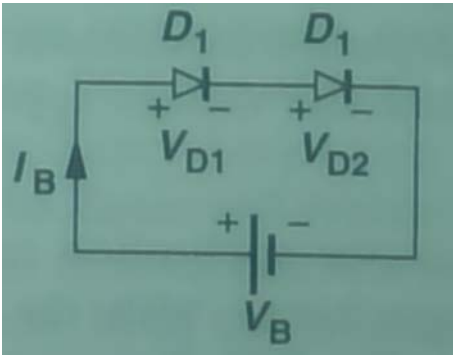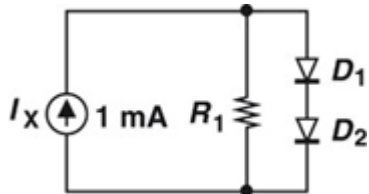Name: ID#

1. (10%) Two diodes with reverse saturation currents of I_{S1} and I_{S2} placed series. Calculate I_B , V_{D1} , and V_{D2} in terms of V_B , I_{S1} , and I_{S2} .
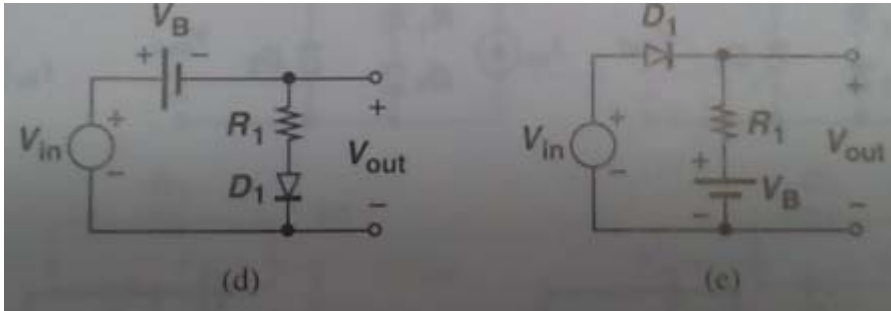

2. (10%) Determine the value of R_1 such that R_1 carries 0.5mA. Assume $I_S = 5\times10^{-16}$ A for each diode.

Ans:

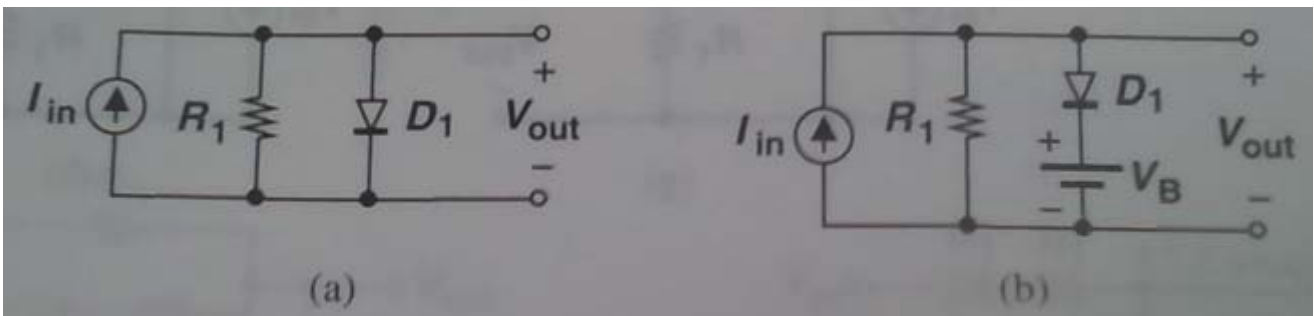3. (10%) Plot the input/output characteristics of the circuit shown below using an ideal model for the diode. (Assume $V_B = 2V$).

(d)   (e)

Ans:

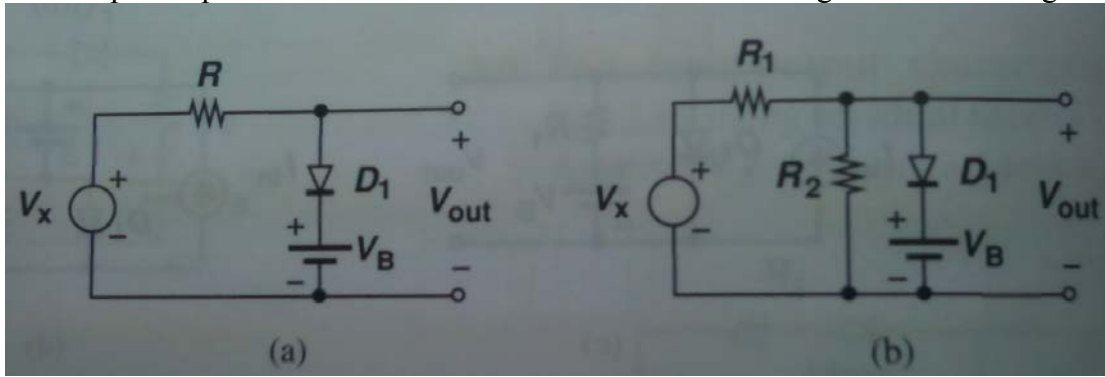(d)   (e)

4. (10%) Assume constant voltage diode model, plot V_{out} as a function of I_{in} for the circuits shown below. (Assume $V_B = 2V$).

(a)   (b)

Ans:
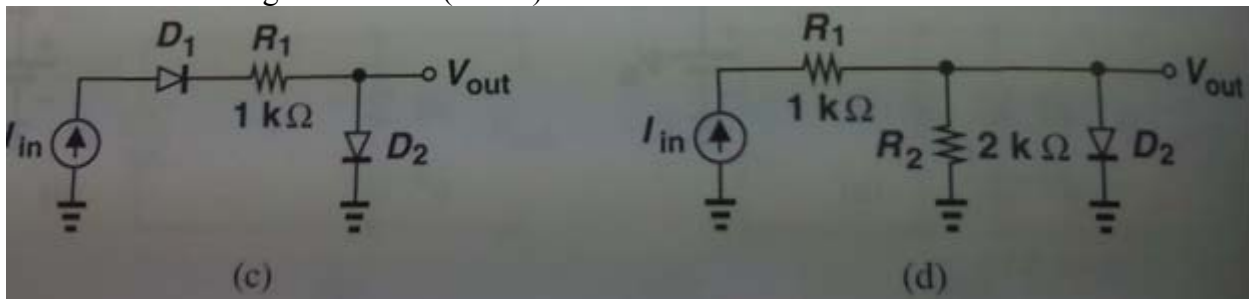
(a)   (b)

5. (10%) Plot the input/output characteristics of the circuit below. Assuming a constant voltage diode model.

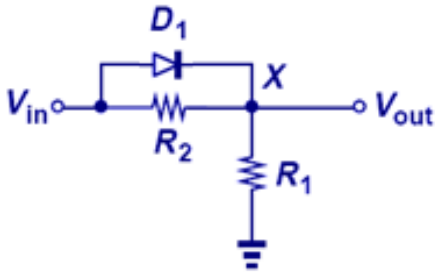
(a)   (b)

Ans:

6. (10%) Beginning with $V_{D,on} \cong 800mV$ for each diode, calculate the change in V_{out} if I_{in} changes from 3 mA to 3.1 mA in following circuits. rd=(26mV)/I

(c)   (d)

Ans:

7. (10%) Plot the input/output characteristic of the following circuit using the constant voltage model.

Ans:

8. (10%) A cellphone incorporates a 2.4GHz oscillator whose frequency is defined by the resonance frequency of an LC tank If the tank capacitance is realized as the pn junction of Example 2.15, calculate the change in the oscillation frequency while the reverse voltage goes from 0 to 1.5 V. Assume the circuit operates at 2.4 GHz at a reverse voltage of 0 V, and the junction area is 2500 μm^2.

$$f_{res} = \frac{1}{2\pi}\frac{1}{\sqrt{LC}} \quad , C_j = 0.265\,fF/\mu m^2 \quad , \quad C_{j,tot} = \frac{C_{j0}}{\sqrt{1+\dfrac{V_R}{V_0}}} \quad , \quad V_0 = 0.73V$$
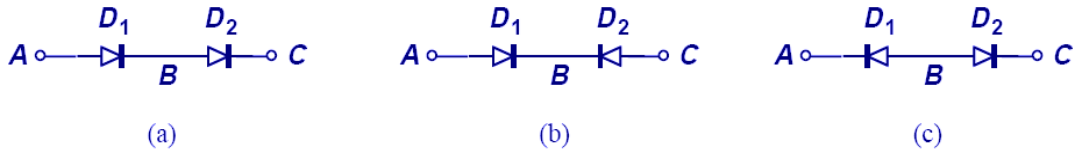
Ans:

9. (10%) If the circuit in the following figure represents a source and load with v_s=90V, and i_1=6mA, then **what are the values of i_3 and R_3?**
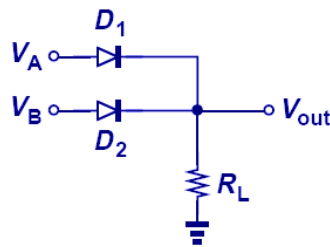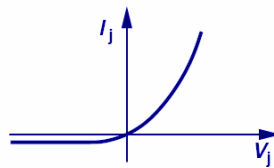
5 kΩ $\quad$ R_3

v_s $\quad i_1$ $\quad + \quad i_3$

$+$ $\quad v_2$ $\quad$ 30 kΩ $\quad$ 6kΩ

$-$
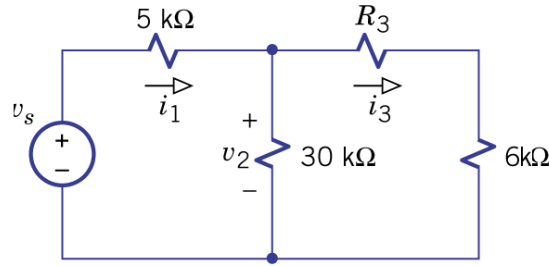
Ans:

10. 1 ($\quad$) Which one of the following figure can conduct current from A to C (2%)

$D_1 \quad D_2$ $\qquad$ $D_1 \quad D_2$ $\qquad$ $D_1 \quad D_2$

A $\longrightarrow$ B $\longrightarrow$ C $\qquad$ A $\longrightarrow$ B $\longrightarrow$ C $\qquad$ A $\longrightarrow$ B $\longrightarrow$ C

(a) $\qquad\qquad$ (b) $\qquad\qquad$ (c)

10.2 ($\quad$) What function does the following figure perform? (a) NOT (b) AND (c) OR gate (2%)

D_1

$V_A \longrightarrow$

$V_B \longrightarrow$ $\qquad$ V_{out}

D_2

R_L

10.3 ($\quad$) What is the diode model of the following figure ? (a) Constant voltage model (b) Exponential model (c) Ideal model (2%)

I_j

V_j

10.4. ($\quad$) What is the current equation in following figure ? (a) i_1= i_2+ i_3 (b) i_2= i_1+ i_2 (c) i_3= i_1+ i_2 (2%)

Node

i_1 $\qquad$ i_3

i_2
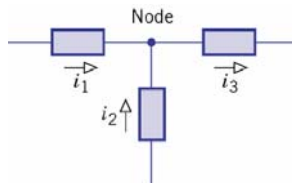
10.5. ($\quad$) Which is the node of cathode of diode in the following figure ? (a) A (b) B (2%)

A $\qquad$ B