Name, Surname:	Student ID Number:
Exam Room:	Signature:

KOÇ UNIVERSITY

College of Sciences

PHYS 102 General Physics 2

Spring Semester 2019

Final Exam

May 26, 2019 Sunday, 11:45-13:25

Please read.

- Count to make sure that there are 5 pages in this question booklet
- Check your **name, number, on front page, and student ID on 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.
- Turn off your mobile phones, and put away.
- You are not allowed to leave the class during the first 15 minutes, and last 15 minutes.
- Write your final answers into the boxes. 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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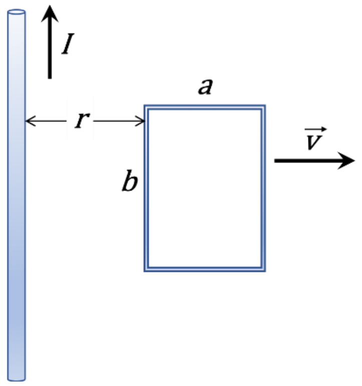
Q1-(25 pts) In the figure, the loop is being pulled to the right at constant speed v. A constant current I flows in the long wire, in the direction shown.



(a) Calculate the magnitude of the net emf ε induced in the loop.

(b) Find the direction (clockwise or counter clockwise) of the current induced in the loop. Explain your reasoning clearly.

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

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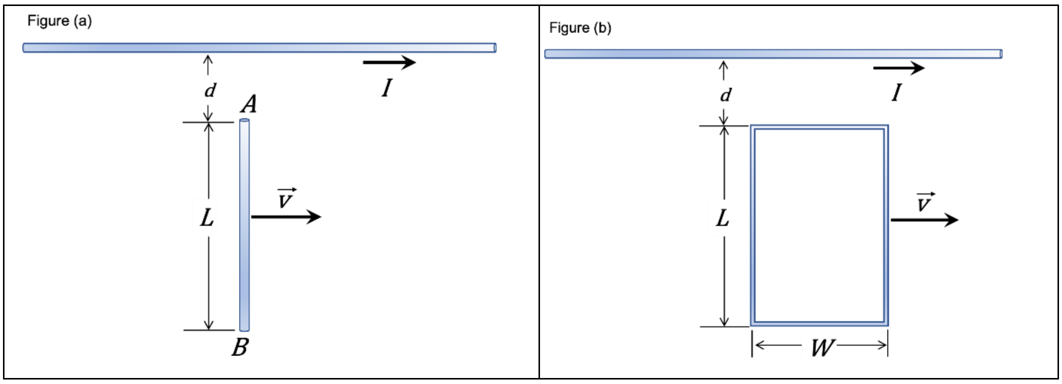
Q2-(25 pts) The long, straight wire shown in Figure (a) carries constant current I. A metal bar with length L is moving at constant velocity $\boldsymbol{v}$, as shown in the figure. Point A is a distance d from the wire.



(a) Calculate the emf induced in the bar.

(b) Which point, A or B, is at higher potential, explain.

(c) If the bar is replaced by a rectangular loop of resistance R, as shown in Figure (b), what is the magnitude of the current induced in the loop?

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

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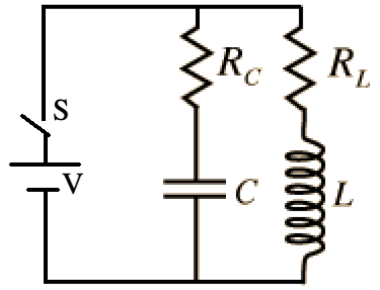
Q3-(25 pts) Consider the RLC circuit that is shown in the figure. The capacitor is initially uncharged, and the switch S is closed at time t = 0.



(a-8pts) What is the current $i_L(t)$ through the inductor as a function of time?

$i_L(t)$=

(b-7pts) What the current $i_C(t)$ through the capacitor as a function of time?

$i_C(t)$=

(c-4pts) Evaluate $i_L(t)$ and $i_C(t)$ immediately after S is closed.

$i_L(0)$ =

$i_C(0)$ =

(d-4pts) Evaluate $i_L(t)$ and $i_C(t)$ long time after S is closed.

i_L(infty)=

i_C(infty)=

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

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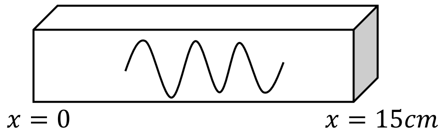
Q4-(25 pts) A standing electromagnetic (EM) plane wave is contained in a cavity that is formed by two mirrors located in vacuum, respectively at $x = 0$ and $x = 15cm$. The electric field of the EM-wave is given by $E_y = -2E_{max} \sin(kx) \sin(\omega t)$, where $E_{max} = 120\ V/m$. Take the speed of EM wave as $c = 3 \times 10^8\ m/s$.



(a) Obtain an explicit expression for the energy density, $u(x,t)$, of the standing EM-wave.

(b) Calculate the the total energy per unit area: $U = \int u(x,t)\ dx$ inside the cavity at $t = 0$. Is the energy completely stored in the electric or in the magnetic field at this time?

(c) Calculate the <u>smallest angular frequency</u> that this standing electromagnetic wave can have to exist in this cavity.(Hint: $\omega = ck$, where $k = \frac{2\pi}{\lambda}$.

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