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BRANCH: BTECH - CSE AND SPEC IN AI/ML – VITCHENNAI

BECE101P_SLOT-L5+L6_EXPERIMENT – 02

FACULTY: PROF. SASITHRADEVI MA'AM

STUDY OF VI CHARACTERISTICS OF P-N JUNCTION DIODE

AIM: To study the VI Characteristics of P-n Junction Diode.

SOFTWARE REQUIRED: **LT-Spice** is used for simulation and to do transient analysis.

THEORY:

P-N JUNCTION DIODE: It is a device that has P and N type semi-conductors, this device has 2 terminals. The semi-conductor has a junction which is called depletion region. The depletion region width keeps changing according to the external potential applied. This allows the electric current in only one direction while blocks the electric current in opposite or reverse direction. If the diode is forward biased, it allows the electric current flow. On the other hand, if the diode is reverse biased, it blocks the electric current flow.

THE WORKING PRINCIPLE OF P-N JUNCTION DIODE:

The PN type semiconductor diode has majority holes and electron as minority carrier.

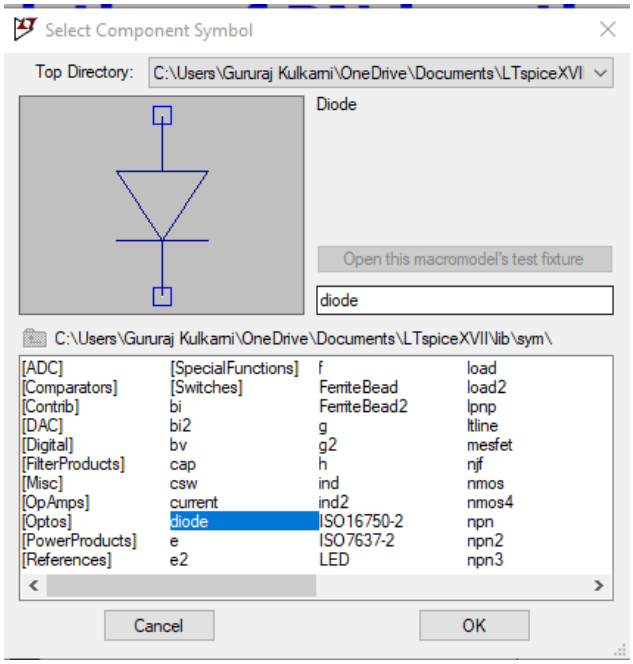
When we apply the external voltage across the semiconductor diode in such a way that the p-side is connected to the positive terminal of the battery and the n-side is connected to the negative terminal, then the semiconductor diode is said to be forward-biased. In this case, the built-in potential of the diode and thus the width of the depletion region decreases, and the height of the barrier gets reduced. The overall barrier voltage, it is the difference between the built-in potential and the applied potential.

When we apply the external voltage across the semiconductor diode in such a way that the positive terminal of the battery is connected to its n-side and the negative terminal of the battery is connected to the p-side of the diode, then it is said to be in the condition of reverse bias. When an external voltage is applied across the diode, as the direction of the external voltage is the same as that of the barrier potential, the total voltage barrier sums up. Also, the width of the depletion region increases. As a result of this, the motion of carriers from one side of the junction to other decreases significantly.

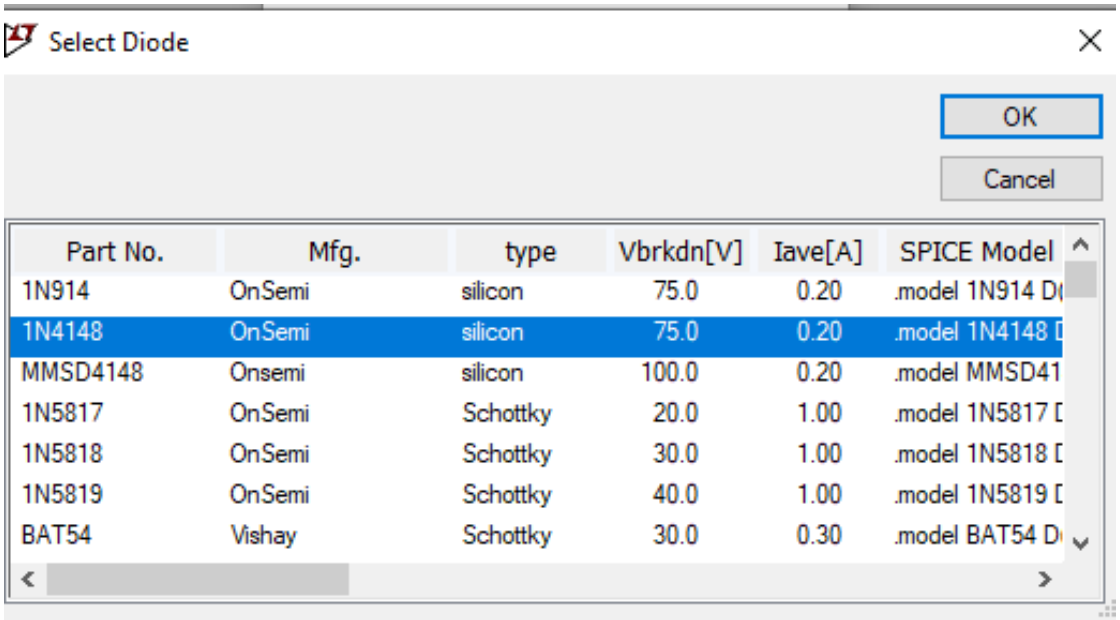
STEPS:

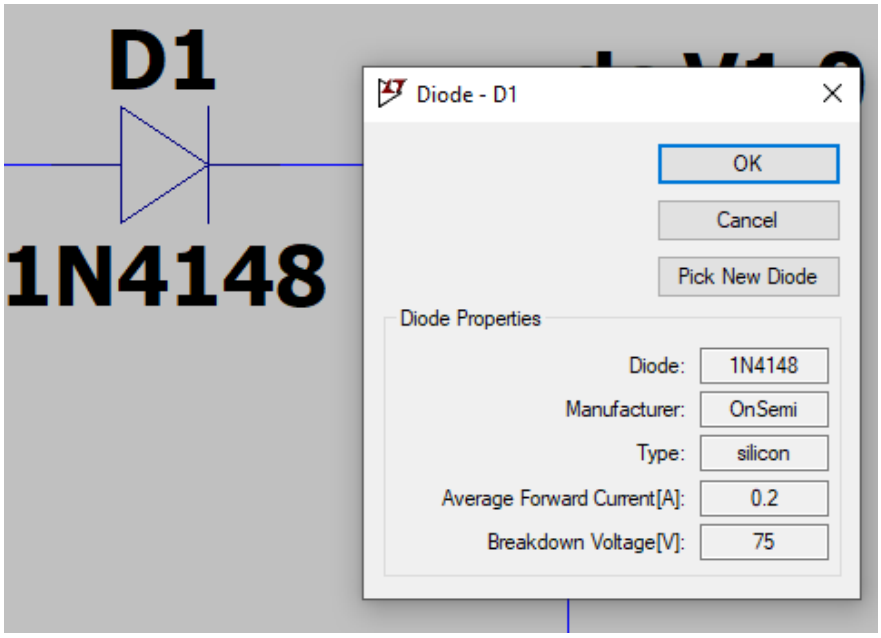
1. **Open LT-Spice application and click on new schematic**
2. **Now, using the above tool tray, draw the circuit as shown in the circuit diagram (shown later).**

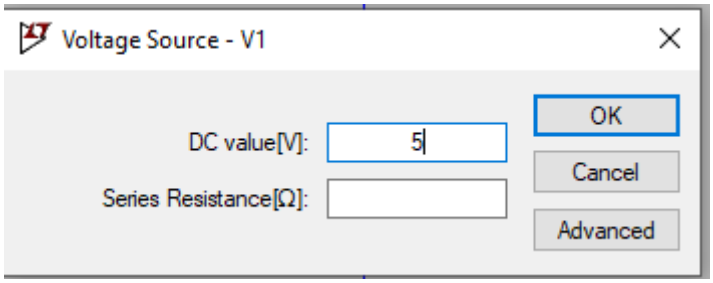
3. **Different circuit for forward and reverse bias.**
4. **Use the components button on the tray, and choose diode, resistor and voltage source. And lastly, draw a ground line to the circuit.**



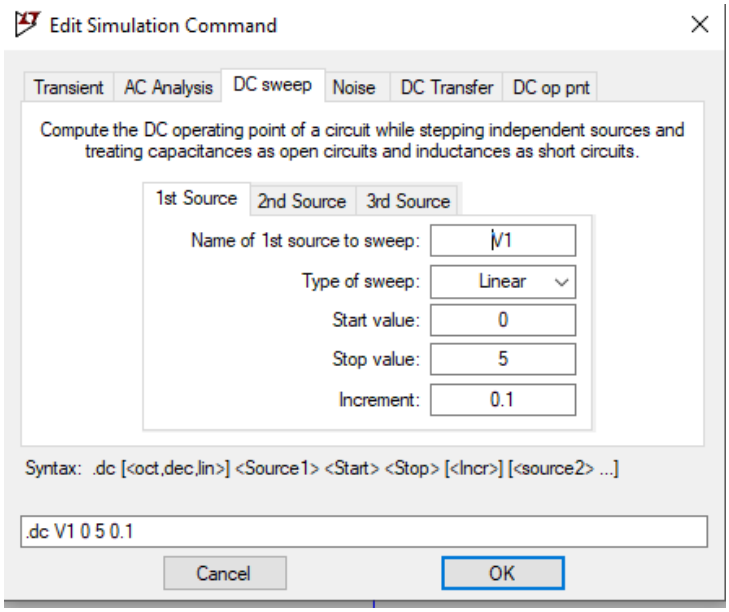
5. **Right click on the diode and choose the diode model number – 1N4148 as shown in circuit, also right click on the resistor to give it the desired value.**







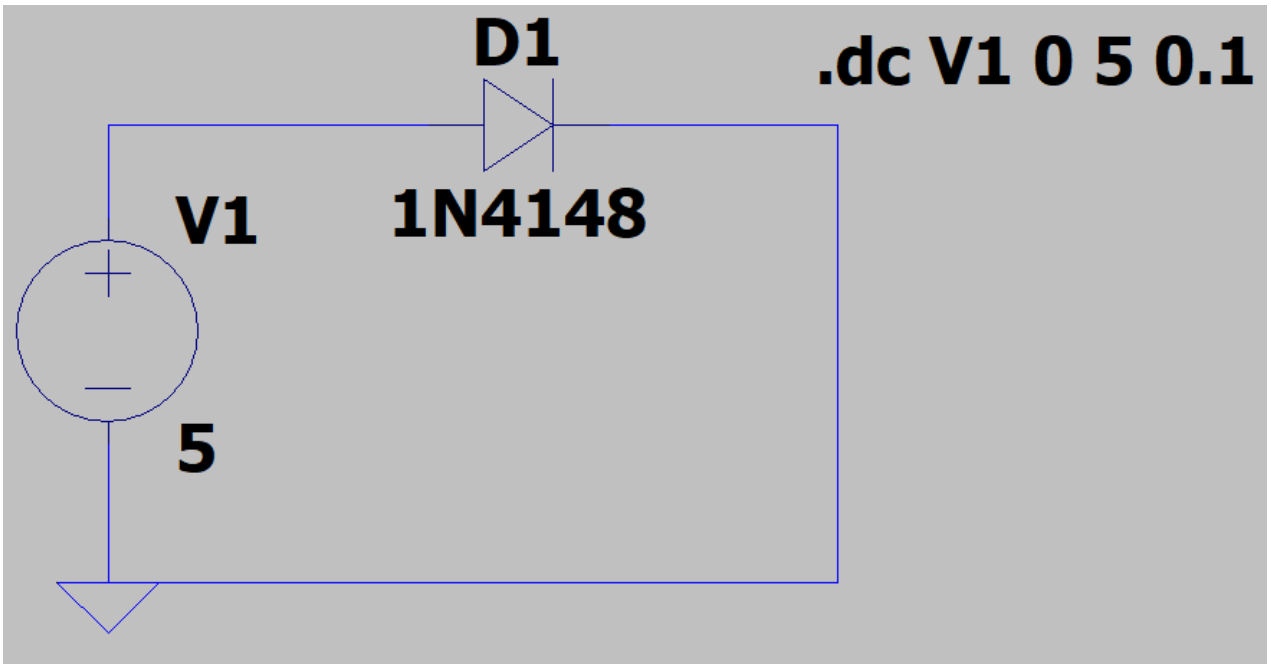
6. **Now, in simulate go to edit simulation command and under DC sweep give the values shown below.**



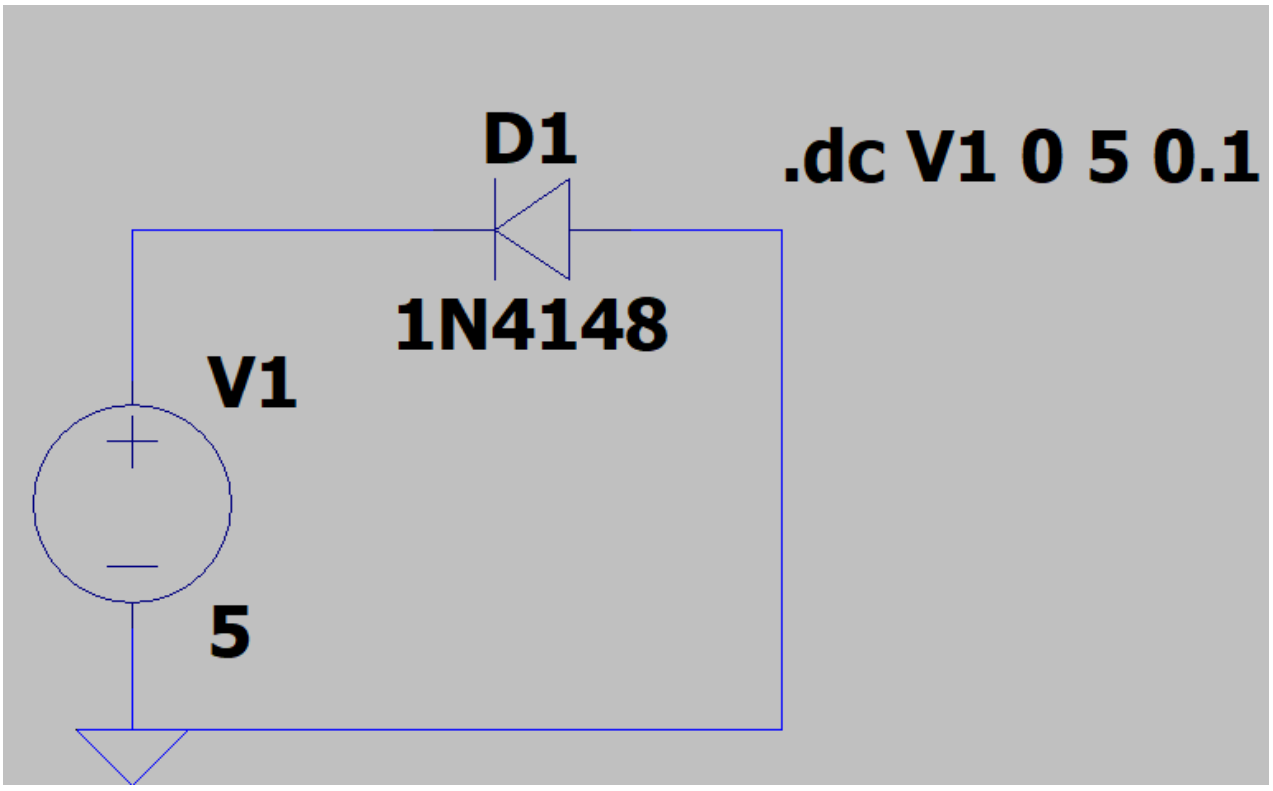
7. **Click on OK and click on Run under simulation.**
8. **The graph will open, now right click on the diode, we will get the VI characteristic graph for this diode at the forward bias.**
9. **Repeat the same process but reverse the direction of the diode to get the reverse bias VI characteristic graph.**
10. **Now, you can observer and understand the VI graphs for the PN junc. Diode at the forward and reverese bias conditions.**

CIRCUIT DIAGRAM:

FORWARD BIAS:

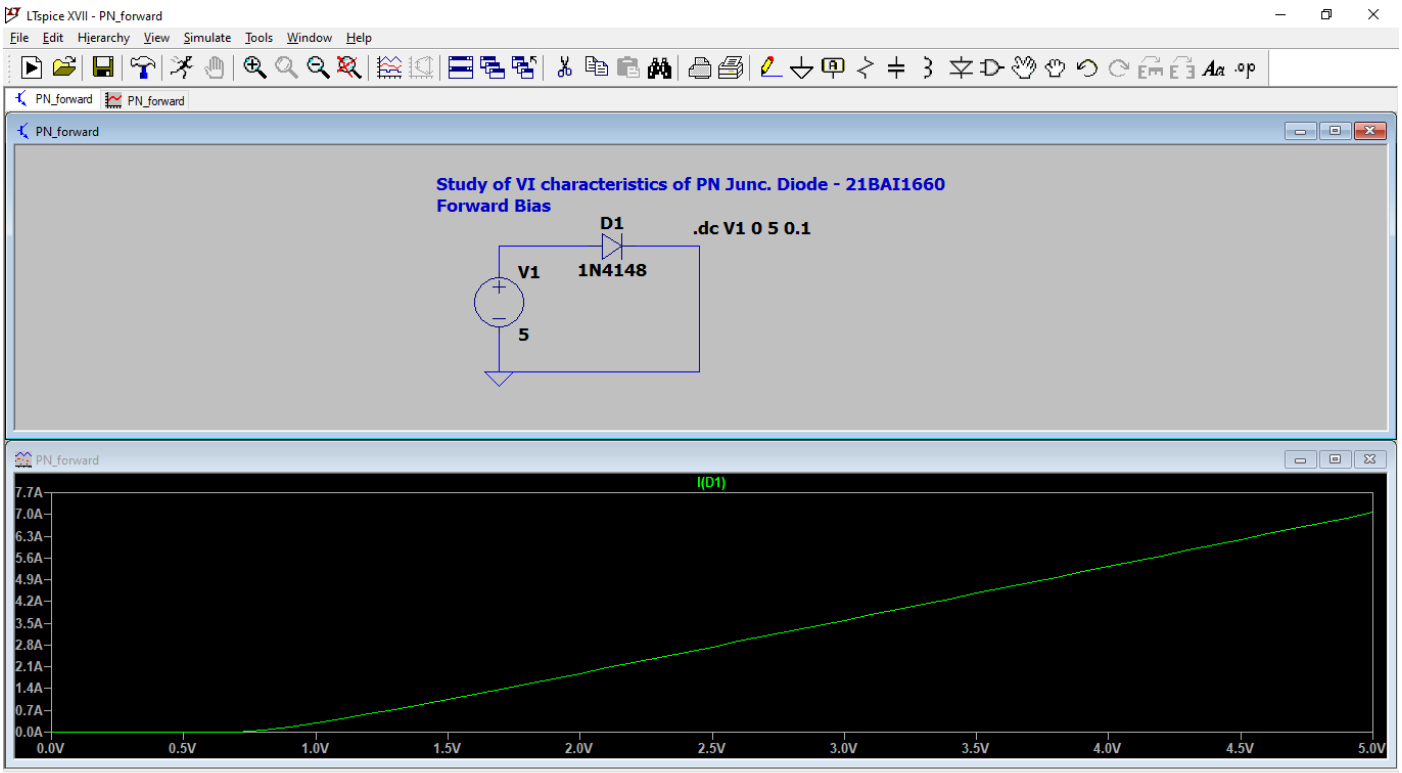


REVERSE BIAS:

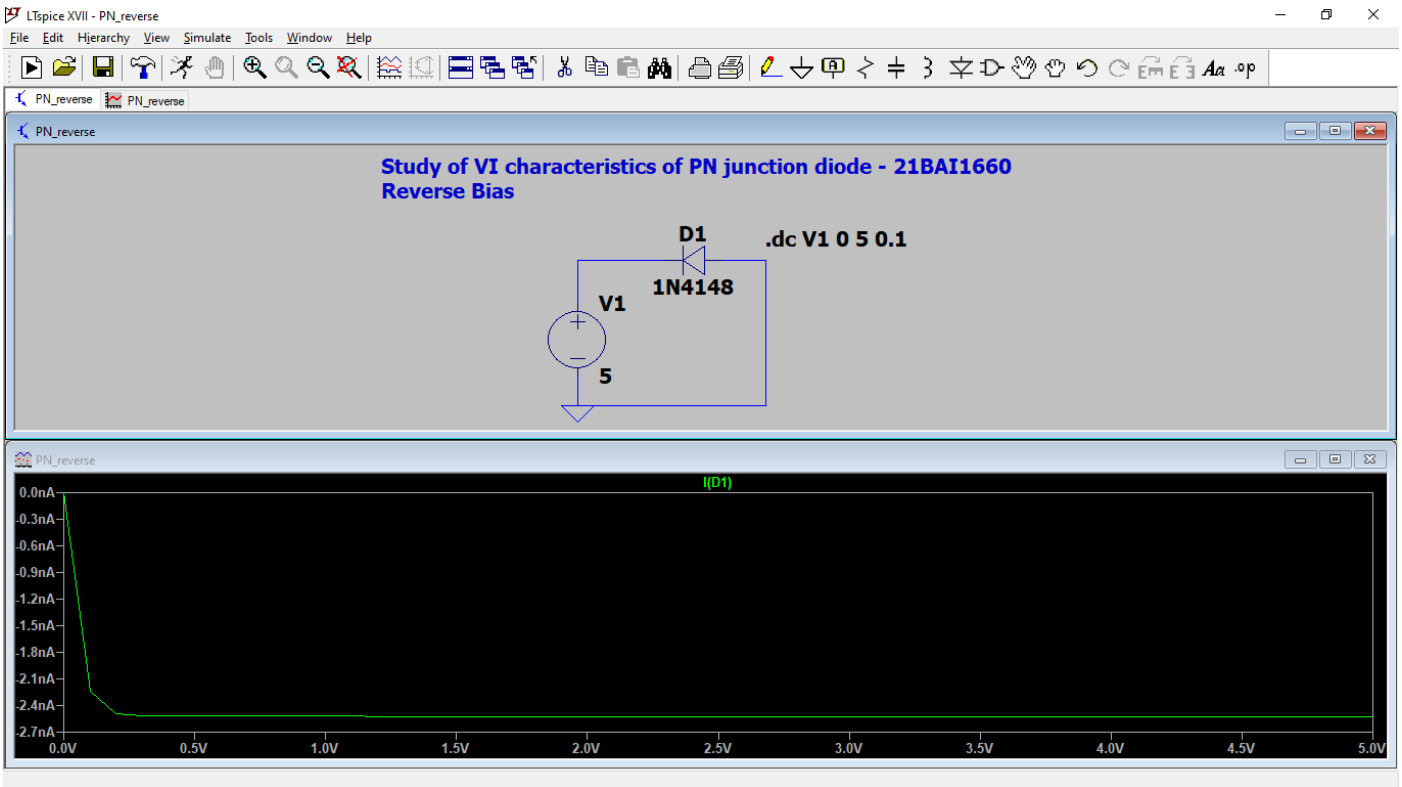


OUTPUT:

VI characteristics of PN junction diode in the FORWARD BIAS



VI characteristics of PN junction diode in the REVERSE BIAS:



Inference: We have inferred that when the diode is forward biased, the current passes through it, while in reverse bias, current of very small order only passes through the diode. We understand the Vi characteristics of the PN junction diode.

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