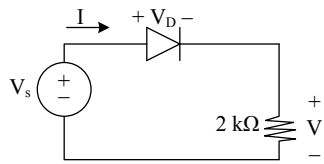


Problem 6 (20 points)

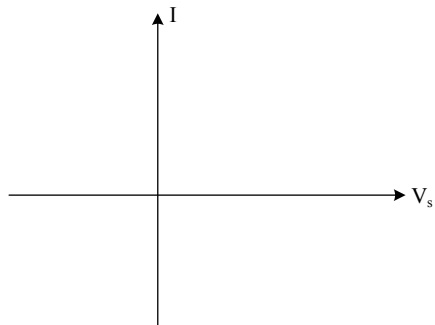


Assume the large signal model with $V_{on} = 0.5$ volts.

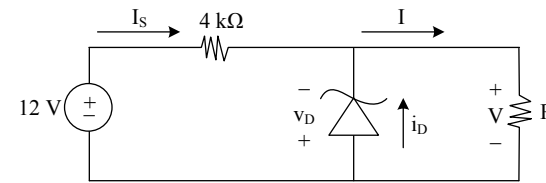
(a) [10 pts.] Solve the circuit for $V_s = 14$ volts. Show all work (be precise and clear).

$V =$ $I =$

(b) [10 pts.] Draw I versus V_s . Show all work for entire graph (be precise and clear). Label graph with all relevant values and units.



Problem 1 (20 points)



$V_{on} = 0.6$ volts
 $V_Z = 5$ volts

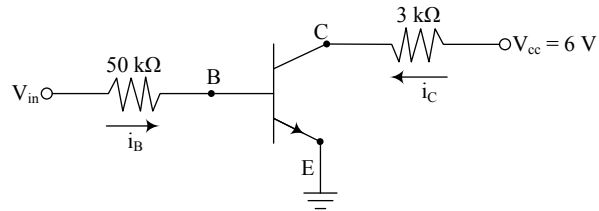
(a) [6 pts.] Draw i_D versus v_D . Explain all parts of the graph.

(b) [6 pts.] Give a condition for R that guarantees the diode is in the Breakdown Region. Show all work.

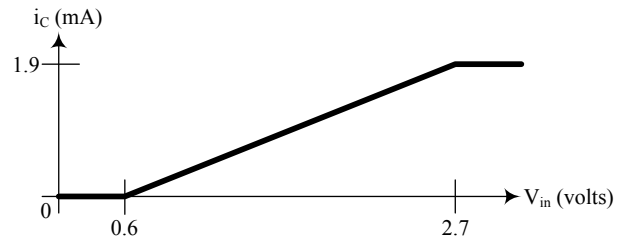
(c) [8 pts.] Find i_D and v_D for $R = 2$ kΩ. Show all work and justify your answer.

$i_D =$ $v_D =$

Problem 2 (20 points) The common emitter circuit below has a npn transistor.



The graph of i_C versus V_{in} is shown.



You will determine the values of the transistor parameters.

a) [6 pts.] Determine the V_{BEon} voltage. Explain your reasoning.

$V_{BEon} =$

b) [6 pts.] Determine the saturation voltage V_{CEsat} . Explain your reasoning.

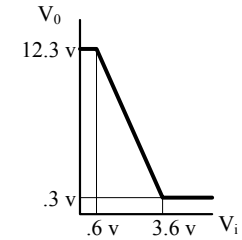
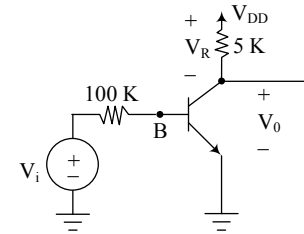
$V_{CEsat} =$

c) [8 pts.] Determine the value of the gain parameter β of the transistor. Explain your reasoning.

$\beta =$

Problem 2 (20 points)

The following circuit has the given transfer characteristic:



a) [5 pts.] What is V_{DD} in this circuit, in volts? Justify your answer.

$V_{DD} =$ V

b) [5 pts.] What is the voltage V_R across the 5 K resistor when the transistor is saturated? Show work.

$V_R =$ V

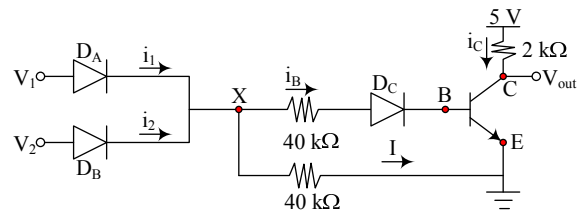
c) [5 pts.] What is V_B when the transistor is active?

$V_B =$ V

d) [5 pts.] What is β for this transistor? Show detailed work to get credit.

$\beta =$

Problem 3 (15 points)



$$V_{on} = V_{BEON} = 0.7 \text{ V}$$

$$\beta = 100$$

$$V_{CESAT} = 0.2 \text{ V}$$

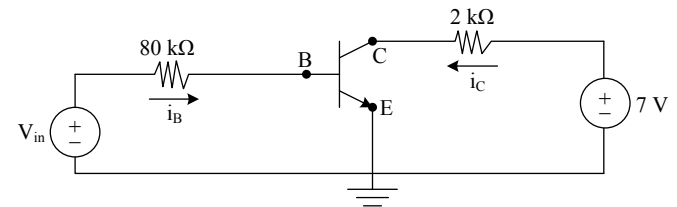
When $V_1 = V_2 = 5$ volts, all diodes are on, and the transistor is on. Compute the quantities requested.

$$V_x = \boxed{}$$

$$i_B = \boxed{}$$

$$i_1 = \boxed{}$$

Problem 2 (20 points)



$$V_{BEON} = 0.6 \text{ V}; \quad \beta = 100; \quad V_{CESAT} = 0.2 \text{ V}$$

For both parts below, use the information above to find the requested quantities and the transistor state.

(a) [10 pts.] Assume $V_{in} = 1 \text{ V}$. Show your work.

$$i_B = \boxed{} \quad i_C = \boxed{} \quad V_{CE} = \boxed{} \quad \text{State } \boxed{}$$

(b) [10 pts.] Assume $i_C/i_B = 80$. Show your work.

$$i_B = \boxed{} \quad i_C = \boxed{} \quad V_{CE} = \boxed{} \quad \text{State } \boxed{}$$