EAST WEST UNIVERSITY

Department of Computer Science and Engineering

Lab-report:01

Course Name: Electronic Circuits
Course Code: CSE 251
Section No: 01

Name of experiment: I-V characteristics and Modeling of Forward Conduction of a Diode

Submitted To:

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Objectives:

1. To measure the I-V characteristics of forward conduction of a p-n junction diode.
2. To determine the models of forward conduction of a p-n junction diode.

Circuit Diagram:

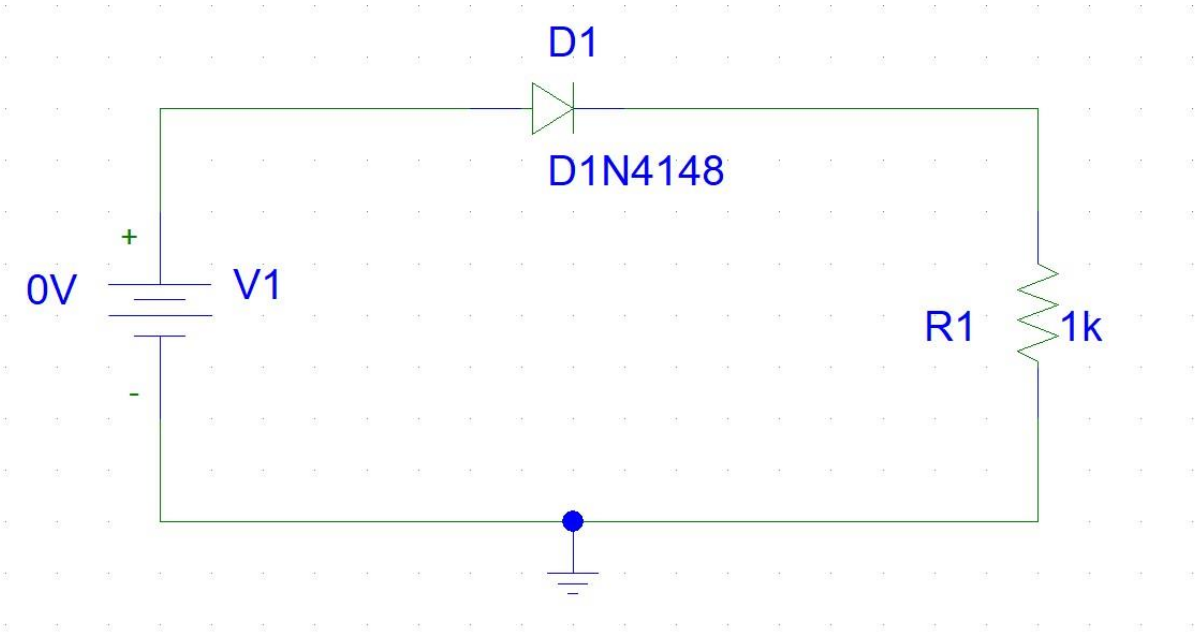

Figure 01: Circuit set up to measure forward bias I-V characteristics of a diode

Answer to the question no: 01

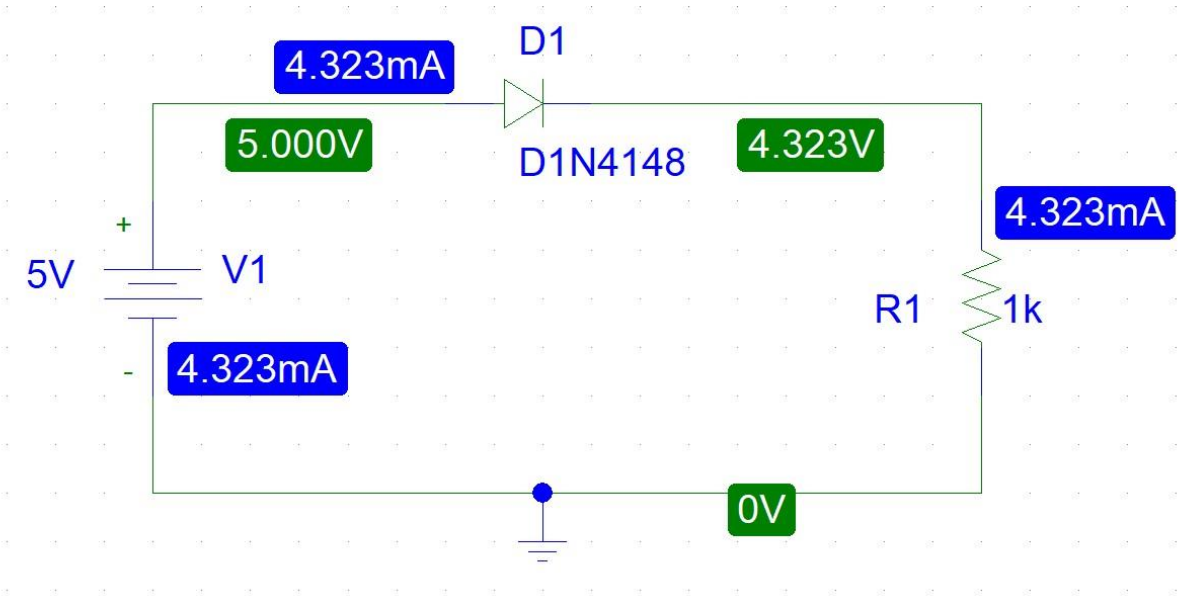

Figure 02: Circuit Simulation of forward biased Silicon PN junction diode

Answer to the question no: 02

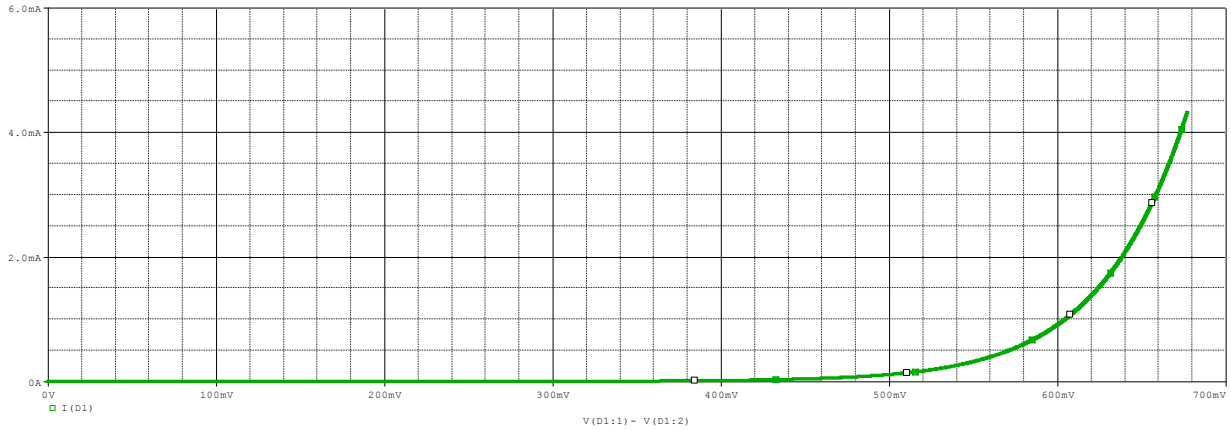

Figure 03: Model Silicon PN junction Diode I-V characteristics in forward bias

Answer to the question no: 03

At I = (X+1) mA =3mA; Here X=2 (Last digit of my Id)

We know,

$I_D = I_S \, exp[V_D / nV_T]$

$\Rightarrow P_1 = I_{D1} = I_S \, exp[V_{D1} / nV_T]$ … … … … … … … … … (1)

$\Rightarrow P_2 = I_{D2} = I_S \, exp[V_{D2} / nV_T]$ … … … … … … … … …(2)

(2) ÷(1) ⇒

$I_{D2} / I_{D1} = I_S \, exp[V_{D2} / nV_T] / I_S \, exp[V_{D1} / nV_T]$

$\Rightarrow I_{D2} / I_{D1} = exp [V_{D2} - V_{D1} / nV_T]$

$\Rightarrow \ln(I_{D2} / I_{D1}) = V_{D2} - V_{D1} / nV_T$

$\Rightarrow n = V_{D2} - V_{D1} / V_T \times \ln(I_{D2} / I_{D1})$ … … … … … … … … (3)

From equation(1);

$I_S = I_{D1} \, exp[-V_{D1} / nV_T]$ … … … … … … … … …… (4)

$I_{D1} = 2.8502$ mA

$V_{D1} = 656.427$ mV

$I_{D2} = 3.3674$ mA

$V_{D2} = 664.233$ mV

Now, $n = (V_{D2} - V_{D1}) / V_T \ln(I_{D2}/I_{D1})$

= (664.233 – 656.427) / {26 mV× ln(3.367 / 2.850)}

=1.805

$I_S = I_{D1}\, exp[\, -V_{D1} / nV_T]$

$=2.850\times10^{-3}\, exp[\, -656.427 / 1.805\times26]$

$=2.40\times10^{-9}$ A

DC Resistance:

$I_D = 3.3674$ mA

$V_D = 664.233$ mV

RD = VD / ID

=664.233mV/3.367 mA

= 197.277 Ω

Average AC Resistance:

$I_{D1} = 2.8502$ mA

$V_{D1} = 656.427$ mV

$I_{D2} = 3.3674$ mA

$V_{D2} = 664.233$ mV

RAC = VD2 - VD1 / ID2 - ID1

= 664.233 – 656.427 / 3.367- 2.850

= 15.098 Ω

Dynamic AC Resistance:

$I_D = 3.367$ mA

$n = 1.805$

$V_T = 26$ mV

$r = nV^T/I_D$

$= (1.805 \times 26)/3.367$

$= 13.938\ \Omega$

Answer to the question no:04

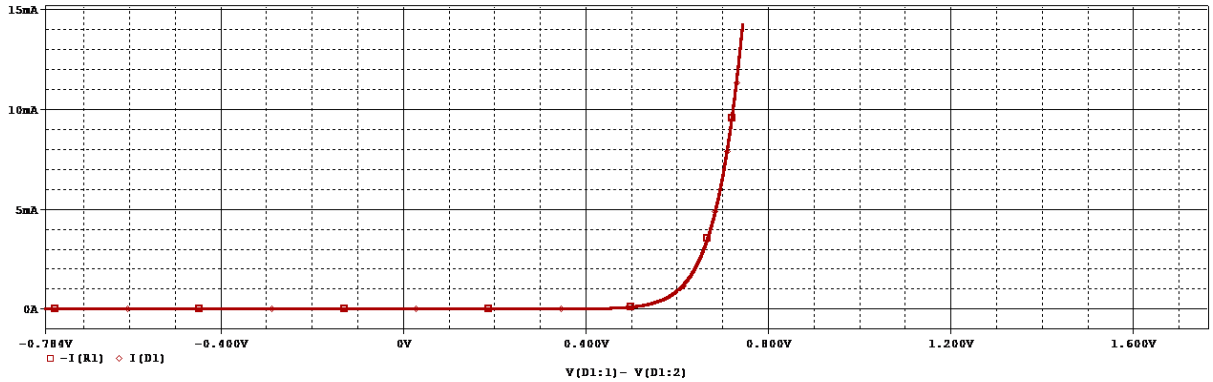

Figure 04: Forward region in Diode I-V characteristics

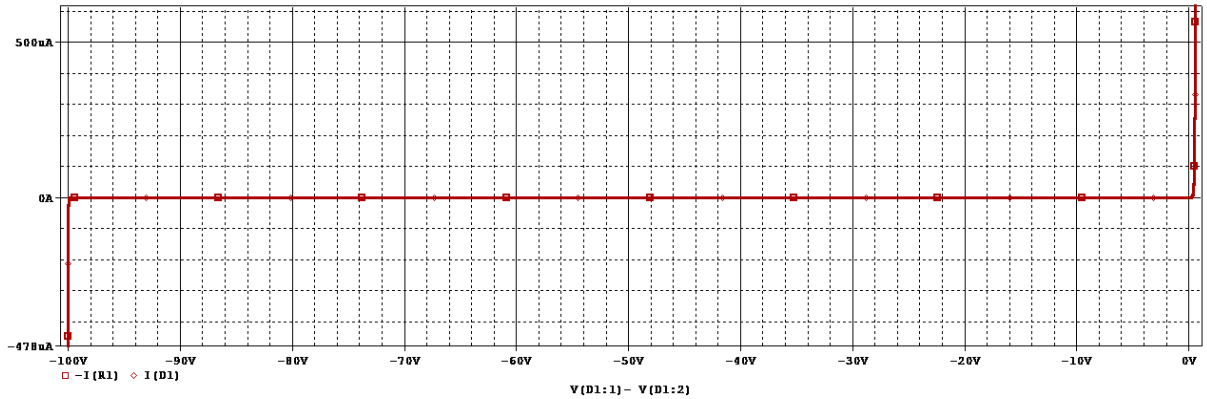

Figure 05: Reverse region in Diode I-V characteristics.

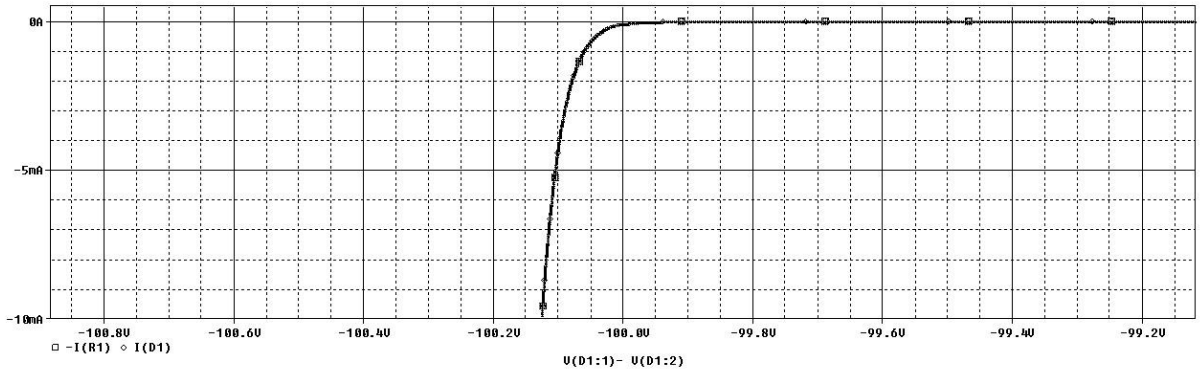

Figure 06: Zener region in Diode I-V characteristics

Discussion:

In forward conduction, an ideal diode works like a short circuit, but in practice, it consumes some voltage to function like a short circuit, but it still doesn't act like a short circuit completely due to leak voltage. Diodes prevent currents from flowing in the wrong direction, as we discovered in our experiment. The I vs. V features teach us about forward and backward situation. Here, all the graphs & values are calculated in the PSpice simulation software.

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