Post Graduation Geophysics
Physics
3/2019

Name:	
Date:	
Time:	90 minutes
Please, write down your name in all the solution pages	
Please read the information carefully	

1. In Figure 1, four particles form a square. The charges are $q_1 = q_4 = Q$ and $q_2 = q_3 = q$. Consider the electrostatic constant equal to K. Determine (2.5 points)

(a) The net vector of Coulombian force ($\mathbf{F_e}$) acting in particle q_3.

(b) Sketch the net vector $\mathbf{F_e}$ acting in particle q_3.

(c) The ratio Q / q for which the net vector of Coulombian force ($\mathbf{F_e}$) in particle 3 to be null

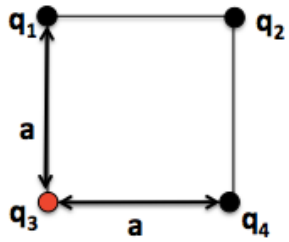

Figure 1

2. (2.5 points) Consider the charges arrangement shown in Figure 1, evaluate

(a) The electric field vector at the point *P* located in the center of the square

(b) Consider the charges q_1, q_2, q_3, q_4 positioned very close to each other at point *P*. Use Gauss's law to calculate the electric field produced by this charge distribution at a radial distance $d = 2a$.

3. (2.5 pontos) Figure 2 shows the cross section of a long, conductive, hollow cylinder with inner radius *a* and outer radius *b* (*b* > *a*). The cylinder conducts an electric current out of the paper plane. The modulus of current density in the cylinder cross section is given by $\boldsymbol{J} = c\,\boldsymbol{r}$, where *c* is a constant and *r* is the radial distance measured from the center of the wire. Calculate the magnetic field vector in the following situations

a) For P1 placed at r, with a < r <b.

b) For P2 placed at r > b

c) For P3 placed at r < a

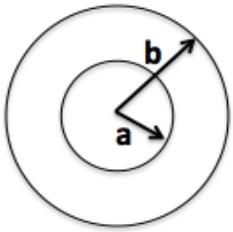

Figure 2

4. (2.5 pontos) A capacitor of circular parallel plates is being charged by a constant current *i* (Figure 3). The electric field **E** between the plates is uniform, directed into the paper (toward the plate) and increases in intensity as the capacitor charge increases. For the region between the capacitor plates, write

(a) Faraday law's in the integral form

(b) Ampére-Maxwell's law in the integral form (with no current sources)

(c) Skecth in Figure 4 the induced magnetic field vector on the negatively charged plate of the capacitor..

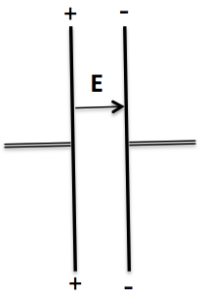

Figure 3

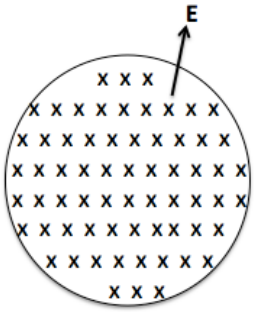

Figure 4