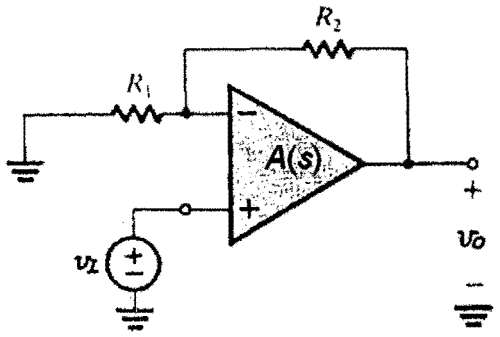
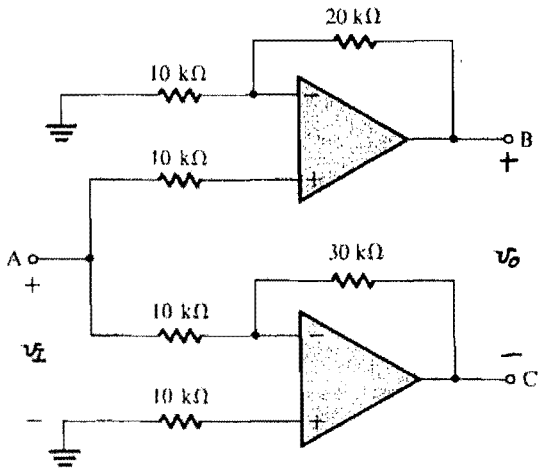
1. A commercial μA741 is employed in the noninverting configuration, $R_1 = 1\,k\Omega$ and $R_2 = 9\,k\Omega$. The op amp has its open-loop gain (or transfer function) as $A(s) = \dfrac{10^4}{1 + \dfrac{s}{2\pi \times 100}}$. (a) Find the closed-loop gain, $G(s) \equiv v_O / v_I$. (8 分) (b) Plot the magnitude and phase responses of $G(s)$. (8 分) (c) If the input signal is $0.1\sin\left(2\pi \times 100 \times 10^3 t\right)$, that is, frequency=100 kHz and amplitude=0.1 V, obtain the output signal. (Note that $1/\sqrt{2} = 0.707$) (4 分)

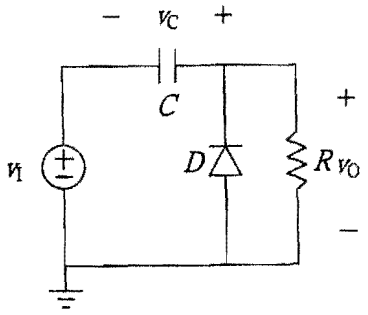


2. The circuit is intended to supply a voltage to floating loads while making greatest possible use of the available power supply. (a) What is the voltage gain v_O / v_I? (6 分) (b) Assuming that the op amps operate from $\pm$15-V power supplies and that their output saturates at $\pm$14-V, what is the largest sine wave output that can be accommodated? Specify both its peak-to-peak and rms values. (Note that $1/\sqrt{2} = 0.707$) (6 分)

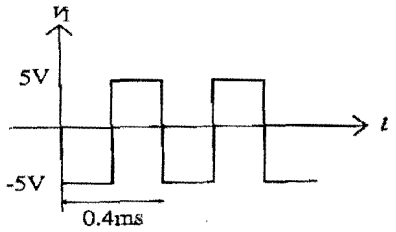


(背面仍有題目,請繼續作答)

3. As shown in the figure, a load resistance R is connected across the diode (D1N4148) in a clamping circuit, where C=1nF and R=100KΩ.

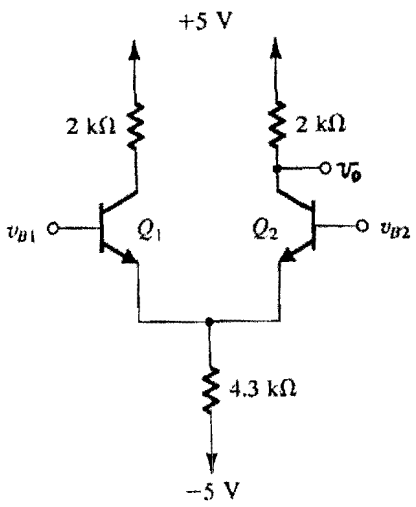


The input is a square wave between -5V and +5V, as shown below.

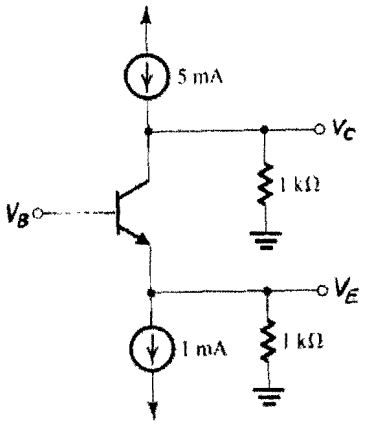


If D1N4148 is modeled by the constant-voltage drop of 0.7V, plot the output waveform. (10 分)

4. For the following circuit, assume that $V_{BE} = 0.7$ V. (a) For $v_{B1} = -v_{id}/2$ and $v_{B2} = v_{id}/2$, find the differential gain. (8 分) (b) For $v_{B1} = v_{B2} = v_{icm}$, find the common-mode gain. (8 分) (c) If $v_{B1} = 0.1\sin 2\pi \times 60t - 0.005\sin 2\pi \times 1000t$ volt and $v_{B2} = 0.1\sin 2\pi \times 60t + 0.005\sin 2\pi \times 1000t$ volt, find v_o. (4 分)



5. For the circuit below, assume $\alpha \cong 1$, V_{BE}=0.4 V and 0.7 V at the edge of conduction and fully conduction, respectively. (a) What are the values of V_E and V_C for V_B=0 V? (6 分) (b) What's the maximum value of V_B for the cutoff of transistor? V_C=? V_E=? (6 分) (c) For what value of V_B does the transistor saturate? V_C=? V_E=? (Note that in saturation, V_{CEsat}=0.2 V) (6 分)



6. A bipolar op-amp circuit with capacitor $C_C = 10$ pF placed in the negative feedback path of Q_5. All transistors have $\beta = 100$, $|V_{BE}| = 0.7$ V, and $r_o = \infty$. (a) The DC voltages of inputs and output are assumed to be 0 V. Find the emitter currents of all transistors. (4 分) (b) Find the gain of the amplifier with $R_L = 10$ kΩ. (10 分) (c) Based on the Miller's theorem , by using the gain of Q_5, C_C can be separated into two capacitors. After doing so, use open-circuit time constant to obtain ω_H. (6 分)