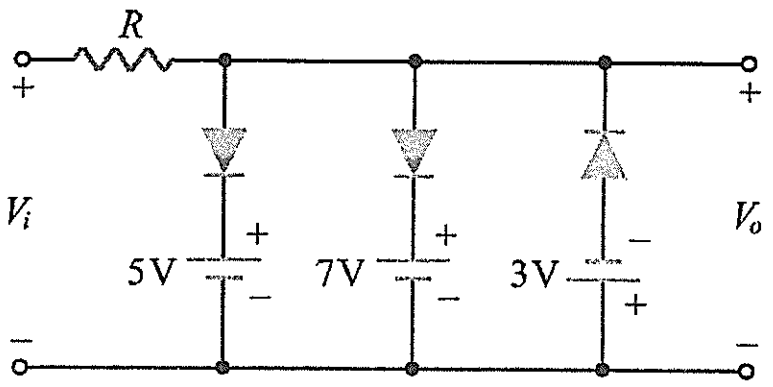
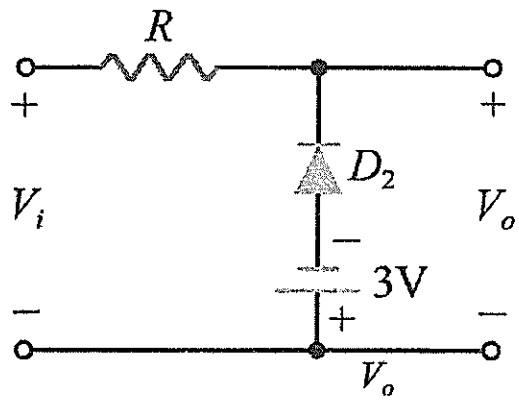
Make your own assumptions if the givens are not enough for you.

1. (a) Vi= 10 sin(t). All three diodes are ideal. Please plot V_o on a V_o-time plot, where V_o is the y-axis, and time is the x-axis. (6%)



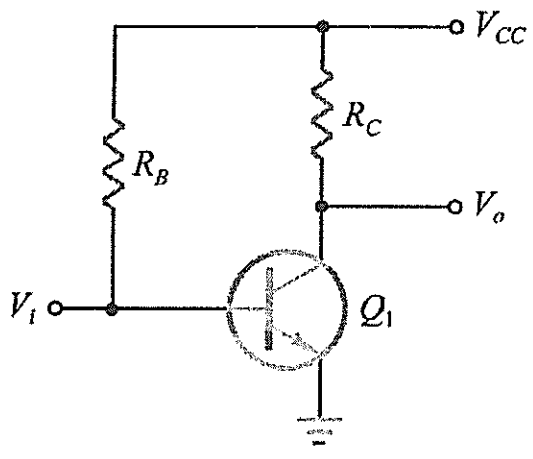


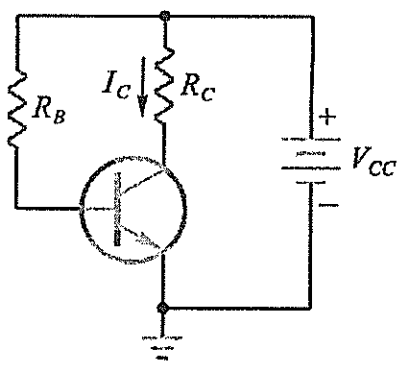
(b) Please plot the transfer curve (V_i is the x-axis and V_o is the y-axis) for the circuit on the left. For D_2, forward voltage V_F= 0.7 V (6%)

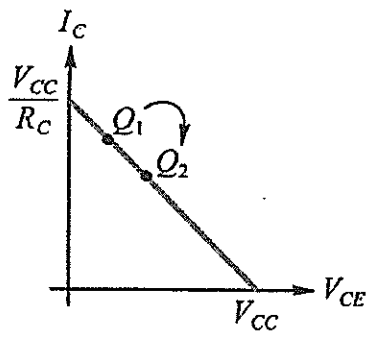
2. For transistors and their corresponding amplifiers, please answer the following questions.

(a) For an NPN BJT transistor working in the saturation region, what are the criteria for V_{BE} and V_{BC}? (4%)

(b) How does R_C or R_B change to move the quiescent point from Q_1 to Q_2? (4%)







(c) For R_C= 1 kΩ, V_{CC}=15 V, β= 100, V_{BE}= 0.7 V, and V_{CE} being greater than 0.4 V for operations in the active region, find the V_{CE} and R_B to ensure to have the maximum non-distortion output. (8%)

(d) Between those amplifiers (common emitter, common base, and common collector) constructed by BJT, which one owns the lowest input impedance? (4%)

(e) Between CE, CB, and CC, which one owns the greatest power gain? (4%)

3. Consider the amplifier shown below. Thermal voltage V_T= 26 mV. Calculate the values for the collector current at the Q-point I_{CQ}, the voltage gain A_V, the input impedance Z_{in}, and the output impedance Z_{out}. (24%)

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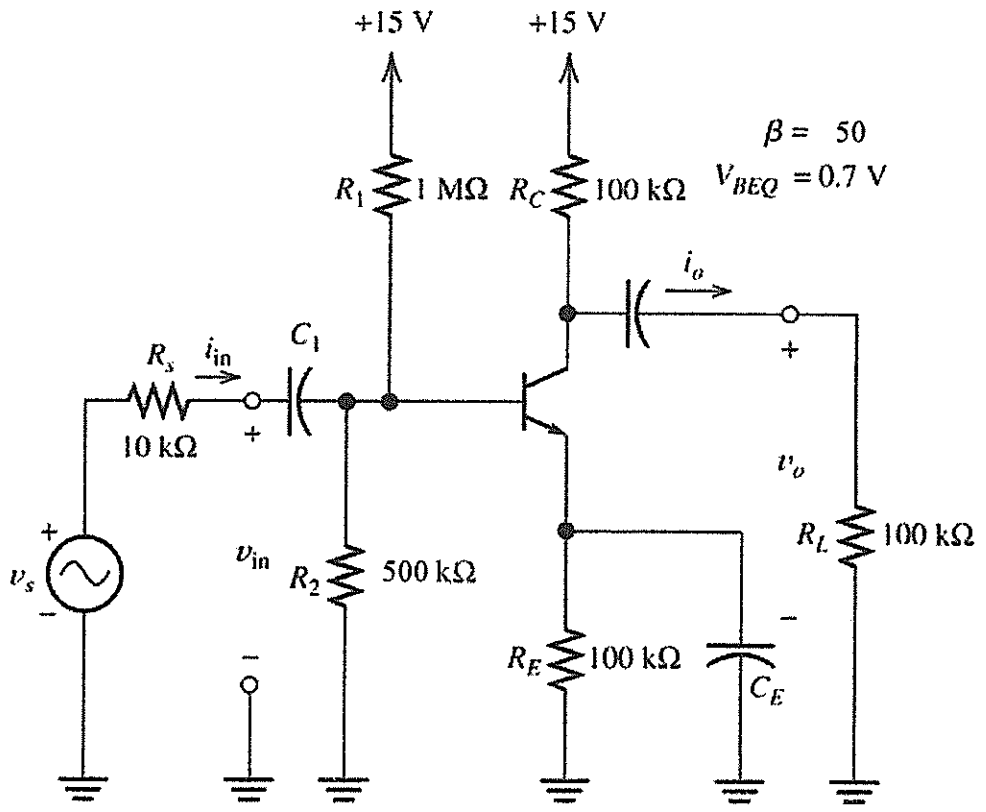
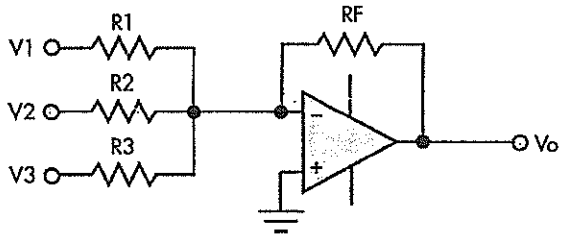


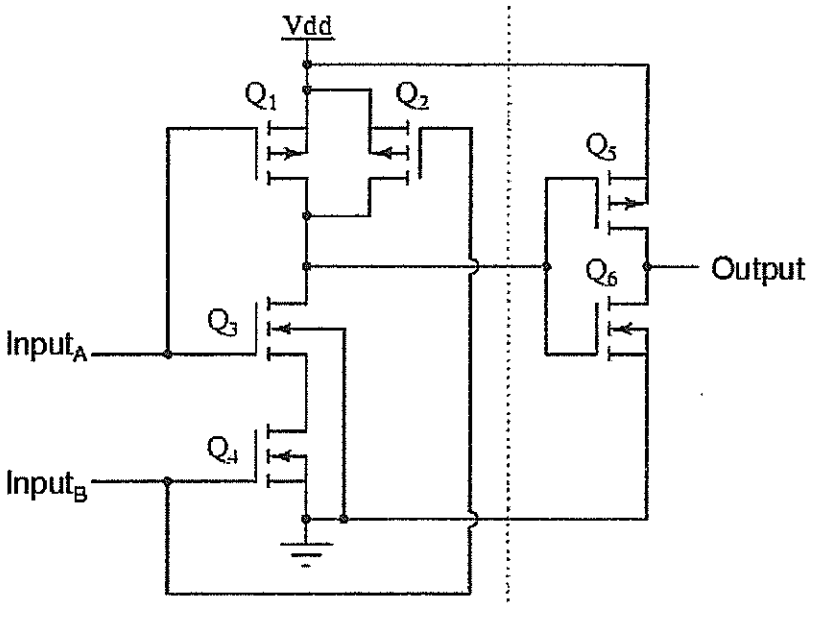
4. An ideal op amp and resistors construct the circuit shown below.



(a) Please derive the Vo as a function of V1 to V3, R1 to R3, and RF. (6%)

(b) The circuit can be expanded as a 4-bit digital analog converter (DAC). Please draw your circuit and specify the values of all resistors. (12%)

5. For the logic gate shown below, please answer the following questions.



(a) Please complete (寫在答案卷) the truth table for the circuit.

1 for high voltage or MOSFET ON; 0 for low voltage or MOSFET off (10%)

$Input_A$ 1 or 0	$Input_B$ 1 or 0	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Output 1 or 0

(b) What is the name of the part of Q1, Q2, Q3, and Q4? Describe the input output relationship. (6%)

(c) What is the name of the part of Q5 and Q6? Describe the input output relationship. (6%)

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