Name: _____ (please print)

Signature: _____

ECE 2300 – Quiz #1
June 12, 2014

Keep this quiz closed and face up until you are told to begin.

1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

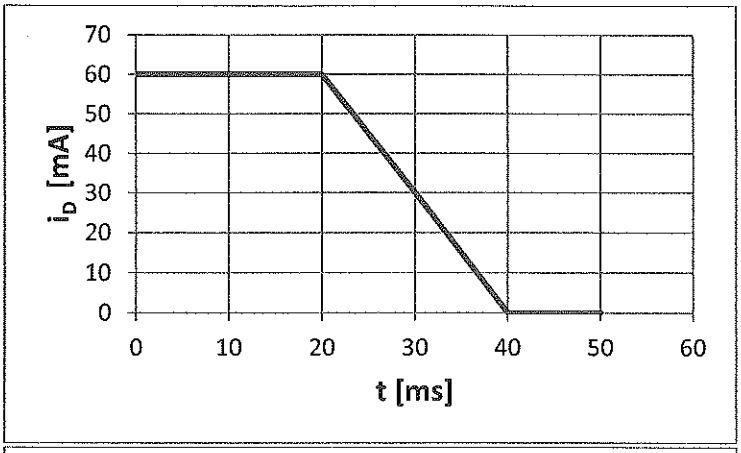
_____/25

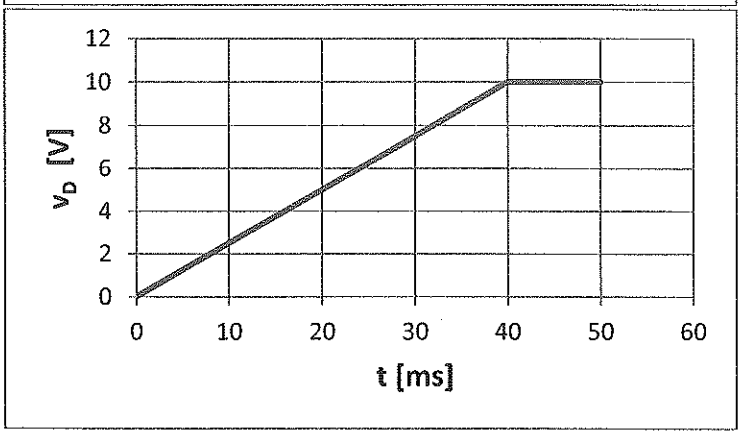
Room for extra work

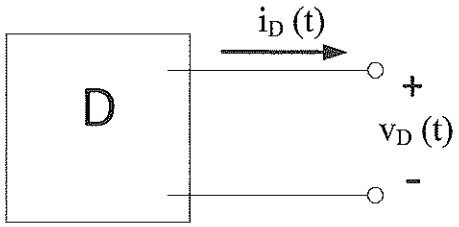
The current i_D and voltage v_D for device D are plotted in the graphs.

a) Find the energy delivered by device D in the time interval 20 [ms] to 40 [ms].

b) State whether charge carriers are gaining or losing energy as they move through device D at t = 10 [ms].







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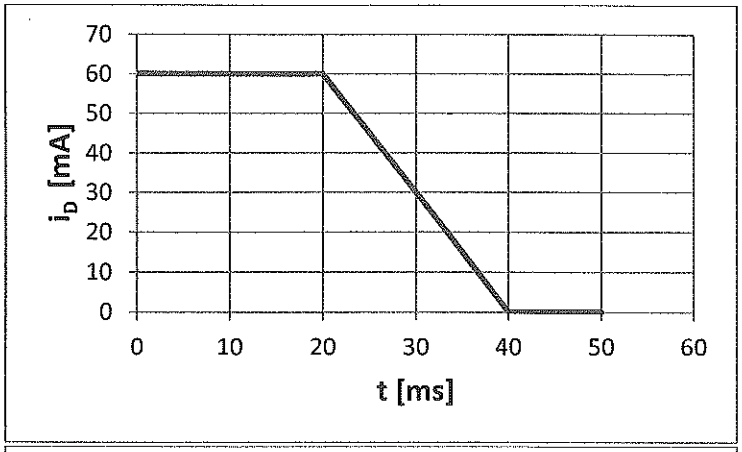

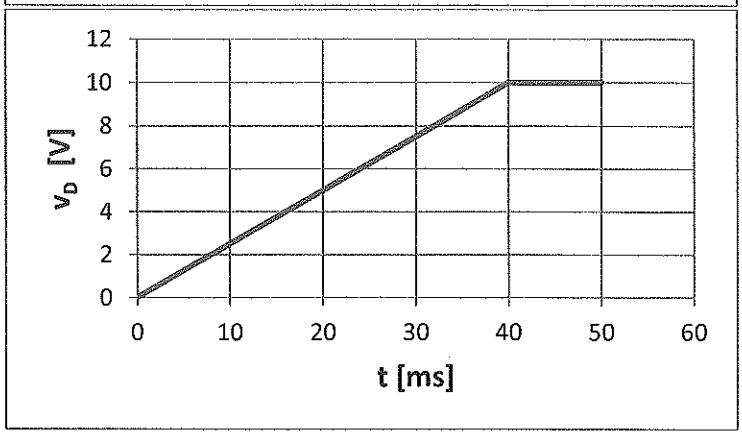

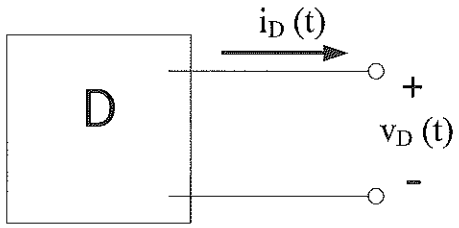

$v_D(t) = \frac{10\,[V]}{40\,[ms]}\,t \qquad t \text{ in } [ms]$

$v_D(t) = 250\left[\frac{V}{s}\right]t \qquad t \text{ in } [s]$

a)

We need equations for $i_D(t)$, $v_D(t)$:

$i_D(t) = mt + b$

$0 = m(0.04) + b$

$0.06 = m(0.02) + b$

$\Rightarrow \quad m = -3\left[\frac{A}{s}\right], \quad b = 0.12\,[A]$

$i_D(t) = -3\left[\frac{A}{s}\right]t + 0.12\,[A] \qquad t \text{ in } [s]$

Room for extra work

Power delivered: $P_{del\ by\ D} = v_D(t) \cdot i_D(t)$

$= (250t)(-3t + 0.12)$

$= -750t^2 + 30t \quad [W]$

∴ Energy delivered is

$$W_{del\ by\ D} = \int_{0.02\ [s]}^{0.04\ [s]} (-750t^2 + 30t)\,dt$$

$$= -\frac{750}{3}t^3 + \frac{30}{2}t^2 \Big|_{0.02}^{0.04}$$

$$= [-250(0.04)^3 + 15(0.04)^2] - [-250(0.02)^3 + 15(0.02)^2]$$

$$W_{del\ by\ D} = 0.004\ [J]$$

b) At $t = 10$ [ms], i_D & v_D are positive and D is delivering energy, which means charge carriers (of either sign) are gaining energy.