Name:	Signature:
Surname:	Student ID Number:

PHYS 102 General Physics II – Final

2 June 2018, Friday 15:00 -16:30

Please read!

- Count to make sure that there are 5 pages in the question booklet
- Check your name and surname on front page, and student ID number on each page, and sign each page.
- This examination is conducted with closed books and notes.
- Put all your personal belongings underneath your seat and make sure that pages of books or notebooks are not open.
- Absolutely no talking or exchanging anything (like rulers, erasers) during the exam.
- You must show all your work to get credit; you will not be given any points unless you show the details of your work (this applies even if your final answer is correct!).
- Write neatly and clearly; unreadable answers will not be given any credit.
- If you need more writing space, use the backs of the question pages and put down the appropriate pointer marks.
- Make sure that you include units in your results.
- Make sure that you label the axis and have units in your plots.
- You are not allowed to use calculators during this exam.
- Only the answers in the boxes will be graded and NO partial credit will be given. No points will be given to unjustified answers. Incomplete calculations will not be graded

P102_Index:

1	2	3	4	TOTAL

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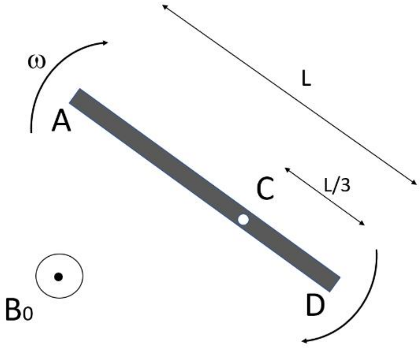
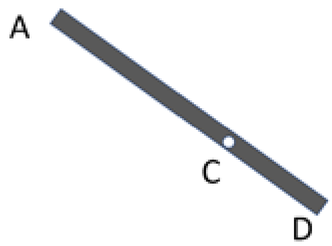
1-(25 pts) As shown in the figure a conducting rod of length L rotates with a constant angular speed *w* about a pivot point C. A uniform magnetic field B_0 is directed perpendicular to the plane of rotation.



a) Calculate the induced voltage between two ends of the rod (points A and D).

$V_{AD} =$

b) Show the positions of the negative and positive charges on the rod.



Solution continues on the back side of the page **Yes** □ **No** □

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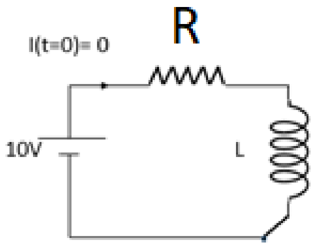
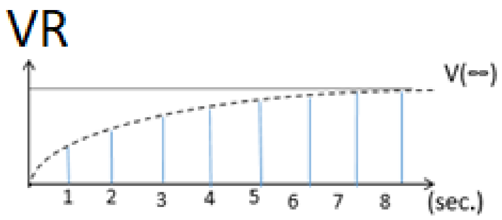
2-(25 pts) As shown in the figure, a simple RL circuit (L = 1H) is powered by a **10 V** batterey. The initial current in the circuit is zero. (e^{-1}=0.367, e^{-2}=0.135, e^{-3}=0.049, e^{-4}=0.018, e^{-5}=0.006)





time (sec)	Vc (Volt)
0	0
1	6.33
2	8.65
3	9.51
4	9.82
5	9.94

a) Calculate the time constant of the RL circuit using the graph given above.

τ=

b) Calculate VR(t) the voltage across the resistor R, as a function of time.

VR(t)=

c) Calculate $V_L(t)$ the voltage across the inductor as a function of time.

V_L(t)=

d) Calculate and plot **P(t)** the power disipation on the resistor.

P(t)=

e) Calculate the total energy stored in the inductor when the circuit reachs the saturation.

E=

Solution continues on the back side of the page   **Yes** □   **No** □

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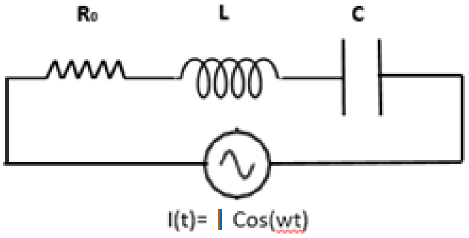
3-(25 pts) As shown in the figure, A simple RLC circuit is driven by a AC current supply. The RMS value of the current source I_{rms} =5 Amp. R_0 = 15 Ω, L=0.5 H, C= 5x10^{-3} F.



a) What is the resonance frequency *f* of the circuit in terms of Hz?

f=

b) When the source operates at ***w***=40 rad/sec, calculate the $V_R(t)$, $V_L(t)$, $V_C(t)$ and $V_T(t)$ total voltage of the circuit.

$V_R(t)$=

$V_L(t)$=

$V_C(t)$=

$V_T(t)$=

c) Calculate the total average power P(ave) over a cycle of the circuit.

P(ave)=

Solution continues on the back side of the page **Yes** □ **No** □

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4-(25 pts)

a) Remember the **microwave oven experiment** demonstrated in the class. We heated a box in a microwave oven and using a thermal camera we observed the hot spots on the box. We assumed that microwave oven is one dimensional system and forms a standing wave pattern. If the distance between two successive hotspots is 5 cm, calculate the frequency of the radiation used in the oven in terms of Hz. (speed of light $C=3x10^8$ m/sec).

f=

b) Remember the **electromagnetic antenna experiment** demonstrated in the class. If we generate 300 MHz electromagnetic wave, what is the minimum length of the antenna to radiate electromagnetic wave efficiently?

L=

c) Assume that the same antenna is radiating freely propagating planar sinusoidal electromagnetic wave (300MHz). Write down the electric field vector (E^+) of the wave **freely propagating** in +Y but oscillating in X directions. Assume that E_0 is the maximum electric field.

E^+ =

d) Write the electric field vector (E^-) of the same sinusoidal electromagnetic wave **freely propagating** in -Y and but oscillating in X direction.

E^- =

e) Write the electric field vector of a **standing** electromagnetic wave formed by the superposition of ($E^+ + E^-$).

($E^+ + E^-$) =

Solution continues on the back side of the page **Yes** □ **No** □