1. (15%) Consider the amplifier of Fig. 1 with a common-mode input voltage of +5 V (dc) and a differential input signal of 10-mV-peak sine wave. Let $(2R_1) = 1$ kΩ, $R_2 = 0.5$ MΩ, and $R_3 = R_4 = 10$ kΩ. Please find the output voltage (v_O).

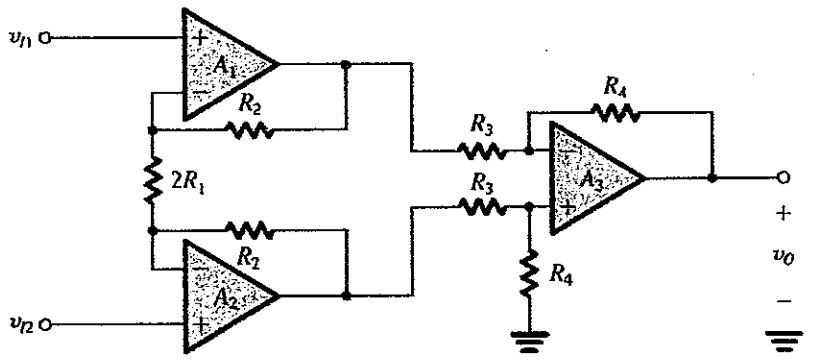

Fig. 1.

2. (20%) The 6.8-V zener diode in the circuit of Fig. 2 is specified to have V_Z =6.8 V at I_Z =5 mA, r_z =20 Ω, and I_{ZK} = 0.2 mA. The supply voltage V^+ is nominally 10 V but can vary by ±1 V. (a) Find V_O with no load and with V^+ at its nominal value. (b) Please find the change in V_O when R_L = 2 kΩ and R_L = 0.5 kΩ. (c) What is the minimum value of R_L for which the diode still operates in the breakdown region?

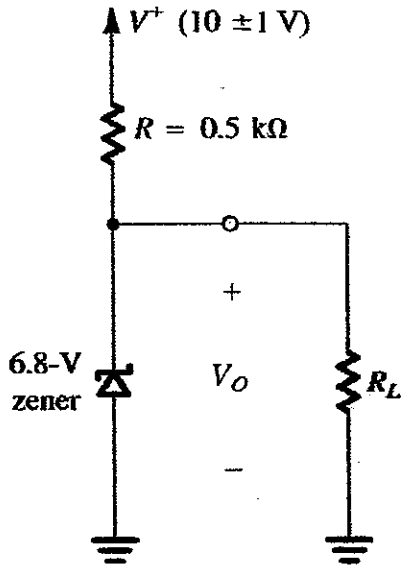

Fig. 2.

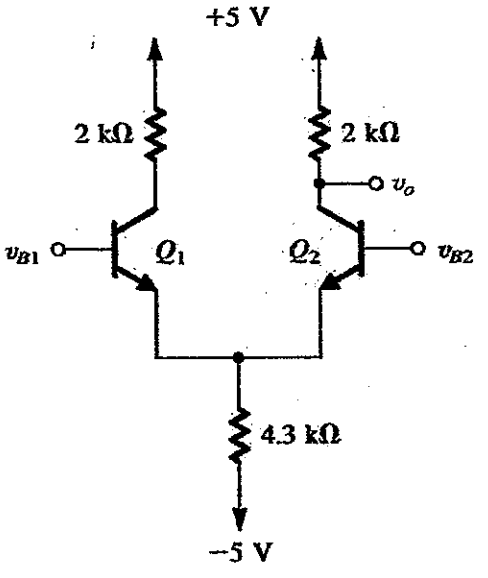

Fig. 3.

3. (15%) The differential amplifier circuit of Fig. 3 utilizes a resistor connected to the negative power supply to establish the bias current I. V_{BE} = 0.7 V.
   (a) For $v_{B1} = v_{id}/2$ and $v_{B2} = -v_{id}/2$, where v_{id} is a small signal with zero average, please find the magnitude of the differential gain, $|v_o / v_{id}|$.
   (b) For $v_{B1} = v_{B2} = v_{icm}$, where v_{icm} has a zero average, find the magnitude of the please common-mode gain, $|v_o / v_{icm}|$.
   (c) Please calculate the CMRR.

見背面

4. (20%) The variable resistor in the circuit in Fig. 4 is adjusted for maximum power transfer to R_O. (a) Find the value of R_O. (b) Find the maximum power that can be delivered to R_O.

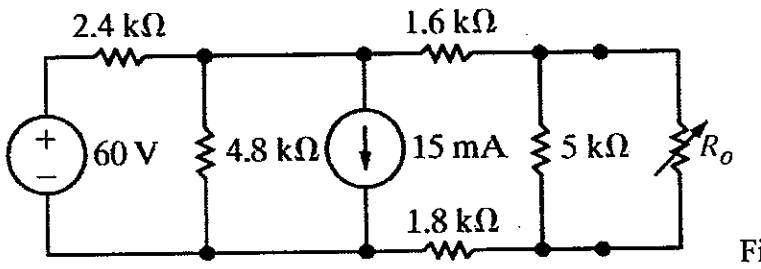

Fig. 4.

5. (20%) The switch in the circuit in Fig. 5 has been in position 1 for a long time. At the $t = 0$, switch moves instantaneously to position 2. (a) Find $v_o(t)$ for $t \geq 0^+$. (b) What percentage of the initial energy stored in the inductor is eventually dissipated in the 6 Ω resistor?

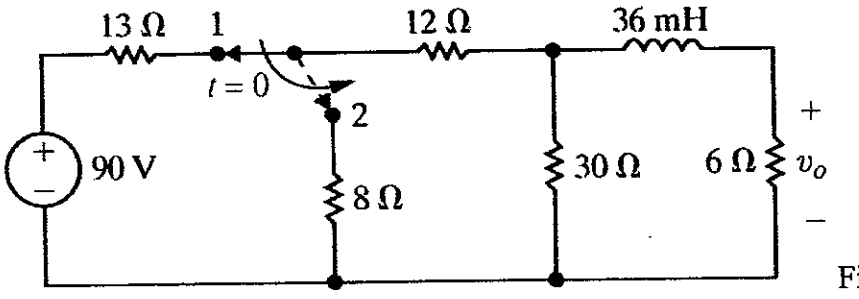

Fig. 5.

6. (10%) Please construct the Bode plots (magnitude and phase) for the transfer function.

$$\mathbf{H}(\omega) = \frac{200j\omega}{(j\omega + 2)(j\omega + 10)}$$

試題隨卷繳回