Name: _____ (please print)

Signature: _____

ECE 2201 – Quiz #1 VERSION A
September 11, 2018

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 35 minutes to work on this quiz.

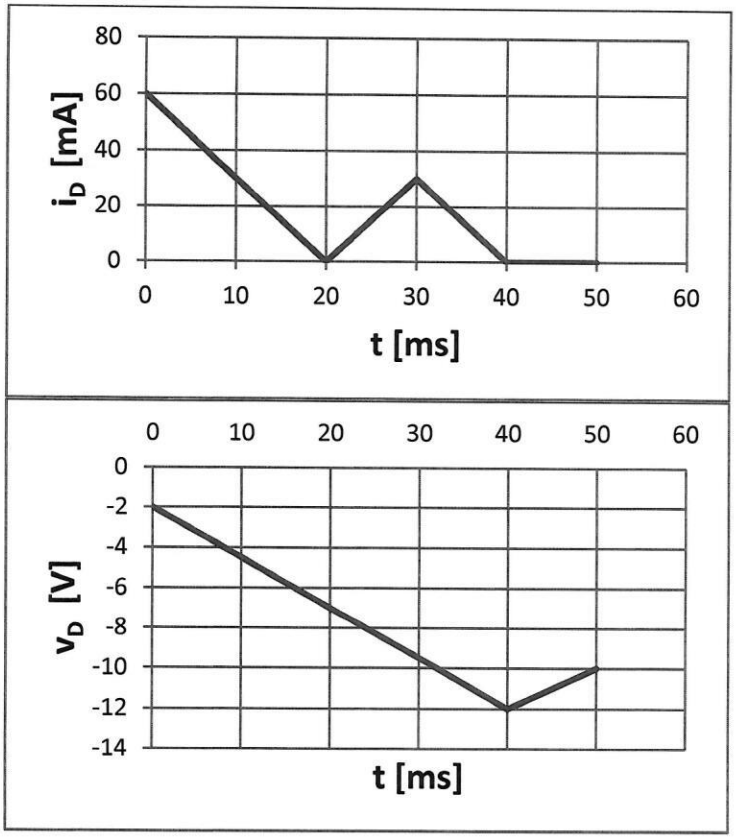
_____/25

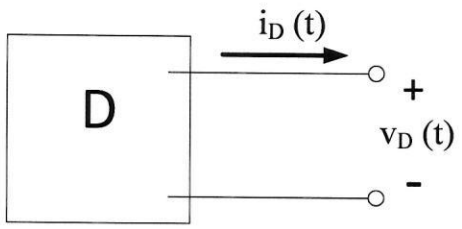
Room for extra work

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

a) Find the energy delivered by device D in the time interval 10 [ms] to 20 [ms].

b) Assuming the charge carrier are electrons, state in which direction they are moving through device D at t = 5 [ms].





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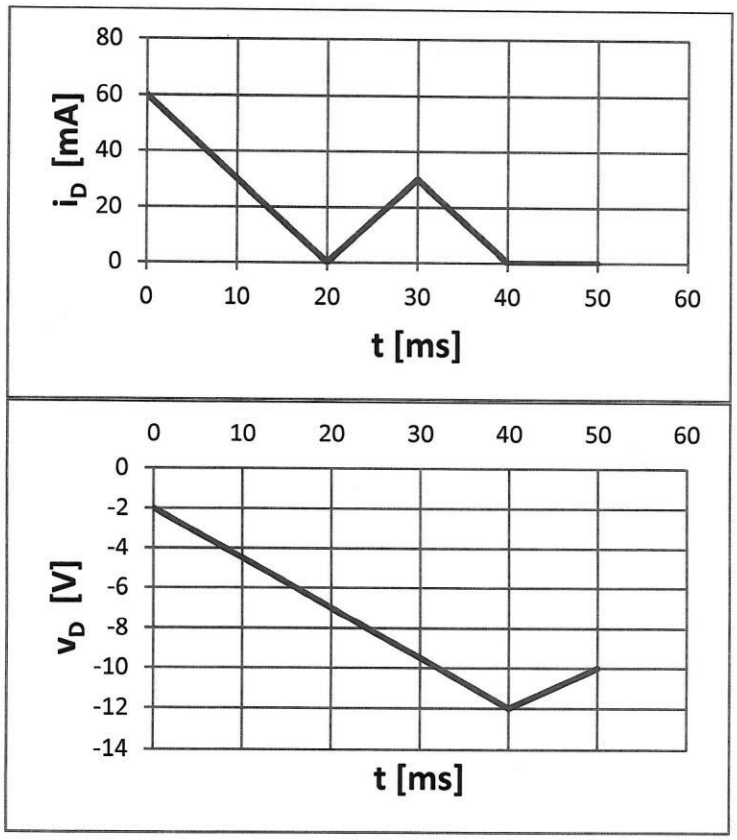

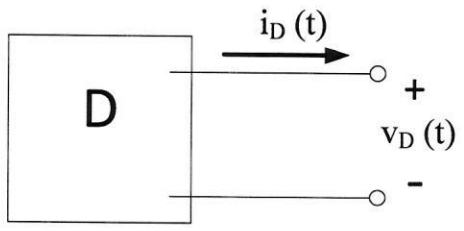

$P_{abs\ by\ D} = -i_D \cdot v_D$

$\Rightarrow P_{del\ by\ D} = i_D \cdot v_D$

We will need equations for the lines representing i_D & v_D, but only between 0 and 20 [ms].

$i_D(t) = -3\left[\frac{mA}{ms}\right]t + 60\,[mA] \qquad 0 \le t \le 20[ms]$

$v_D(t) = -0.25\left[\frac{V}{ms}\right]t - 2\,[V] \qquad 0 \le t \le 40[ms]$

$$P_{del\ by\ D} = \int_{10[ms]}^{20[ms]} \left(-3\left[\frac{mA}{ms}\right]t + 60\,[mA]\right)\left(-0.25\left[\frac{V}{ms}\right]t - 2\,[V]\right) dt$$

$$= \int_{10[ms]}^{20[ms]} \left(0.75\left[\frac{mW}{ms^2}\right]t^2 - 9\left[\frac{mW}{ms}\right]t - 120\,[mW]\right) dt$$

Room for extra work

$$P_{del\ by\ D} = \frac{0.25}{3}\left[\frac{mw}{ms^2}\right] t^3 \Big|_{10[ms]}^{20[ms]} - \frac{9}{2}\left[\frac{mw}{ms}\right] t^2 \Big|_{10[ms]}^{20[ms]} - 120[mw]\, t \Big|_{10[ms]}^{20[ms]}$$

$$= 0.25\left[\frac{mw}{ms^2}\right](20^3 - 10^3)[ms^3] - \frac{9}{2}\left[\frac{mw}{ms}\right](20^2 - 10^2)[ms^2]$$

$$- 120[mw](20 - 10)[ms]$$

$$= 1750[mw \cdot ms] - 1350[mw \cdot ms] - 1200[mw \cdot ms]$$

$$\boxed{P_{del\ by\ D} = -800[\mu J]}$$

If we change units to A, V, s, we get

$$P_{del\ by\ D} = \int_{0.01[s]}^{0.02[s]} \left(-3\left[\frac{A}{s}\right] t + 0.06[A]\right)\left(-250\left[\frac{V}{s}\right] t - 2[V]\right) dt$$

$$= -8 \times 10^{-4}[J] = -800[\mu J]$$

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ECE 2201 – Quiz #1 VERSION B
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Room for extra work

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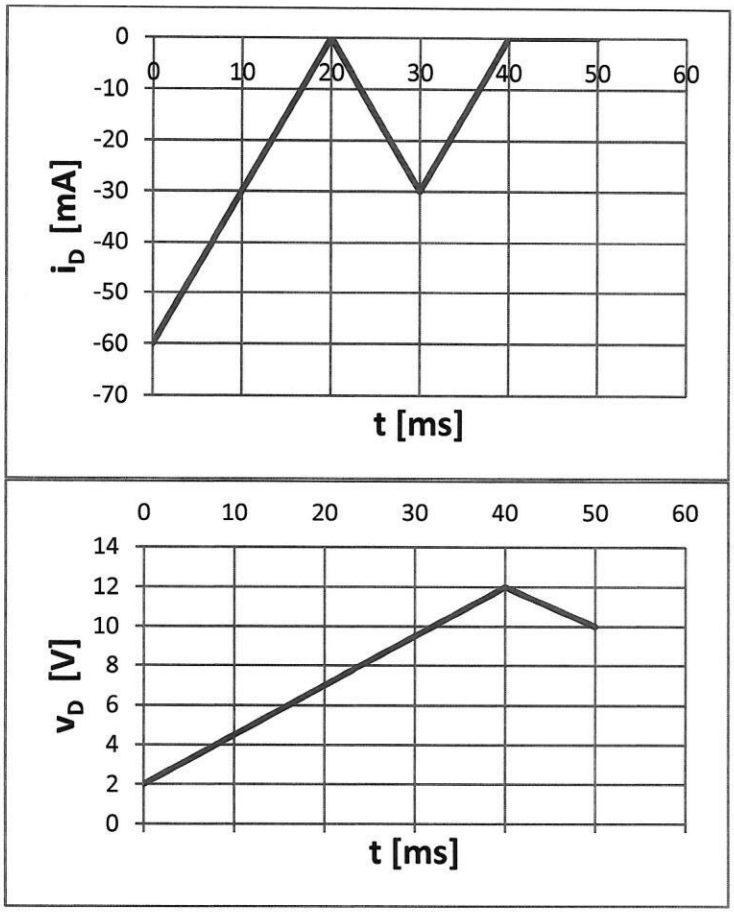

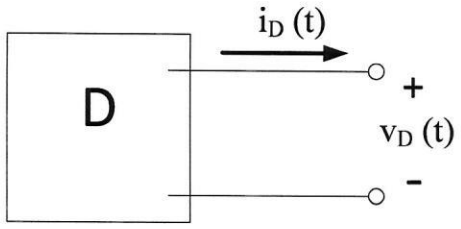

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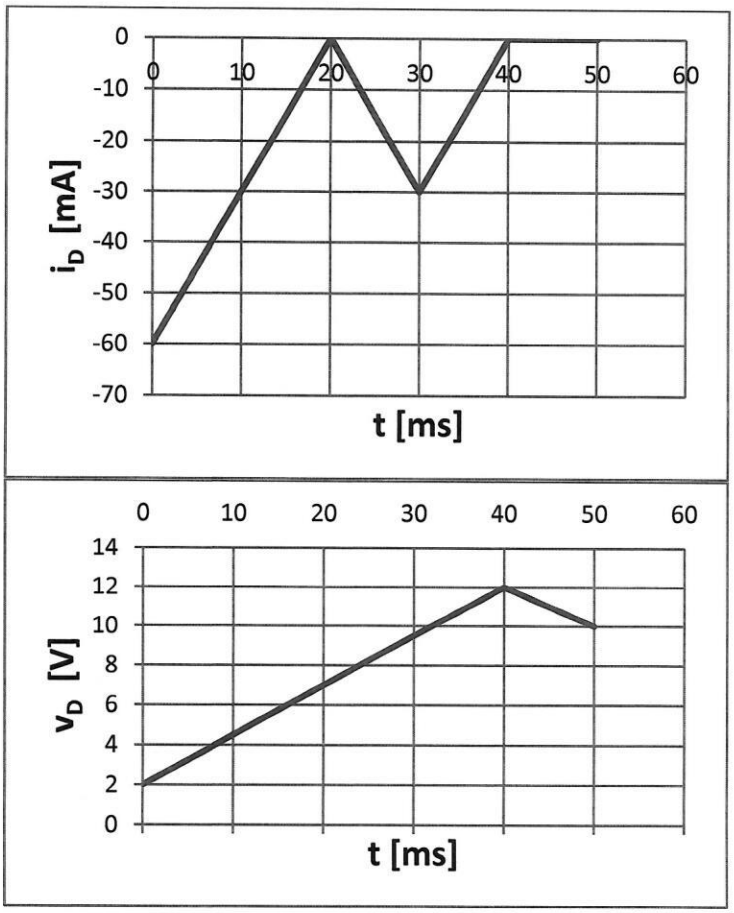

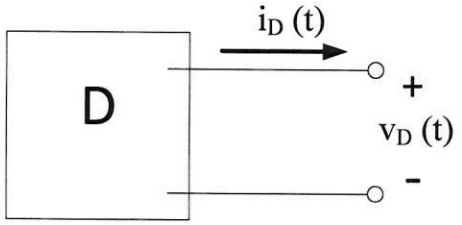

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Room for extra work

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