##### DO NOT BEGIN THIS EXAM UNTIL TOLD TO START

# Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### ECE 2317

#### Applied Electricity and Magnetism

**Exam 1**

#### Oct. 23, 2013

1. This exam is closed-book and closed-notes notes. A formula sheet is provided. A calculator is allowed (as long as it cannot be used to communicate), but no other device (laptop, phone, tablet, etc.) is allowed.
2. Show all of your work. No credit will be given if the work required to obtain the solutions is not shown.
3. Perform all your work on the exam in the space allowed.
4. Write neatly. You will not be given credit for work that is not **easily** legible.
5. Leave answers in terms of the parameters given in the problem.
6. Show units in all of your final answers.
7. Circle your final answers.
8. Double-check your answers. For simpler problems, partial credit may not be given.
9. If you have any questions, ask the instructor. You will not be given credit for work that is based on a wrong assumption.
10. Make sure you sign the academic honesty statement on the next page.

Academic Honesty Statement

I agree to abide by the UH Academic Honesty Policy during this exam. I understand that the punishment for violating this policy will be most severe, including the possibility of getting an F in the class and/or getting expelled from the University.

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Signature

FORMULA SHEET















































**TABLE OF INTEGRALS**

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TABLE OF COORDINATE SYSTEM FORMULAS

 

 

 

 

 



























Problem 1 (30 pts.)

A cloud of electrons exists everywhere in space, and has an electron density (number of electrons per cubic meter) *Nv* given in cylindrical coordinates by

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Each electron has a charge of -1.602 ×10-19 [C]. The electrons are moving in the *z* direction with a velocity of *v*0 [m/s].

Calculate the total current that flows upward through a circle of radius *a* that lies in the *z* = 0 plane, centered at the origin.

*z*

*y*

*x*

*a*

ROOM FOR WORK

Problem 2 (30 pts.)

A semi-circular annular disk of uniform surface charge density *ρs*0 lies in the *z* = 0 plane, centered at the origin, as shown below. The inner radius of the disk is *a* and the outer radius is *b*.

Find the electric field vector at the origin.

*a*

*x*

*y*

*b*

*ρs*0

ROOM FOR WORK

Problem 3 (40 pts.)

An infinite cylindrical tube of uniform surface charge density *ρs*0 [C/m2] of radius *a* is surrounded by a perfectly conducting metal shield (PEC) that has an inner radius of *b* and an outer radius of *c*. The structure is infinite in the *z* direction.

a) Assuming that the metal shield is neutral (no net charge), find the electric field vector in all four regions: *ρ*  < *a*, *a* < *ρ*  < *b*, *b* < *ρ*  < *c*, and *ρ*  > *c*.

b) Assuming that the metal shield is neutral (no net charge), find the surface charge densities *ρsb*and *ρsc* on the inner and outer surfaces of the PEC shield.

c) Find the surface charge density *ρsc* on the outer surface of the shield assuming that the metal shield is now grounded.

d) For the grounded case in part (c), find the voltage drop *VAB*, where *A* is at the origin and *B* is at infinity.

PEC

*b*

*c*

*ρs*0

*a*

*x*

*y*

ROOM FOR WORK

ROOM FOR WORK