Name, Surname:	Student ID Number:
Exam Room: SNA A21	Signature:

KOÇ UNIVERSITY

College of Sciences
PHYS 102 General Physics 2
Spring Semester 2019
Midterm 2 Exam
April 22, 2019 Monday, 19:00-20:40

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.
- Use of calculators are not allowed during this exam.
- Put all your personal belongings underneath your seat and make sure that pages of books or notebooks are not open.
- Turn off your cell phones and put away.
- 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 backside of the respective question's page and put down the appropriate pointer marks.
- Results must include proper units.
- Plots must have proper axis labels and units.
- You are not allowed to leave the room in the first and last 15 minutes of the exam.
- 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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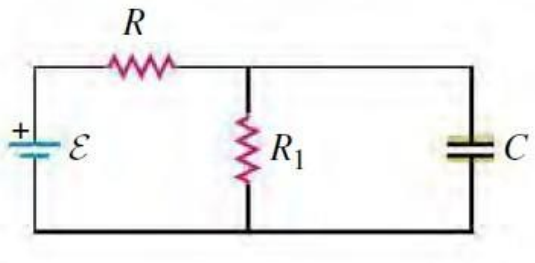
Q1-(25 pts) The circuit below is running for a long time and reached the steady state. The battery has negligible internal resistance. Given $\varepsilon = 12.0\,V, R = 20\,\Omega, C = 60\,\mu F$.



(a) [15 pts.] Calculate the value of R_1 for which the power dissipated on R_1 is maximum (show your calculation steps explicitly).

(b) [10 pts.] Calculate the charge on the capacitor (Note: if you did not solve part (a), solve this part by leaving R_1 as it is in your solution).

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

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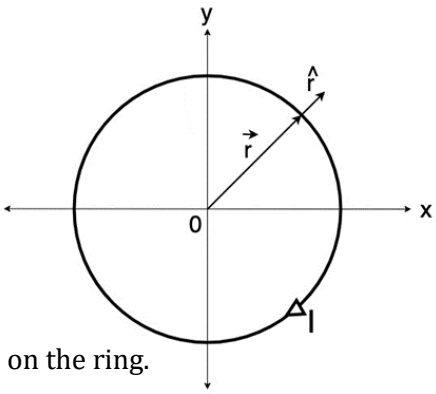
Q2-(25 pts) A conducting ring of radius R lies in the xy plane with its center at the coordinate origin. The ring carries a clockwise current I. If the external magnetic field in the xy plane is given by $\vec{B} = a\vec{r} + b\hat{j}$, where $\vec{r} = r\hat{r}$ is the position from the origin, $\hat{j}$ is a unit vector along the $+y$ axis, and a and b are positive constants:



(a-15pts) Calculate the magnitude and direction of the net force on the ring.

(b-10pts) Calculate the magnitude and direction of the net torque on the ring.

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

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Q3-(25 pts) A circular loop of radius R and a square loop of edge length $2a$ are centered about the origin and they both lie on the $x-y$ plane. They both carry current I but in opposite directions. They are electrically isolated from each other. If the net magnetic field at the origin is zero, determine the radius of the loop in terms of a. Does the loop fit into the square or the opposite? (Hint: The magnetic field strength of a straight wire at a distance x from its center is given by $B = \frac{\mu_0 I}{4\pi} \frac{2a}{x\sqrt{x^2+a^2}}$, where $2a$ is the length of the wire and I is the current).

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

P102_Index:	Student ID Number:
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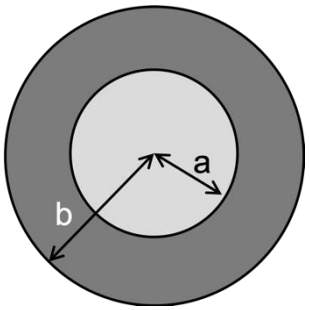
Q4-(25 pts) Consider an infinitely long straight cylindrical wire consisting of two coaxial metals as shown light and dark colored regions in the figure. The currents flowing the inner and the outer metallic regions are given to be as I_1 and I_2, respectively.



(a) Find the current density in each metallic region.

(b) Using the Ampere's law, determine the magnetic field in each metallic region and outside the wire.

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