Lab Assignment - 1

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Here, V_{R1} = Voltage drop across R1 resistor
V_{R2} = " " " R2 "

V_A	V_B	V_{R1}	V_{R2}	I_{R1}	I_{R2}	$V_R = Y$
0	0	0	0	1.193×10^{-20}	1.193×10^{-20}	1.386×10^{-15}
0	5	-1.22×10^{-9}	0.012190	-4.42×10^{-12}	4.41×10^{-5}	4.41342
5	0	0.01219	1.22×10^{-9}	4.41×10^{-5}	-4.42×10^{-12}	4.41342
5	5	6.13×10^{-3}	6.13×10^{-3}	2.218×10^{-5}	2.218×10^{-5}	4.43727

Table 1: OR Gate

V_A	V_B	V_{R1}	V_{R2}	I_{R1}	I_{R2}	$V_R = Y$
0	0	0.006125	0.006125	-2.218×10^{-5}	-2.218×10^{-5}	~~4.4372273~~ 0.5627 27
0	5	-0.012185	2.6007×10^{-9}	-4.413×10^{-5}	9.423×10^{-12}	~~4.413425~~ 0.586575
5	0	2.6007×10^{-9}	0.012185	9.423×10^{-12}	-4.413×10^{-5}	0.586575 ~~4.413425~~
5	5	1.38×10^{-9}	1.38×10^{-9}	5×10^{-12}	5×10^{-12}	5

Table 2: AND Gate

V_i	V_{R1}	V_{R2}	V_{RC}	I_1	I_2	I_B	I_C	Y
0	0.6522	4.348	0	4.348×10^{-5}	4.348×10^{-5}	-3.195×10^{-12}	1.729×10^{-11}	5
5	4.2967	5.7033	4.8019	0.0002864	5.7×10^{-5}	0.0002294	0.00222358	0.108117

Table 3: Inverter

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Report:

1) In Diode AND circuit, both the inputs must be high for the output to be high. When, both inputs or one of the inputs is low, then both diodes or one of the diodes will be forward biased. As a result, output voltage will be low or close to zero. On the other hand, when both inputs are high, both diodes will be reverse biased and act like a open circuit. Thus, the output voltage become high or 5 volt.

2) Yes, it works when $V_A = V_B = 6V$ and $V_R = 5V$.

V_A	V_B	Y
0	0	0.562727
0	1	0.586575
1	0	0.586575
1	1	5

So, it works like a diode AND circuit.

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3) When the input is high, this R2 resistor helps to keep the transistor in saturation mode by maintaining the base voltage around 0.7 volt.

4) When the input is low, there will be no current through the base. So, the transistor will be in cutoff mode and output will be high.

On the other hand, when the input is high both junctions of the transistor will be forward biased and transistor will turn on. Thus, the transistor will be in saturation mode by having the voltage difference between emitter and collector close to zero volt. So, output will be low in that case.

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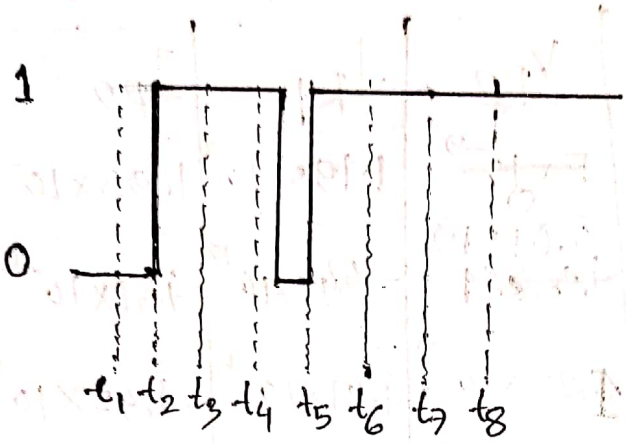
5)



output: