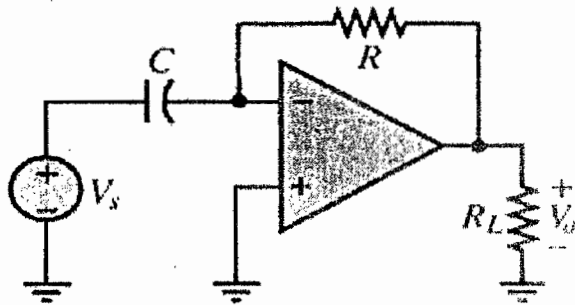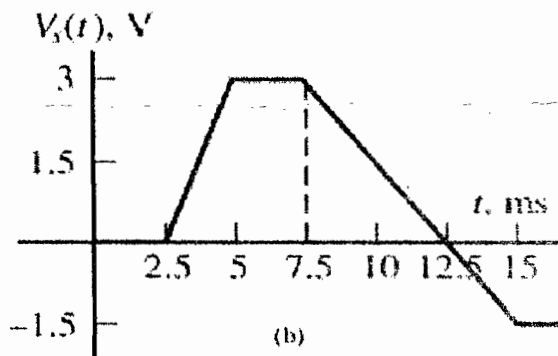1. Give a circuit shown in the part (a) of the following figure, where V_s is the input voltage and its waveform is given as part (b). Please calculate the output voltage V_o and plot your result on a new figure. The C=1uF, R=10KΩ, RL=1KΩ.[20]
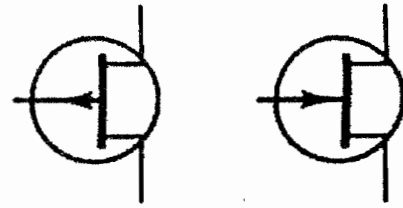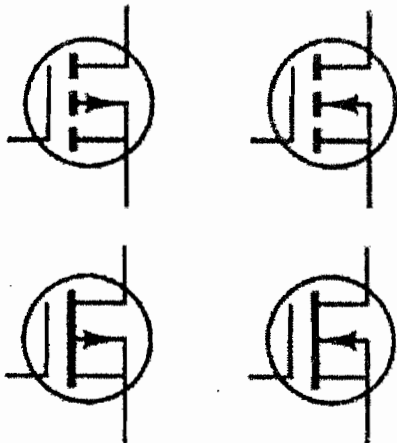

(a)

(b)

2. Please give the complete name of the following symbols: [10]

3. Determine the logic function implemented by the CMOS gate of the following figure. Use the table below to summarize the behavior of the circuit. Note that the states of Mi must be filled with "on" or "off" to indicate the status of CMOS gates. The output voltage, v_{out}, will be the real voltage with respect to the input voltages. [20]
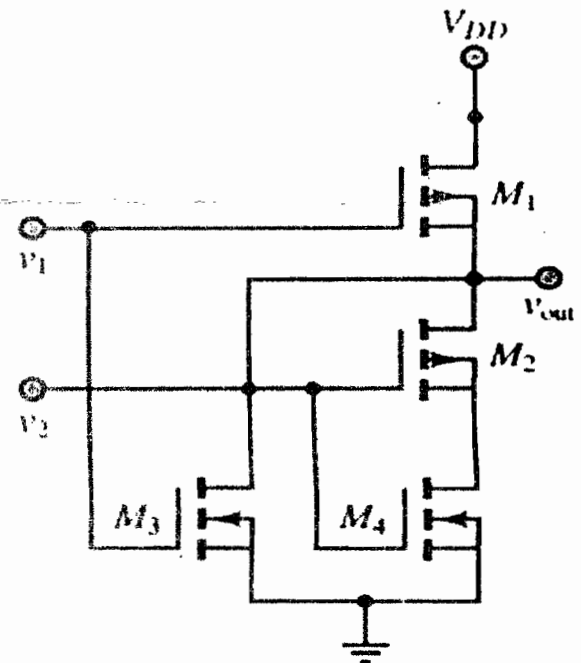

| v1	v2	State of M_1	State of M_2	State of M_3	State of M_4	v_{out}
0V	0V					
0V	5V					
5V	0V					
5V	5V					

4. Please answer the following questions:

(a) Please describe the meaning of depletion region of a PN diode. [5]

(b) Give a bridge rectifier circuit shown at the top part of the following figure. If the input voltage, $v_s(t)$, is shown in the lower part of the figure. Please draw the output voltage, $v_L(t)$, and the current $i_L(t)$ of the load resistor RL with respect to the input voltage. [10]
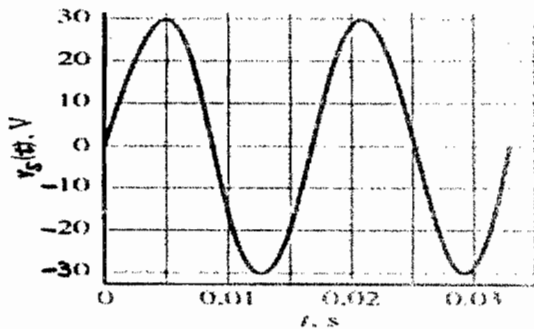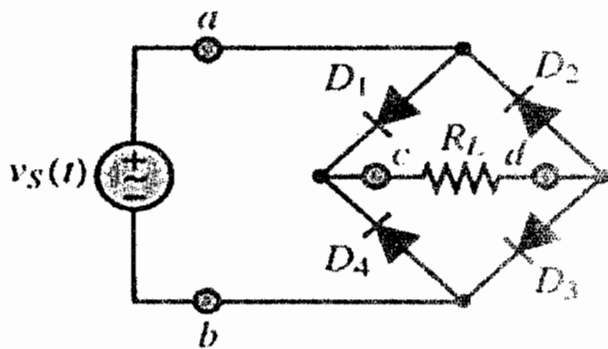
5. Give a "Notch" filter, shown as follow. The natural frequency is $w_0 = \sqrt{LC}$. [15]
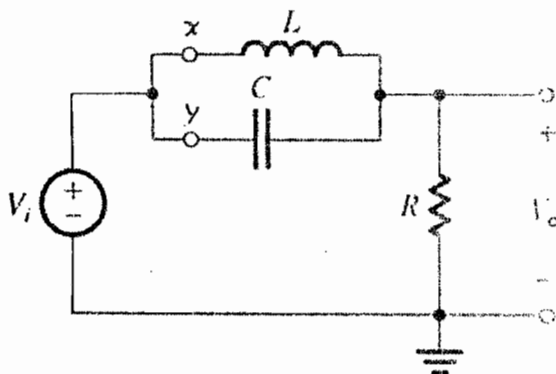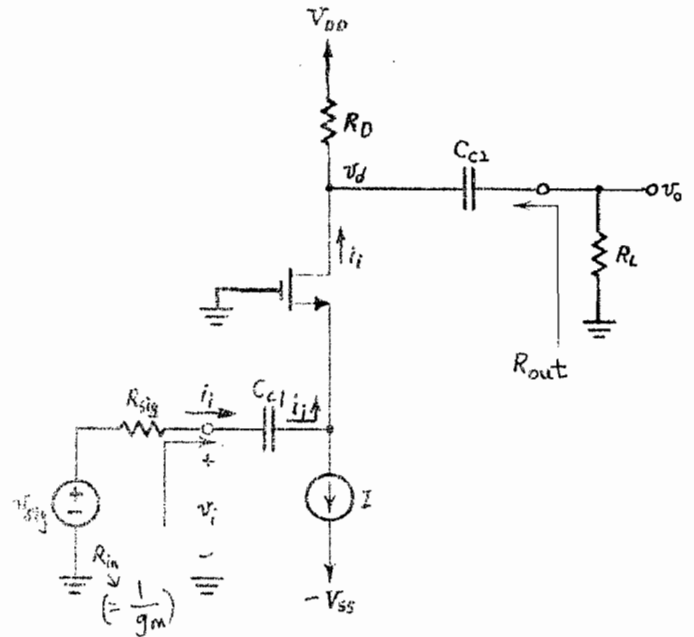

a、 Please show the transfer function.

$$G(s) = \frac{V_o(s)}{V_i(s)} = \frac{a(s^2 + w_0^2)}{s^2 + s(w_0/Q) + w_0^2}$$

b、 Please give the value of a.

c、 Please show the value of Q.

6. Give a common-gate (CG) circuit. An input signal, v_{sig}, is applied to the source, and the output is taken at the drain of MOSFET with the gate forming a common terminal between the input and output ports. Please answer the following questions:[20]

a、 Please give the voltage of v_i with respect to v_{sig}, g_m and resistors.

b、 Please derive the i_i with respect to g_m and v_i.

c、 Please find out the output voltage, v_o, with respect to gm, v_i and resistors.

d、 Please give the open-circuit gain, A_{vo}.

e、 Please give the output resistance, R_{out}.