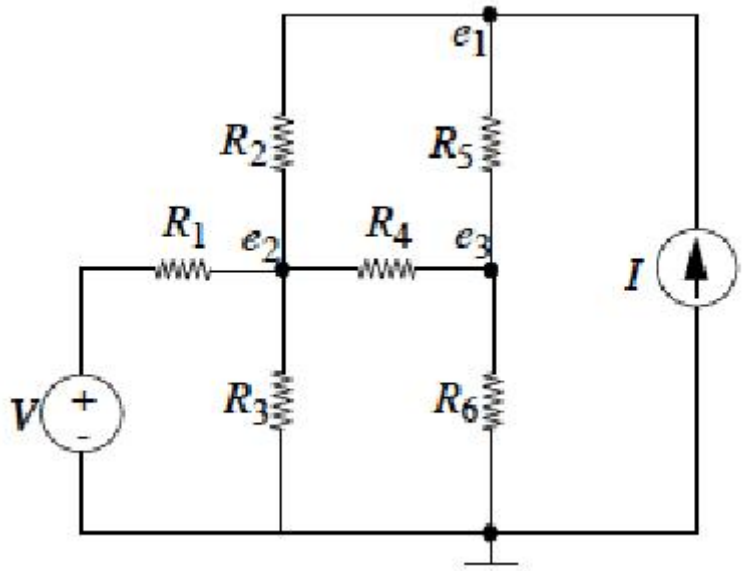
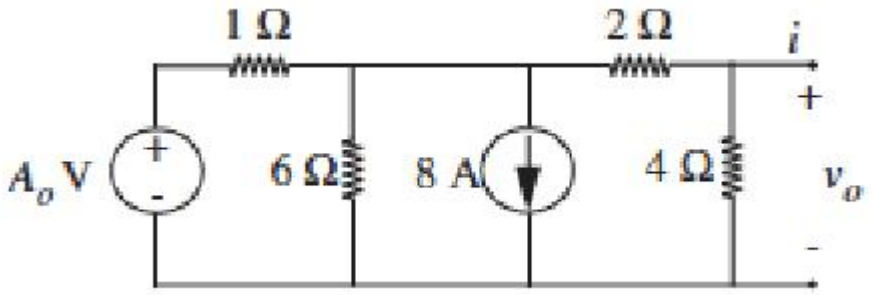
模拟题

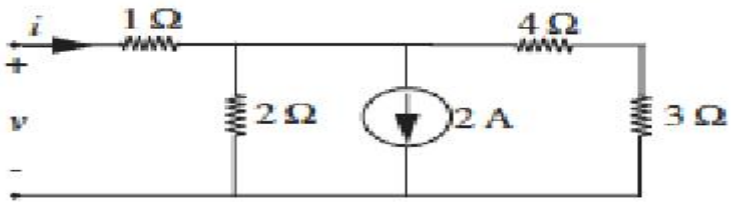
1、针对e_1, e_2, e_3节点，列出节点方程，并用矩阵形式$G\begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = S$表示。



2、请写出v_0的表达式，分别使用节点法和叠加法。



3、请给出下列图像中的戴维南等效以及诺顿等效，并给出对应的 i-v 关系图。



4、请完成下列各个问题。

EXERCISE 6.3 Figure 6.60 shows an inverter circuit using a MOSFET and a resistor. The MOSFET has a threshold voltage $V_T = 2$ V. Assume that $V_S = 5$ V and $R_L = 10$ kΩ. For this exercise, model the MOSFET using its switch model. In other words, assume that the on-state resistance of the MOSFET is 0.

a) Draw the input versus output voltage transfer curve for the inverter.

b) Does the inverter satisfy the static discipline for the voltage thresholds $V_{OL} = 1$ V, $V_{IL} = 1.5$ V, $V_{OH} = 4$ V and $V_{IH} = 3$ V? Explain. (Hint: To satisfy the static discipline, the inverter must interpret correctly input values that are valid logic signals. Furthermore, given valid logic inputs, the inverter must also output valid logic signals. Valid logic 0 input signals are represented by voltages less than V_{IL}, valid logic 1 input signals are represented by voltages greater than V_{IH}, valid logic 0 output signals are represented by voltages less than V_{OL}, and valid logic 1 output signals are represented by voltages greater than V_{OH}.)

c) Does the inverter satisfy the static discipline if the V_{IL} specification was changed to $V_{IL} = 2.5$ V? Explain.

d) What is the maximum value of V_{IL} for which the inverter will satisfy the static discipline?

e) What is the minimum value of V_{IH} for which the inverter will satisfy the static discipline?

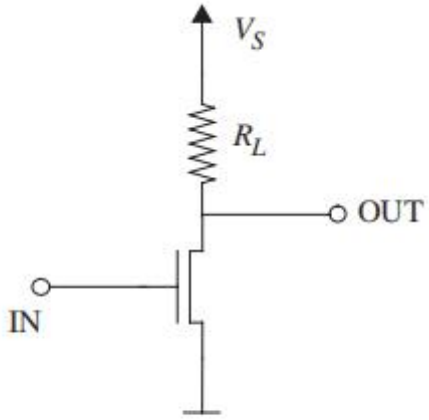


FIGURE 6.60

5、请完成下述问题。

EXERCISE 8.4 Consider the MOSFET amplifier shown in Figure 8.50. Assume that the amplifier is operated under the saturation discipline. In its saturation region, the MOSFET is characterized by the equation

$$i_{DS} = \frac{K}{2}(v_{GS} - V_T)^2$$

where i_{DS} is the drain-to-source current when a voltage v_{GS} is applied across its gate-to-source terminals.

a) Write an expression relating v_O to v_I. What is its operating-point output voltage V_O, given an input operating-point voltage of v_I? What is the corresponding operating-point current I_{DS}?

b) Assuming an operating-point input voltage of V_I, derive the expression relating the small-signal output voltage v_o to the small-signal input v_i from the relationship between v_O and v_I. What is the small-signal gain of the amplifier at the input operating point of V_I?

c) Draw the small-signal equivalent circuit for the amplifier based on the SCS model of the MOSFET assuming the operating-point input voltage is V_I.

d) Derive an expression for the small-signal gain of the amplifier from the small-signal equivalent circuit. Verify that the gain computed from the small-signal equivalent circuit is identical to the gain computed in part (b).

e) By what factor must R_L change to double the small-signal gain of the amplifier? What is the corresponding change in the output bias voltage?

f) By what factor must V_I change to double the small-signal gain of the amplifier? What is the corresponding change in the output bias voltage?

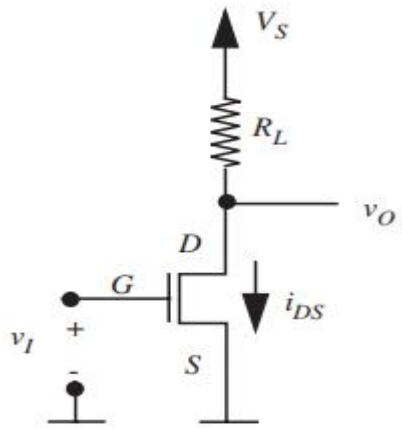
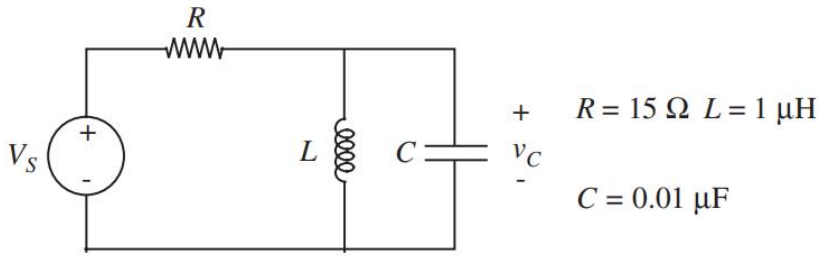


FIGURE 8.50

6、请回答下述问题。

a) Is the zero input response of the circuit shown in Figure 12.64 under-damped, over-damped, or critically-damped?



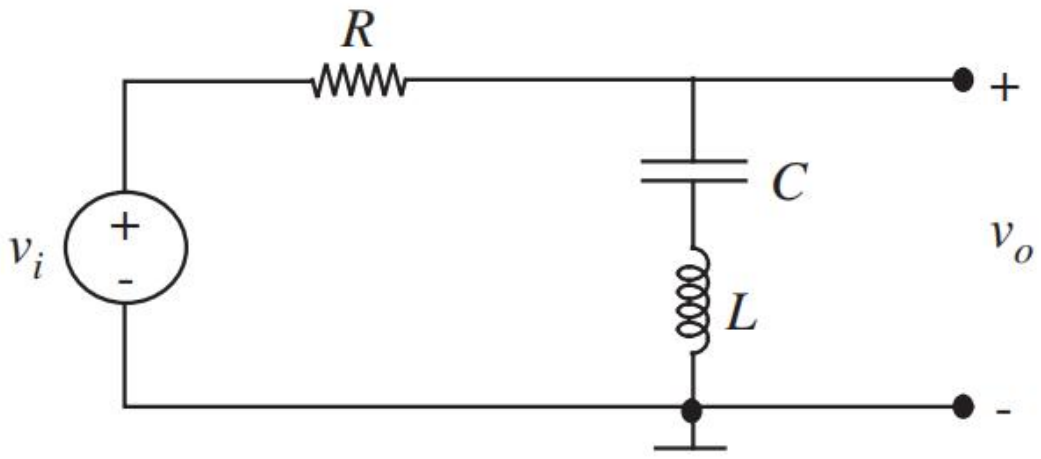
b) What is the form of the zero input response (v_C) for the same circuit? Make a rough sketch.

7、请回答下述问题。

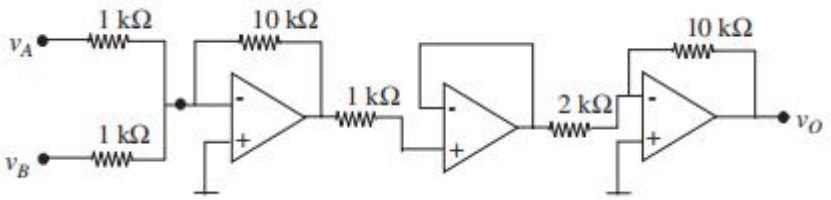
EXERCISE 14.9

a) In the circuit in Figure 14.52, find an expression for the complex amplitude V_o as a function of V_i after transients have died out, assuming v_i is a sinusoid: $v_i = V_i \cos(\omega t)$.

b) Find $v_o(t)$ at the frequency $\omega_0 = 1/\sqrt{LC}$.



8、请计算v_O，其中$v_A = 0.1V, v_B = 0.2V$。



9、请完成下述问题。

EXERCISE 15.4 The circuit in Figure 15.44 is called a differential amplifier.

a) Using the ideal Op Amp model, derive an expression for the output voltage v_O in terms of v_1, v_2, R_1, R_2, R_3, and R_4.

b) Does connecting a load resistor R_L between the output and ground change the previous expression for v_O? Why?

c) Let $v_1 = v_2$ and $R_1 = 1\ \text{k}\Omega$, $R_2 = 30\ \text{k}\Omega$, and $R_3 = 1.5\ \text{k}\Omega$. Find R_4 so that $v_O = 0$.

d) Let $v_2 = 0$ and $v_1 = 1$ V. Using the preceding resistor values (including that computed for R_4), find v_O.

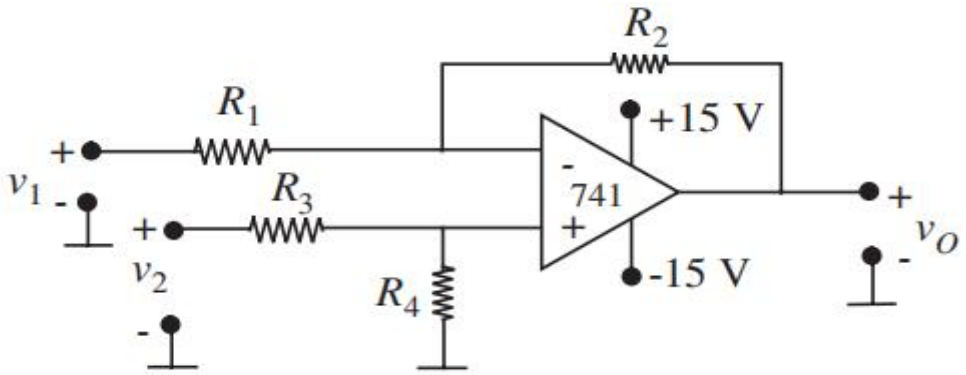
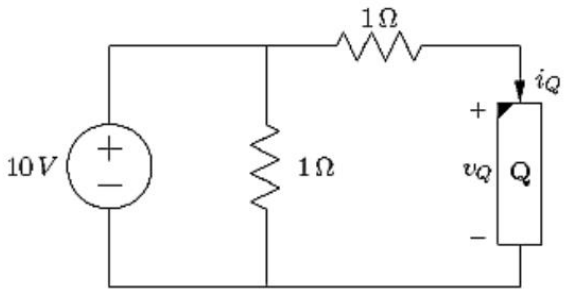


FIGURE 15.44

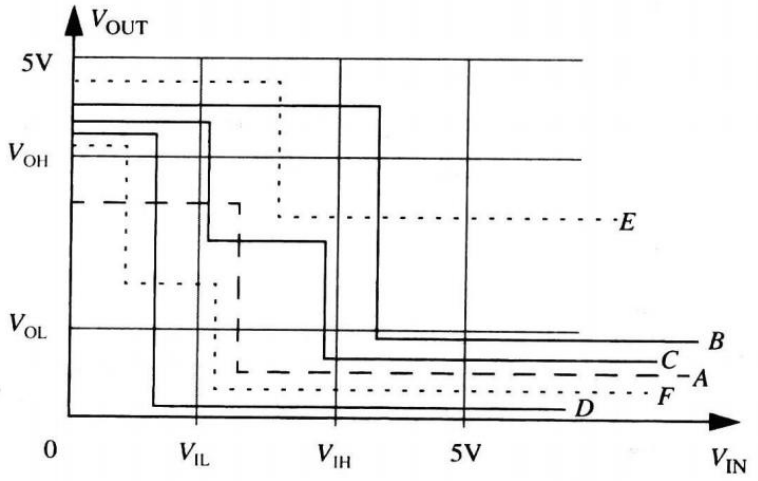
10、(5 Points) 电路网络中元件 Q 的 *i-v* 关系如下，请求解v_Q

$$i_Q = v_Q^2 + 2v_Q \quad v_Q > 0$$
$$i_Q = 0 \quad v_Q \le 0$$



$v_Q =$	$\frac{-3+\sqrt{11}}{2}V$	$1V$	$2V$	$\frac{-3+\sqrt{29}}{2}V$	$10V$

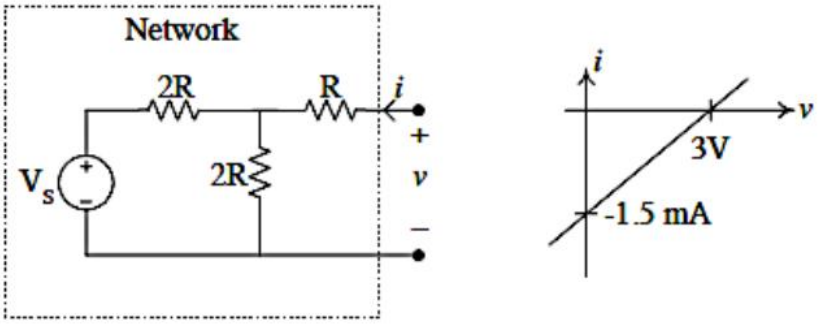
11、（5 Points ）如图所示单输入单输出器件的输入输出电压传递函数，对于给定的电压阈值，哪些器件可以作为有效的反相器？



2、（本小题 15 分）电路网络如图所示。

（1）请给出该电路网络的戴维南等效电路。

（2）请根据右侧的 *v*-*i* 关系，确定该电路网络的元件参数。



3、（本小题 10 分）请用**叠加法或节点法**分析下列电路网络。