EE 735 Assignment - 6

Process and Device TCAD Simulation

Deadline: April 2, 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 A6 RollNo for this assignment
- Assignments are to be done individually

2 Question - 1

Create a pn junction by implanting phosphorus on a Boron-doped ($5e16 \ cm^{-3}$) Si substrate. Check the impact of (a) implant energy (use 10, 20, and 40 keV) and (b) implant dose (use 1e12, 5e14, and 5e16 cm^{-2} for comparison) on the peak concentration and junction depth

- Plot net-active concentration along device depth
- Simulate the I-V and band diagram at equilibrium for each case
- Explain your observations

3 Question - 2

Create a MOSCAP using sprocess with oxide thickness 10 nm, p-type substrate doping $10^{17} cm^{-3}$, workfunction = 5 eV

- Simulate C-V
- Plot band diagrams at accumulation, depletion, and inversion regions

4 Question - 3

Design a MOSFET transistor to achieve $V_T = 0.x V$, where x is the sum of the last two digits of your roll number. Explain the design process. Plot the transfer, output, and C-V characteristics of the designed MOSFET

5 Question - 4

Simulate C-V, Id-Vg for the following cases for the MOSFET designed above. Use trap concentration of $10^{12}cm^{-2}$

- Uniform distribution of acceptor traps in entire bandgap in Si/SiO_2 interface
- Uniform distribution of donor traps in entire bandgap in Si/SiO_2 interface
- Uniform distribution of acceptor traps in the top half of the bandgap and donor traps in the bottom half of the bandgap in Si/SiO_2 interface