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

#### ECE 3318

#### Applied Electricity and Magnetism

**Exam 1**

#### March 31, 2020

**Remote Exam Instructions**

You are not allowed to use your computer, or any other device, to communicate with anyone other than the instructor during the exam.

If you wish to ask a question during the exam, please use the “chat” feature of Zoom to chat with the instructor (please chat only with the instructor, not with “everyone”).

By taking this exam, you agree to the UH Academic Honesty Policy.

1. This exam is open-book and open-notes.
2. Show all of your work. No credit will be given if the work required to obtain the solutions is not shown.
3. Write neatly. You will not be given credit for work that is not **easily** legible.
4. Leave answers in terms of the parameters given in the problem.
5. Show units in all of your final answers.
6. Circle your final answers.
7. Double-check your answers. For simpler problems, partial credit may not be given.
8. If you have any questions, ask the instructor. You will not be given credit for work that is based on a wrong assumption.

**TABLE OF INTEGRALS**

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Problem 1 (30 pts.)

An electrode is at the origin in a conducting medium, and it spews out current equally in all directions in spherical coordinates. The total current coming out of the electrode is *I* amps. The current density vector is thus given in spherical coordinates as

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Find the total current (in amps) that is going upward through a horizontal circular disk that has a radius *a* and is at a height *h* above the *z* = 0 plane, as shown below.

Problem 2 (35 pts.)



A uniform surface charge density  lies in the *xy* plane inside of a circular region defined by  and , as shown below.

a) Find the electric field component  at the point  as shown below.

b) Find the electric field component  at the point  as shown below.

c) Without doing any calculation, how is  related to  at the point ?



Problem 3 (35 pts.)

An infinite tube of uniform volume charge density  having a radius *a* is surrounded by an infinite metal pipe as shown below.

The metal pipe has an inner radius *b* and an outer radius *c*. The metal pipe is neutral.

a) Find the voltage drop *VAB* between the *z* axis (point *A*) and the pipe (point *B*).

b) Find the surface charge densities  and  on the pipe surfaces at  and .

c) If the pipe is now grounded, how will the answers to part (b) change?

