Electronic Devices
Sheet #1

1. A flat aluminum strip has a resistivity of 3.44×10^{-8} Ω m, a cross-sectional area of 2×10^{-4} mm^2, and a length of 5mm. what is the voltage drop across the strip for a current of 50 m A?

2. The resistance of no.18 copper wire (diameter= 1.03mm) is 6.5 ohms per 1000 ft. The concentration of free electrons in copper is 8.4×10^{28} electrons/m^3. If the current is 2A, find the followings:
   (a) Drift velocity (b) Conductivity (c) Mobility (1 ft. = 0.3 m)

3. A specimen of silicon is 4cm long and has a square cross section 2x2mm. the current is due to electrons whose mobility is 1300 cm^2/v. Two volts impressed across the bar results in a current of 8mA.
   (a) Calculate the concentration n of free electrons.
   (b) The drift velocity.

4. Show that the resistivity of intrinsic germanium at 300°k is 45 ohm.cm, and also find the resistivity of intrinsic silicon at 300°k.

5. (a) Determine the concentration of free electrons and holes in a sample of germanium at 300°k which has a concentration of donor atoms equal to 2×10^{14} atoms/cm^3 and a concentration of acceptor atoms equal to 3×10^{14} atoms/cm^3. Is this p or n type germanium? In other words, is the conductivity due primarily to holes or to electrons? (n_i for Ge at 300°k = 2.5×10^{13} atoms/cm^3).
   (b) Repeat part a for equal donor and acceptor concentration of 10^{15} atoms/cm^3 Is this p or n type germanium?
   (c) Repeat part a for a donor concentration of 10^{16} atoms/cm^3 and an acceptor concentration 10^{14} atoms/cm^3.

6. A sample of germanium is doped to the extent of 2×10^{14} donor atoms/cm^3 and 3×10^{14} acceptor atoms/cm^3 at the temperature of the sample the resistivity of pure (intrinsic) germanium is 60 ohms.cm. Assume that value of the mobility of holes and electrons is approximately the same as at 300°k (μ_p=1800cm^2/v.s and μ_n= 3800cm^2/v.s) If the applied electric field intensity is 2v/cm, find the total conduction current density.