Student ID Number: _____

PRELIMINARY EXAMINATION

Department of Physics
University of Florida
Part B, August 20, 2018, 14:00–17:00

Instructions

1. You may use a calculator and CRC Math tables or equivalent. No other tables or aids are allowed or required. You may **NOT** use programmable calculators to store formulae.

   (a) All of the problems will be graded and will be tabulated to generate a final score. Therefore, you should submit work for all of the problems.

   (b) For convenience in grading please write legibly, use only one side of each sheet of paper, and work different problems on separate sheets of paper. The sheets for each problem will be stapled together but separately from the other two problems.

   (c) Your assigned student **ID Number**, the **Problem Number**, and the **Page Number** should appear in the upper right hand corner of each sheet. Do **NOT** use your name anywhere on the Exam.

   (d) All work must be shown to receive full credit. Work must be clear and unambiguous. Be sure that you hand your completed work to the Proctor.

   (e) Each problem is worth 10 points.

   (f) Following the UF Honor Code, your work on this examination must reflect your own independent effort, and you must not have given, nor received, any unauthorized help or assistance. If you have any questions, ask the Proctor.

University of Florida Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

DO NOT OPEN EXAM UNTIL INSTRUCTED

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B1. **(Woodard)** A current I flows in a circuit consisting of an equilateral triangle of side length L.

(a) **[3 points]** What is the magnitude of the magnetic dipole moment of the circuit?

(b) **[3 points]** What is the magnetic field at the center of the triangle?

(c) **[4 points]** What is the magnetic field at a height h above the center of the triangle?

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B2. **(Meisel)**

(a) **[10 points]** Consider an infinitely thin spherical shell of radius R. A special surface charge, σ, is fixed to it, where $\sigma = k \cos\theta$ and k is a constant with the appropriate units. The angle θ is the *polar angle* in spherical coordinates, *i.e.* the angle with respect to the z-axis of Cartesian coordinates. Calculate the dipole moment of this charge distribution.

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B3. **(Ramond)**

(a) **[10 points]** Using judicious physics reasoning, dimensional analysis (Length, Mass, Time), and the fundamental constants c, $\hbar$.

Derive the non relativistic expression (up to a dimensionless number) for the power P radiated by an electron of mass m, electric charge e moving along an arbitrary trajectory $\vec{x}(t)$.

Stating your reasoning is crucial for partial credit