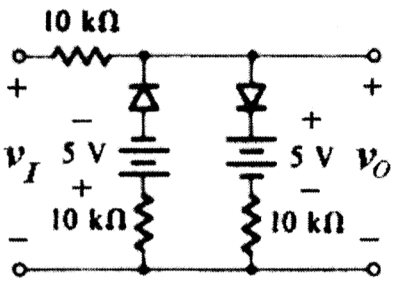

Fig. P4.1

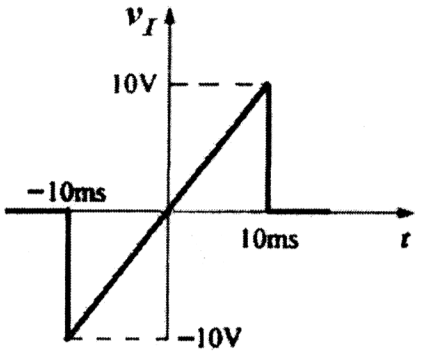

Fig. P4.2

5. For the circuit shown in Fig. P5.1, the diode is assumed to be ideal, $R_2C >> T$ and $R_1C << T$, sketch the output waveform for the input shown as Fig. P5.2. (15%)

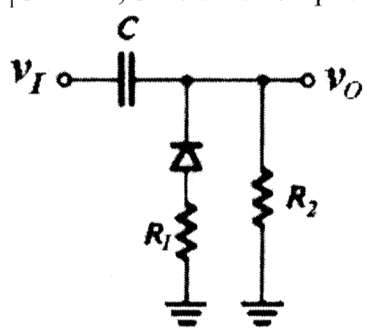

Fig. P5.1

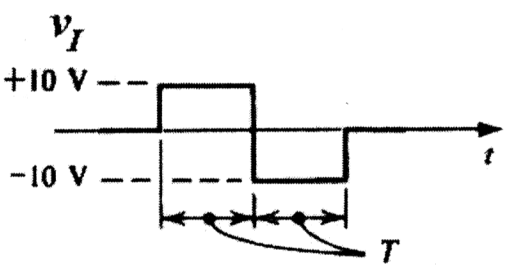

Fig. P5.2

6. Consider the amplifier circuit of Fig. P6 with a bias current I = 1 mA and a collector resistor $R_C = 5\,\text{k}\Omega$. Let the BJT have $\beta = 100$, and neglect the Early effect. The signal source has a resistance $R_S = 5\,\text{k}\Omega$.
   (a) Please sketch the small signal equivalent circuit. (5%)
   (b) Find the value of R_e that gives the amplifier an input resistance four times that of the source.(5%)
   (c) For the resulting circuit, find voltage gain $A_v = \frac{v_o}{v_s}$. (10%)
   (d) If v_π is to be limited to 5 mV, find the maximum v_s that can be applied with and without R_e included. (6%)

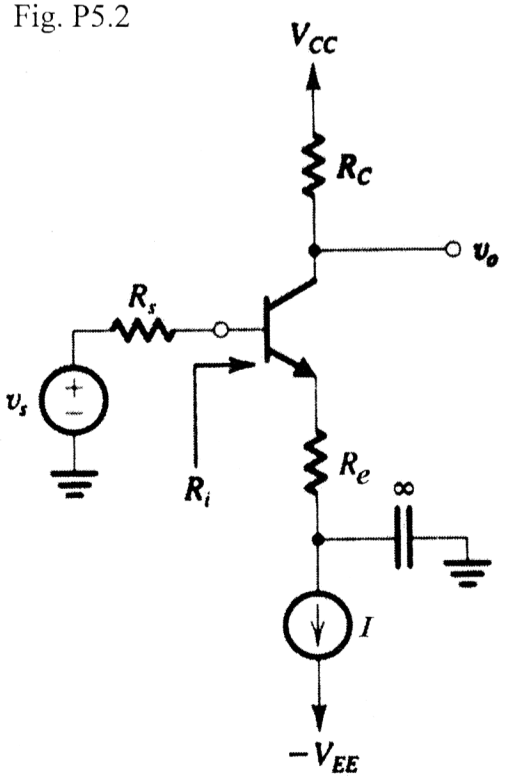

Fig. P6