Midterm Exam No. 01 (Spring 2015)

PHYS 420: Electricity and Magnetism II

Date: 2015 Feb 11

1. (**20 points.** Take home exercise, to be submitted during exam.)
   Consider a spherical cavity of radius a with perfectly conducting walls that is grounded. The inside of the cavity is described by vacuum properties ε_0. A point charge q is placed inside the cavity.

   (a) Using method of images determine the magnitude and position of the fictitious image charge that will simulate the boundary conditions of a perfect conductor on the inner surface of the conductor.

   (b) Write down the total electric potential due to the original charge (inside the sphere) and the image charge. Thus determine the electric potential everywhere inside the spherical conductor.

   (c) Determine the induced charge density on the inner surface of the spherical conductor.

   (d) Integrating the induced charge density over the inner surface of the conductor determine the total induced charge. Thus, find out if the total induced charge equals the image charge?

2. (**20 points.**)

3. (**20 points.**)

4. (**20 points.**)

5. (**20 points.**)