Name:_____

Student ID #:_____

EECS170A
Homework #4
HW will be collected in DISCUSSION, TA OFFICE HOURS, OR A SPECIAL TURN-IN SECTION ON FRIDAY November 5, 2004 FROM 12-12:30 pm.
Homeworks will not be accepted in Professor's office.
(Location of special turn-in is ECT 124.)
Do not turn your HW in anywhere else, or it will not be accepted.
You are encouraged to turn it in at your own discussion section.
You may turn it in at any discussion section.
Last option to turn in: Special turn-in session, November 5, 2004, 12-12:30.
DUE: 12:30 PM Friday, November 5, 2004.

Please *staple* this sheet to the front of your homework.

1a	1b	1c	2a	2b	2c	3a	3b	3c	3d	Total
/10	/10	/10	/10	/10	/10	/10	/10	/10	/10	/100

1) For Si at 300 K, with no light, and under steady state conditions, with $N_A = 10^{17}$ cm^{-3}, and zero electric field:
   a. Find $\Delta n_p(x)$ from 0 to infinity if $\Delta n_p(0)=10^{14}$ cm^{-3}; $\Delta n_p(\text{infinity})=0$. (Use $\tau=1$ μs).
   b. Find n(x) under same conditions.
   c. Find p(x) under same conditions.

2) For Si at 300 K, with no light, and under steady state conditions, with $N_D = 10^{17}$ cm^{-3}, and zero electric field:
   a. Find $\Delta p_n(x)$ from x=0 to x=1 μm if $\Delta p_n(0)=10^{11}$ cm^{-3}; $\Delta p_n(x=1\ \mu m)= 10^{8}$ cm^{-3}. (Use $\tau=1$ μs).
   b. Find p(x) under same conditions.
   c. Find n(x) under same conditions.

   For both problems, remember, you can only apply diffusion equation solutions to minority carriers. Also remember, if low-level conditions prevail as discussed on page 112 (do they?) then the majority carrier concentration is essentially unperturbed from its equilibrium value.

3) For a Si p-n diode at 300 K, with no applied voltage, with $N_A = 10^{14}$ cm^{-3}, and $N_D = 10^{19}$ cm^{-3}
   a. Calculate V_{bi} in units of V
   b. Calculate x_p in units of μm
   c. Calculate x_n in units of μm
   d. Calculate $W= x_n + x_p$ in units of μm