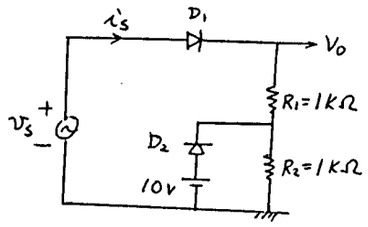
(一) The diodes in the figure are ideal.

(a) please plot the transfer characteristic (v_o versus v_s)

(b) please plot the input characteristic (i_s versus v_s)

Indicate all slopes, voltage or current levels and the states of D_1 and D_2 (ON or OFF) over each region of the characteristics.



(二) (a) What is the circuit in Fig.(a)?

(b) What is the circuit in Fig.(b)?

(c) What is the circuit in Fig.(c)?

(d) What is the circuit in Fig.(d)?

(e) For a one-bit full binary subtractor ($X_i - Y_i$) shown in Fig.(e), please find the borrow output B_{i+1} =? (Simplification on Karnaugh map)

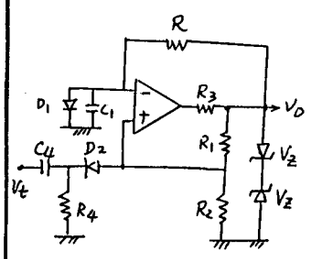


Fig.(a)

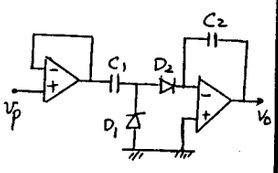


Fig.(b)

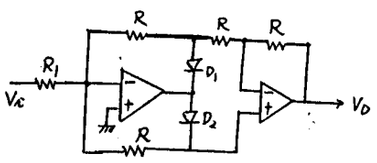


Fig.(c)

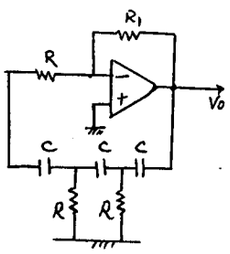


Fig.(d)

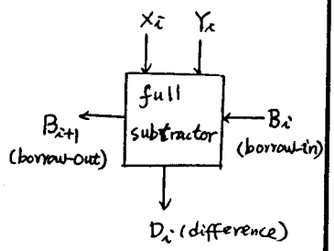


Fig.(e)

(三) please draw the circuit of the op-amp Wien bridge oscillator and find

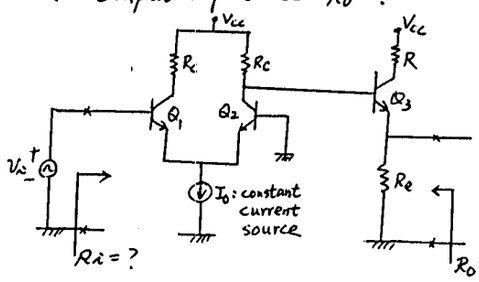
(a) what is the frequency of oscillation?

(b) what is the condition needed to sustain oscillations.

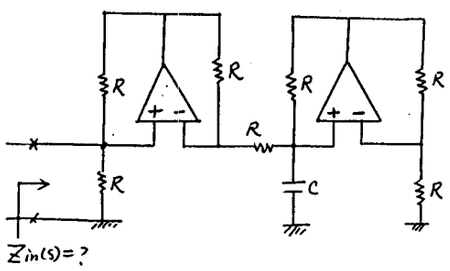
② For the circuit shown, assume all transistors are identical, with parameters h_{ie} and h_{fe}. please find

(c) input impedance R_i = ?

(d) output impedance R_o = ?



(四) For the following circuit, please find $Z_{in(s)}$ = ?



(五) Using the T-type flip-flop, design a sequential circuit of the 2-bit counter with the following count sequences.

If the control input d=0, the count sequence is

$(y_1, y_2) = (0,0) \rightarrow (1,0) \rightarrow (0,1) \rightarrow (0,0) \xrightarrow{\text{repeat}}$

If the control input d=1, the count sequence is

$(y_1, y_2) = (0,0) \rightarrow (0,1) \rightarrow (1,0) \rightarrow (0,0) \xrightarrow{\text{repeat}}$