ELEG340 FALL 2007 QUIZ 4 NAME:

Useful Formulae:

$E=\hbar\omega$

$J=\sigma\mathcal{E}$

$\sigma_n=nq\mu_n$

$\sigma_p=pq\mu_p$

$I=JA$

$V=IR$

$V = -\int \mathcal{E}\cdot dl$

$Potential\ Energy=(-q)V$

$\mu=v/\mathcal{E}$

$E=mc^2$

$v_G=d\omega/dk$

$m^*= \hbar^2/(d^2E/dk^2)$

$\rho=1/\sigma$

$ln(10)\sim 2.3$

$k_BT=26meV\ @\ RT\ (300K)$

$hc=1240\ nm\cdot eV$

$1V=1\ A\Omega$

$1A=1C/s$

$n_0=n_i exp((E_F-E_i)/k_BT)=N_c exp((E_F-E_c)/k_BT)$

$p_0n_0=n_i^2$

$p_0=n_i exp((E_i-E_F)/k_BT)=N_v exp((E_v-E_F)/k_BT)$

$dn/dt=(generation\ rate)-(recombination\ rate)$

$$\delta n(x,t) = \frac{\Delta n}{2\sqrt{\pi Dt}} e^{-\frac{(x-vt)^2}{4Dt}} e^{-t/\tau}$$

$\mathcal{E}=\rho d/2\varepsilon \qquad \oint \mathcal{E}\cdot dS = Q/\varepsilon$

$$x_n = \sqrt{\frac{2\varepsilon(V_0-V)N_a}{qN_d(N_a+N_d)}} \qquad x_p = \sqrt{\frac{2\varepsilon(V_0-V)N_d}{qN_a(N_a+N_d)}} \qquad W = \sqrt{\frac{2\varepsilon(V_0-V)(N_a+N_d)}{qN_dN_a}}$$

$$J = q\left(\sqrt{\frac{D_n}{\tau_n}}n_p + \sqrt{\frac{D_p}{\tau_p}}p_n\right)\left(e^{qV/kT}-1\right)$$

$C=dQ/dV$