明新科技大學 101 學年度研究所考試入學招生 試題卷

系所類別	科目	節次	准考證號碼 (考生請填入)	考試 日期
電機工程系碩士班（電機組）	電子學	第一節		101/4/29

※答案須寫在答案卷內，否則不予計分。

1. For the circuit shown in Fig. 1, assume that the diode with constant forward voltage drop V_D=0.7V. The circuit parameters are V_{DD}=5V and R=1kΩ. If the dissipated powers of diode and resistor are named P_D and P_R respectively. Determine the values of P_D and P_R. (10%)

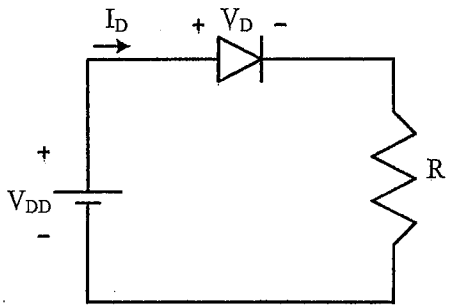

Fig. 1

2. Considering the circuit shown in Fig. 2, assume that the operational amplifier is ideal. Derive the transfer function $A_V(S)=V_O(S)/V_i(S)$. (10%)

3. Considering the circuit shown in Fig. 3, assume that the operational amplifier is ideal, R_1=10kΩ and R_2=50kΩ. If v_i=0.1sin(2000πt), derive the expression of V_O. (10%)

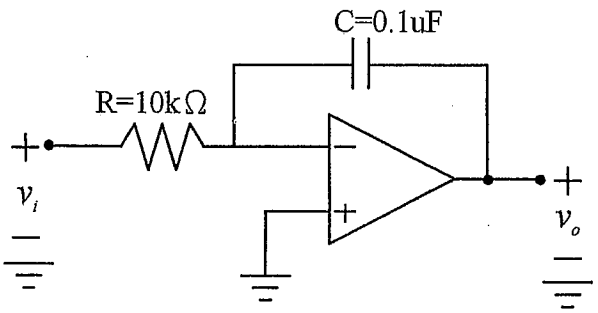

Fig. 2

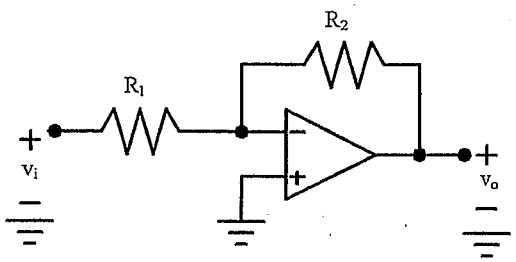

Fig. 3

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4. The operational amplifier circuit shown in Fig. 4 is a hysteresis comparator circuit. Assume that the operational amplifier is ideal and has the output saturation voltages ± 10V. Derive and plot the transfer characteristics between v_o and v_i. (10%)
5. For the circuit shown in Fig. 5, assume that the NPN transistor has β=100 and forward bias V_{BE}=0.7V. Find the values of I_C 、I_E 、V_B 、V_C, and V_E. (10%)

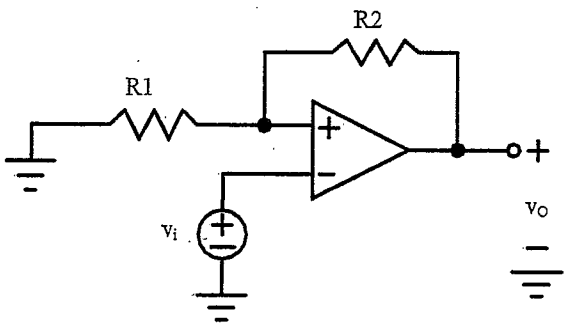

Fig. 4

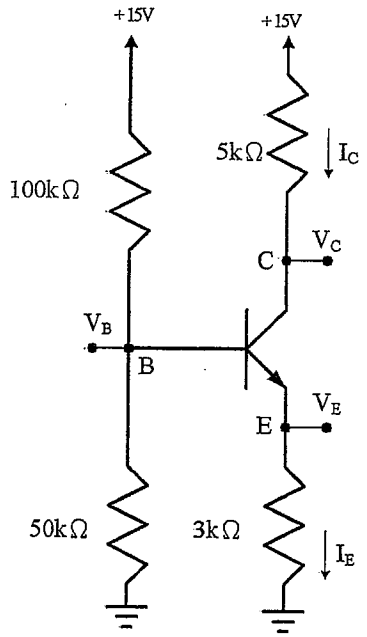

Fig. 5

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6. The small-signal model of an NPN transistor and its amplifier circuit are shown in Fig. 6. (10 %)

(1) Plot the small-signal model of the amplifier circuit. (Hint：Let the current source I be open circuit, the three capacitors be short circuit, and the power supply V_{CC} be grounded.)

(2) Derive the voltage gain $A_v = v_o / v_i$.

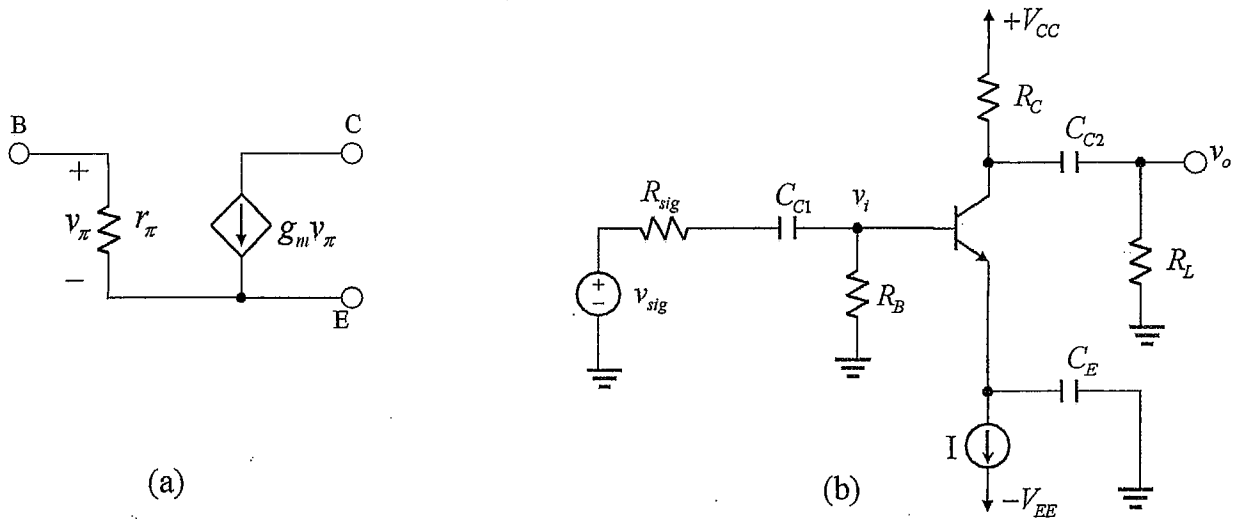

Fig. 6 (a) The small-signal model of an NPN transistor,(b) The NPN amplifier circuit.

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7. The small-signal model of an NMOS transistor and its amplifier circuit are shown in Fig. 7.(10%)
   (1) Plot the small-signal model of the amplifier circuit. (Hint：Let the current source I be open circuit, the three capacitors be short circuit, and the power supply V_{DD} and V_{SS} be grounded.)
   (2) Derive the voltage gain $A_v = v_o / v_i$.

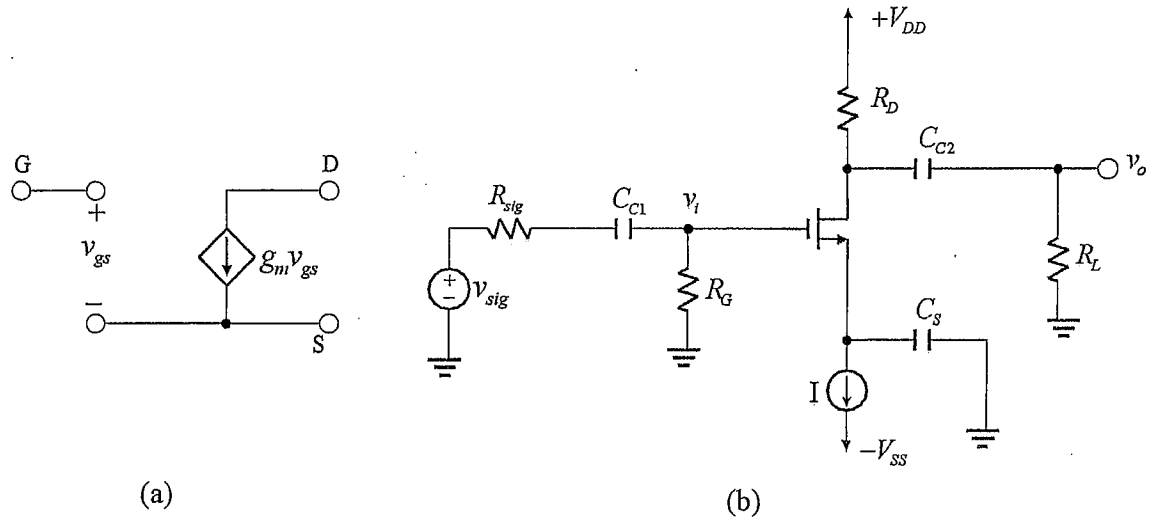

Fig. 7 (a) The small-signal model of an NMOS transistor, (b) The NMOS amplifier circuit.

8. A two-transistor current source (current mirror) is shown in Fig. 8. The current gain for both the transistor Q_1 and Q_2 is β，(a) Write down the expression of I_{REF} in terms of V^+, V^-, V_{BE}, R_1, (b) Write down the relationship between I_O and I_{REF}. (10 %)

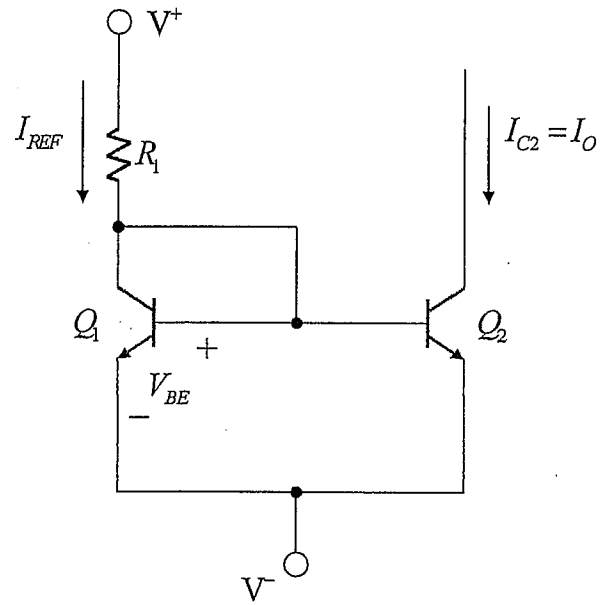

Fig. 8 The current source (mirror) circuit.

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9. A limiter circuit is shown in Fig. 9. The input signal is $v_I(t) = 10\sin\omega t$. The breakdown voltage for the two zener diodes is $V_{Z1} = V_{Z2} = 8\,\text{V}$，The voltage drop for the two zener diodes when conducting in the forward direction is 0.7 V, $R = 10\text{K}\Omega$, Please plot the waveform of the output voltage v_O. (10 %)

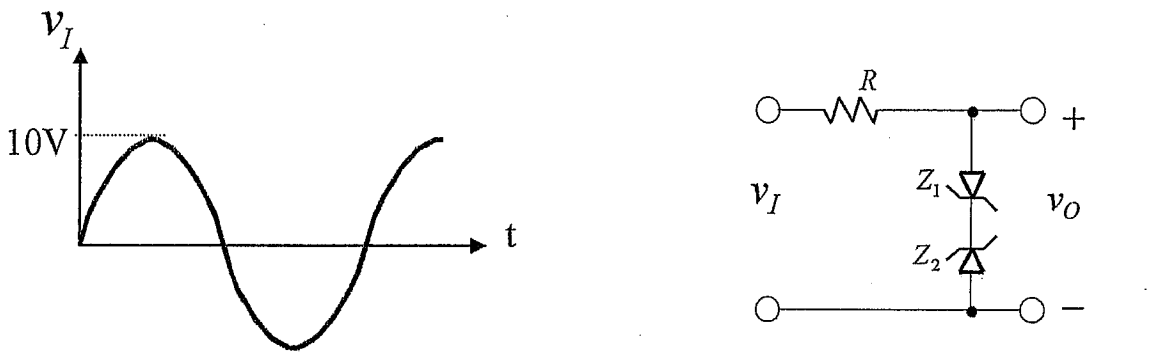

Fig. 9 The limiter circuit and its input waveform.

10. A clamped capacitor (DC restorer) with a load resistance R is shown in Fig. 10. Assuming the diode is ideal, please plot the output waveform of the circuit with the square-wave input. (10 %)

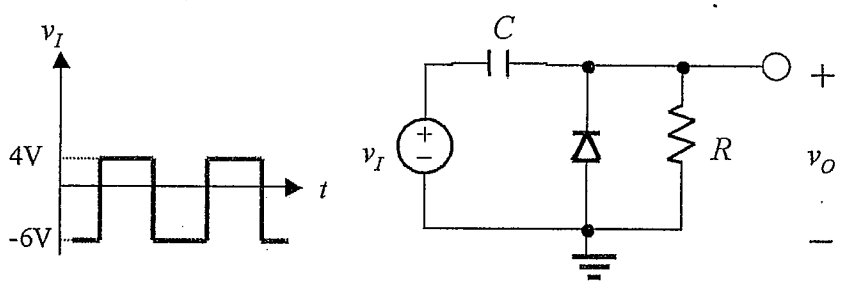

Fig. 10 A clamped capacitor (DC restorer) with a load resistance R