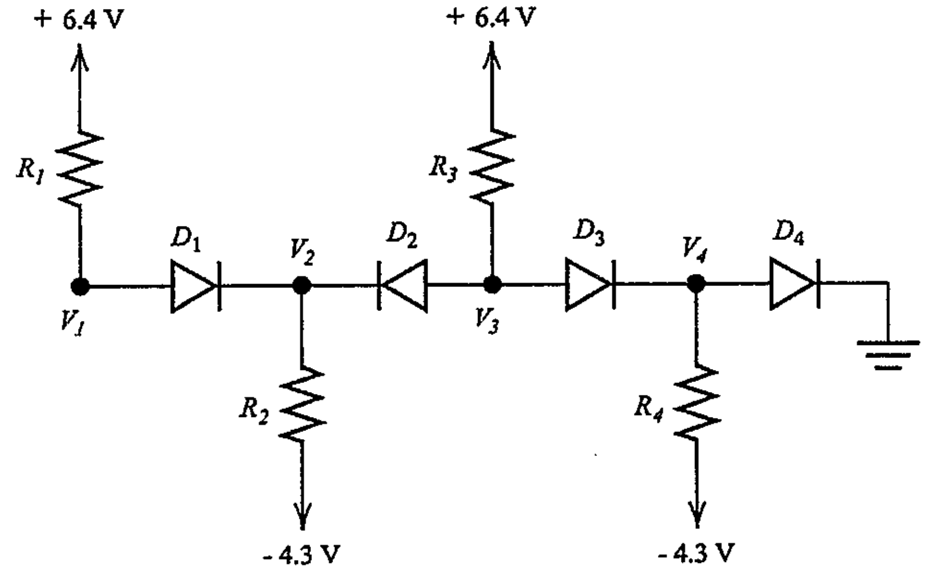
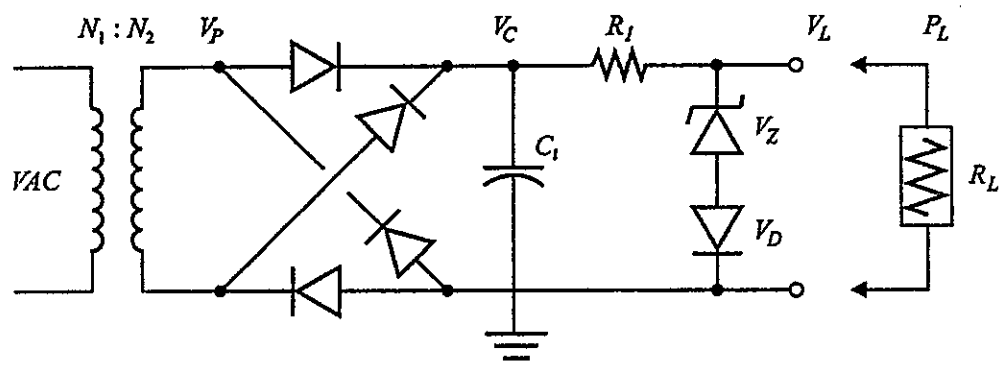
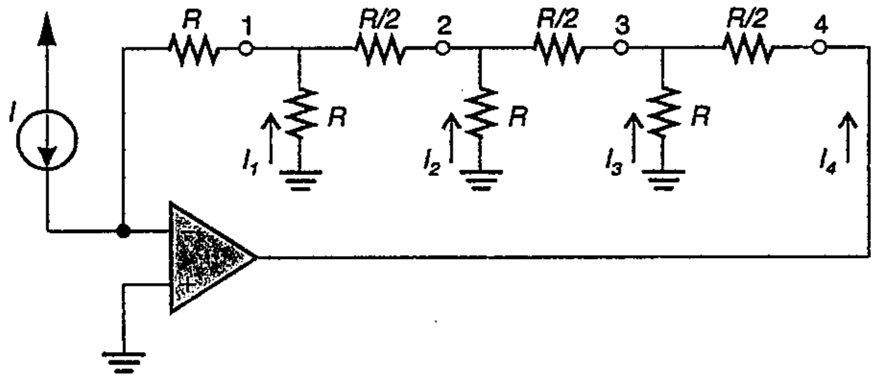
1. (20%) Determine node voltages $V_1$, $V_2$, $V_3$, $V_4$ and the currents through each of the diodes for $R_1 = 4.0\ \text{k}\Omega$, $R_2 = R_3 = 2.5\ \text{k}\Omega$ and $R_4 = 5.0\ \text{k}\Omega$. Assume all the diodes follow common voltage drop (CVD) model.




2. (15%) For the full-wave rectifier (FWR) topology shown in the figure, please choose component values that will support a Zener diode regulated 240 mW, 6V application from a 120 V, 60 Hz power tap. Transformer turns ratio $N_{12} = 12{:}1$. Assume all diodes are Si power diodes ($V_D = 0.8$ V).
   (a) Determine $V_C$ and $V_P$.
   (b) If $V_C(\text{min}) = 8.0\ V$ with the load connected, what values of $R_1$ and $C_1$ are required, assuming that the current through the Zener diode approaches zero when $V_C$ approaches $V_C(\text{min})$.
   (c) What average power must the Zener diode dissipate when the load is not connected?

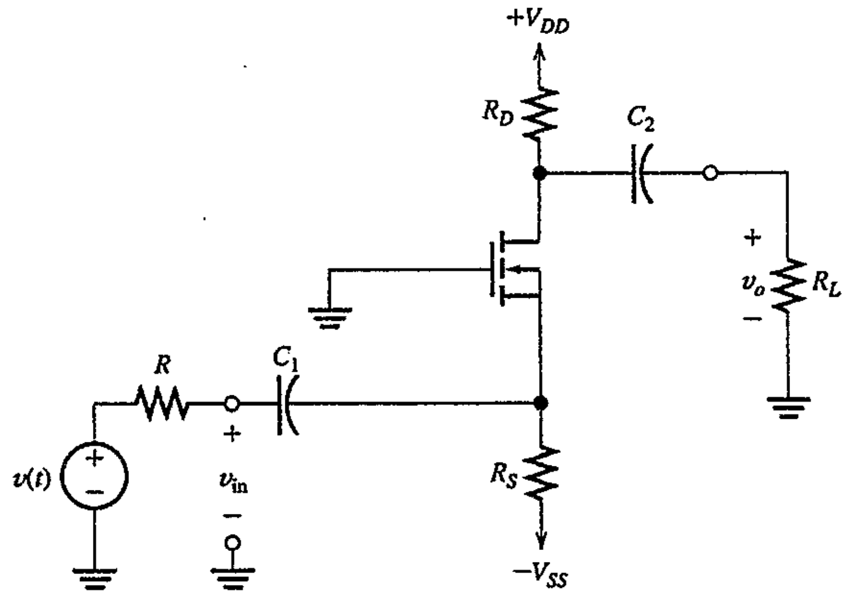



3. (20%) The circuit is shown in the figure. Assume the OP amplifier is ideal. Please answer the questions in terms of the resistance $R$ and the input current $I$.
   (a) Find the resistances looking into node 1, $R_1$; node 2, $R_2$; node 3, $R_3$; and node 4, $R_4$.
   (b) Find the currents $I_1$, $I_2$, $I_3$, and $I_4$.
   (c) Find the voltages at nodes 1, 2, 3, and 4, that is, $V_1$, $V_2$, $V_3$, and $V_4$.

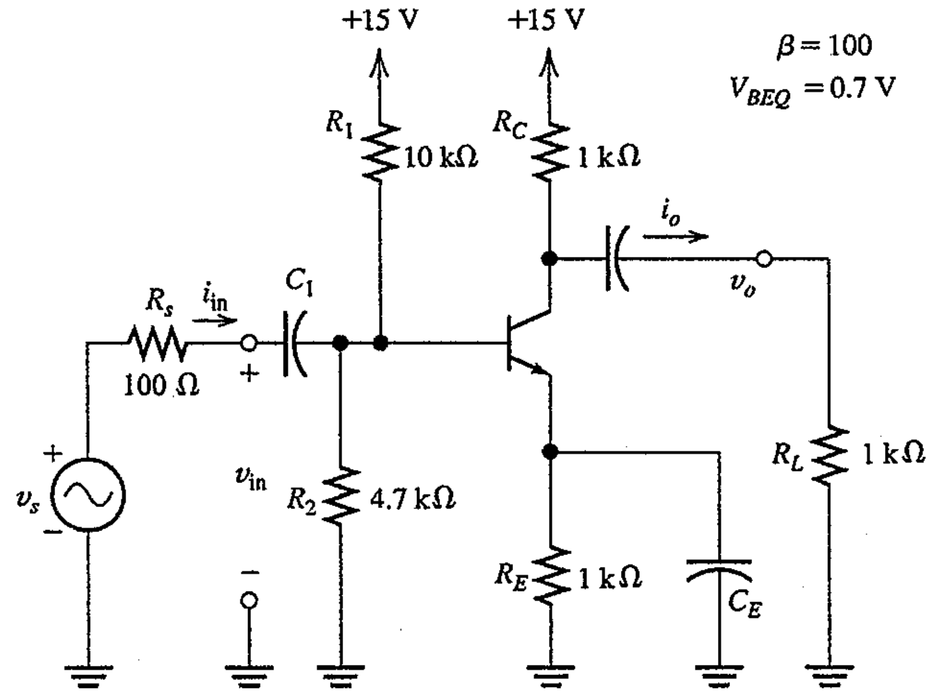



見背面

4. (20%) Consider the common-gate amplifier shown in the figure. The MOSFET has $K = 1.5\, mA/V^2$ and $V_{to} = 1$V, $r_d = \infty$. The supply voltages are $V_{DD} = 15$ V and $V_{SS} = 15$ V. The resistances are $R_S = 3$ kΩ, $R_L = 10$ kΩ, and $R_D = 3$ kΩ. Determine the $Q$ point and the transconductance of the device, $g_m$. Determine the input resistance and the voltage gain.




5. (25%) Consider the common-emitter amplifier of the figure.
   (a) Draw the dc circuit and find $I_{CQ}$. Find the resistance, $r_\pi$, in the small-signal equivalent circuit. Then calculate values for voltage gain $A_v$, the voltage gain in an open circuit $A_{vo}$, input impedance $Z_{in}$, the current gain $A_i$, the power gain $G$, and output impedance $Z_o$. Assume that the circuit is operating in the midband region for which the coupling and the bypass capacitors are short circuits.
   (b) Repeat (a) if all resistance values, including $R_S$ and $R_L$, are increased in value by a factor of 100. Prepare a table comparing the results for the low-impedance amplifier with those for the high-impedance amplifier.




試題隨卷繳回