**BECE201L Electronic Materials and Devices**

**Digital Assignment I**

1. Calculate the drift mobility and the mean scattering time of conduction electrons in copper at room temperature, given that the conductivity of copper is 5.9 × 105 Ω−1 cm−1. The density of copper is 8.96 g cm−3 and its atomic mass is 63.5 g mol−1. If the mean speed of the conduction electrons in Cu is roughly 1.6 × 106 m s−1, what is the mean free path between collisions?
2. What is the applied electric field that will impose a drift velocity equal to 0.1 percent of the mean speed *u* (∼106 m s−1) of conduction electrons in copper? What is the corresponding current density and current through a Cu wire of diameter 1 mm?
3. Determine the thermal-equilibrium concentrations of electrons and holes in silicon at *T =* 300 K if the Fermi energy level is 0.215 eV above the valence-band energy.
4. Calculate the intrinsic carrier concentration in silicon at *T =* 250 K. Assume the bandgap energy of silicon is 1.12 eV.