EE 735 Assignment - 5

Device TCAD Simulation

Deadline: March 18, 11.59 pm (100% Penalty for Late Submission)

1 Instructions

- Submit all the codes

- Prepare a report with the observation, plots and analysis

- Name the file EE735 A5 RollNo for this assignment

- Assignments are to be done individually

2 Question - 1

Consider a Si bar of thickness 500 nm and length 500 nm. Compute the following using TCAD for both p-type and n-type doping of $10^{18} cm^{-3}$

- Simulate I-V from Voltage 0 to 2 V

- Plot band diagram at equilibrium and 2 V

- Plot the Electric Field at equilibrium and 2 V

- Calculate (i) & (iii) using analytical expressions and compare with values obtained from TCAD

3 Question - 2

In the previous structure, consider one of the contacts to be Schottky with workfunction = 5 eV, length of Si bar = 1 um, and simulate the following

- Device structure with mesh points

- I-V characteristics of the device

- Band diagram of the device at equilibrium, -2V and 2V

- Electric Field at equilibrium, 2V, -2V

- Compare these values with the analytical expressions

4 Question - 3

For the above structures, simulate I-V for the following mobility models

- Constantmobility

- Dopingdependence

- Highfieldsaturation

5 Question - 4

Simulate PN junction diode with p-type doping of $10^{16}cm^{-3}, 10^{17}cm^{-3}, 10^{18}cm^{-3}$ for a constant n-type doping of $10^{17}cm^{-3}$ and find the following

- Plot the I-V

- Doping concentration, donor and acceptor concentration Band diagram, Electric field, Space charge density at Voltage = 0, 2 V and - 2V

- Calculate these using analytical expressions and compare

6 Question - 5

Simulate MOSCAP with workfunction 4.5eV, oxide thickness 20 nm, Si length 2 um and p-type substrate doping of $10^{18}cm^{-3}$

- Plot band diagram, electron density, hole density, electric field, space charge at gate voltage of -3 V, 0 V, 3 V