Physics 230

Homework Set 11

1. Calculate the expression for electric potential at a point \((r, \theta)\) from the knowledge of electric potential on the axis of symmetry (along z axis) at a distance \(r\) from the center of the charge distribution given below:
   
   a. Ring of charge \(Q\) with radius \(a\) placed in xy plane with its center at the origin.
   
   \[
   V(r,0) = k \frac{Q}{(r^2 + a^2)^{1/2}}
   \]

   b. Disk of charge \(Q\) with radius \(a\) placed in xy plane with its center at the origin.
   
   \[
   V(r,0) = k (2\pi\sigma) [(r^2 + a^2)^{1/2} - r] \quad \sigma = Q/\pi a^2
   \]

2. Calculate the expression for electric potential due to a spherical shell with radius \(a\) at a point outside. Assume the top and bottom hemispherical surfaces are at potential \(V\) and zero respectively. We have worked out this problem in class for inside of the shell.

3. Calculate \(\int dx \left[ \frac{x^4}{(x^6 + 1)} \right]\) from zero to infinity.

Reading Assignment

Chapter 15, Legendre Function
List of pages: 727 - 730