

Lab Assignment - 1

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Section : 07

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Experiment No: 2

Input A	Input B	V_{DA}	V_{DB}	V_P	I_{R1}	I_{R2}	V_b	Output Y
0	0	0.658803	0.658807	0.658807	0.00237224	2.226×10^{-11}	0.516818	5
0	1	0.676729	0	0.676729	0.00236244	2.229×10^{-11}	0.499497	5
1	0	0	0.676729	0.676729	0.00236244	2.229×10^{-11}	0.499497	5
1	1	0	0	2.15652	0.00155381	0.00267803	0.823525	0.0991997

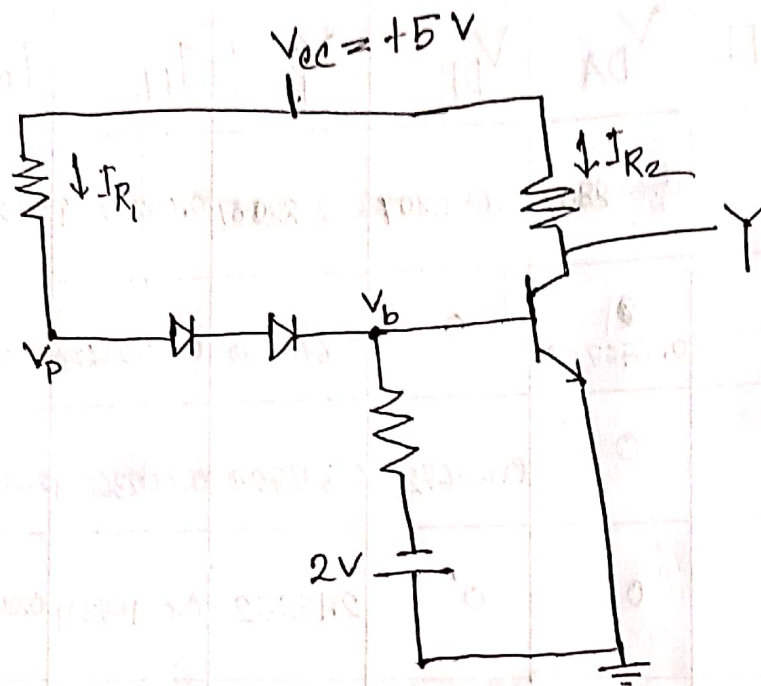
Table :- 1

Input A	Input B	V_P	V_b	Output Y
1	0	0.676729	0.499497	5
1	1	2.15652	0.823525	0.0991997

Table :- 2

Report:

1.

Fig 1: Partial circuit when both inputs are logic High

2. Logic operation in the table 2 is logic inverter. By keeping 1 input to High and using the other input as 'input terminal', we ^{can} make this logic operation from NAND operation.

When input is logic Low, the corresponding diode will turn on and V_P becomes 0.7V which is not enough to turn on

the transistor. For that, transistor will be in cut-off mode and output will be $V_{ce} = +5V$ or Logic High.

On the other hand, when input is high, diode will act as an open circuit and V_p is about 2.15 V which is enough to turn the transistor on. Thus, output will become close to 0 Volt or Logic Low and in this way, it works like a logic inverter.

3. When both inputs are Logic Low, both corresponding diodes will be forward biased and V_p becomes close to 0.7 Volt which is not enough to turn the transistor on. For that reason, transistor will be in cut-off mode and output will be $V_{ce} = +5$ Volt.

Same goes for when one of the inputs is Logic low. But when both inputs are Logic High, both diodes will be in reverse biased or open circuit. As a result, V_p becomes ~~2.5~~ close to 2.2 Volt which is enough to turn the transistor on and keep the transistor in saturation mode.

Thus, V_{CE} or output becomes close to 0.4 Volt or logic low and in this way, this circuit performs NAND operation.

4. When one of the inputs is HIGH and other one is low, the operation mode of Q_1 is cut-off mode as $V_e > V_b$.

5. If we set the values of input A, B to 0.65 V or less than 0.65 V, then output will be always HIGH. So, maximum value is 0.65 Volt to keep the output HIGH.

