Name:	Signature:
Surname:	Number:

KOÇ UNIVERSITY

College of Sciences

PHYS 102 General Physics 2

Spring Semester 2017

Final Exam

May 24, 2017 Wednesday, 08:30-10:10

Please read.

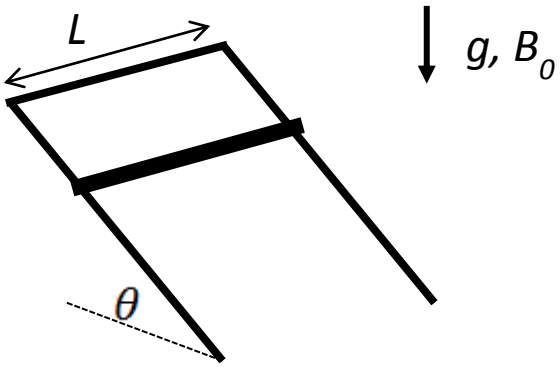
- Count to make sure that there are 5 pages in this question booklet
- Check your **name, number, on front page, and student ID on each page.**.
- This examination is conducted with closed books and notes.
- Put all your personal belongings underneath your seat and make sure that pages of books or notebooks 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.
- Answer the following questions. Show your calculations. Unjustified answers will not be given any score. Write your answers in the boxes.

P102_Index:

1	2	3	4	Total

ExamRoom:	P101_Index:
Student ID Number:	Signature:

1- (25 Points) A conducting bar of length *L*, mass *M* and electrical resistance *R* can slide down a long conducting frame without friction. The frame is inclined by angle θ from the horizontal and has no electrical resistance. The whole system is in a constant downward magnetic field $\vec{B} = -B_0\hat{j}$, and there is also the gravitational field $-g\hat{j}$. The bar starts sliding down.



a) What is the magnitude of the EMF induced in the closed circuit at the moment when the bar has speed *v*?

b) What is the magnetic force on the bar at the moment when the bar has speed *v*?

c) What is the maximal speed the bar can reach?

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

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2-(25 Points)

Unjustified answers will not be given any score. Write your answers in the boxes; answers outside the boxes will not be given any score.

Consider an RL-series circuit, with L = 200 mH and R = 100 mΩ, driven by a constant voltage source with V = 300 mV. Assume initially there is no current in the circuit. Find

(take e = 3)

(i) the time constant of the circuit,

(ii) the current in the circuit after 2 seconds,

(iii) the current in the circuit after very long time.

(i)	(ii)	(iii)

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

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3-(25 Points)

Unjustified answers will not be given any score. Write your answers in the boxes; answers outside the boxes will not be given any score.

A capacitor is connected to an inductor to form an LC circuit. Initially the capacitor is uncharged and there is current in the circuit. After a while a measurement is performed which indicates that the charge on the capacitor is 4 C and the current in the circuit is 1 A. The period of LC oscillations is observed to be 24 s. Calculate (take $\pi = 3$)

(i) the maximum charge on the capacitor;
(ii) the earliest time when measurement is performed.

(i)	(ii)

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

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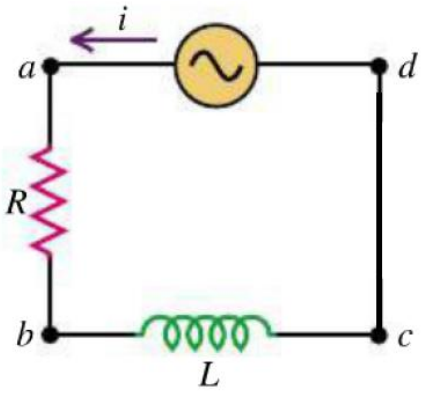
4- (25 Points) A resistor R and an inductor L are connected in series (as in the figure) to an AC current source which supplies a current

$$i(t) = I\cos(\omega t)$$



(a) Draw the phasor diagram for the current *i(t)* and the voltages v_{ab} *(t)*, v_{bc} *(t)*, and v_{ad} *(t)*.

(b) The source voltage v_{ad} can be expressed as:

$$v_{ad}(t) = V_s\cos(\omega t + \phi)$$

Calculate V_s and ϕ in terms of *I*, *R*, *L*, and ω.

(c) How much power is delivered by the AC source <u>on average</u>?

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