**BECE201L Electronic Materials and Devices**

**Digital Assignment II**

1. (a) Consider a GaAs PN junction with doping concentrations *Na* = 5 x 1016 cm-3 and *Nd* = 1016 cm-3. The junction cross-sectional area is *A* =10-3 cm2 and the applied forward-bias voltage is *Va* = 1.10 V. Calculate the (*a*) minority electron diffusion current at the edge of the space charge region, (*b*) minority hole diffusion current at the edge of the space charge region, and (*c*) total current in the pn junction diode.

(b) Verify the answer by designing the diode from the current values.

1. An n+p silicon diode at *T* = 300 K has the following parameters: *Nd* =1018 cm-3, *Na* = 1016 cm-3, *Dn* = 25 cm2 /s, *Dp* = 10 cm2 /s, *n*0 = *p*0 = 1 s, and *A* = 10-4 cm2. Determine the diode current for a forward-bias voltage of 0.5 V.
2. An ideal one-sided silicon p+n junction at *T* = 300 K is uniformly doped on both sides of the metallurgical junction. It is found that the doping relation is *Na* = 80 *Nd* and the built-in potential barrier is *Vbi* = 0.740 V. A reverse-biased voltage of *VR* = 10 V is applied. Determine (*a*) *Na*, *Nd*; (*b*) *xp*, *xn*; (*c*) |Emax|; and (*d*) *Cj*. Repeat the same problem for zero bias condition.