Theory and Technology of Semiconductor Devices
Assignment 2

Dr. Shooshtari

KN Toosi University of Technology

Due Date: Dec 20

Problem 1 Doing an Arsenic diffusion on a p-type wafer with background doping of $10^{17} cm^{-3}$ and limited $10^{14} cm^{-2}$ amount of Arsenic (constant-total-dopant) at $1100°C$ for 1.5 hours, find the surface concentration and junction depth.
Note: $D = 2.07 \times 10^{-14}\ cm^2/s$ for Arsenic at $1100°C$

Problem 2 A two-step Boron diffusion is used on an n-type wafer to form a p-type region; first 30 minutes with constant surface concentration of $1.1 \times 10^{20} cm^{-3}$ at $900°C$ followed by 4 hours (the constant-total step) at $1100°C$. find (a) junction depth at the end of each step (b) the gradient of concentration for $x = x_j$ at the end of each step (c) the surface concentration at the end of step 2
Note: $900°C \rightarrow D = 1.45 \times 10^{-15}\ cm^2/s$
$1100°C \rightarrow D = 2.96 \times 10^{-13}\ cm^2/s$
Background doping: $3 \times 10^{16}\ cm^{-3}$
Note: solving step 2 has Bonus score (not required)

Problem 3 Drive the concentration equation ($C(x,t)$), solving the Fick's equation for (a) constant surface source (b) limited amount of dopant (constant-total-dopant)
Note: this Problem has Bonus score (not required)

Note: Solving all bonus parts can boost the score up to 120%