Introduction to Semiconductor Devices
(Purdue University EE 305/606)
Supplemental Homework Exercises

Tutorial questions based on *BJT Lab v1.0* available online at https://www.nanohub.org/

Reference book: Semiconductor Device Fundamentals by Robert E. Pierret (Chapter 10/11)

Q1) Run the standard BJT lab for npn structure in common emitter mode. Set the length and doping as the standard values. Set Material as Silicon (Si) and temperature, T=300K.

(a) What biasing modes does the device go through for the (Vb/Ve) voltage sweeps.
(b) Find Emitter efficiency at the final bias (γ).
(c) Find Base transport factor at the final bias (αt).
(d) Find Common Base DC current gain at the final bias (αdc).
(e) Find Common Emitter DC current gain at he final bias (βdc).

Q2) For the same simulation run answer the following,
(a) Comment on the 'Net charge density' figure at equilibrium and final bias condition.
(b) Comment on the 'Recombination rate' figure at equilibrium and final bias condition.
(c) Plot Common Emitter DC current gain (βdc) Vs Ic (A).
(d) Calculate Early Voltage for the device from Ic-Vce characteristics.