

**PHY 303 : Assignment 1**  
*Submit by 04 September 2024 midnight*

1. Show that the solutions of the **electrostatic field** obtained using the Neumann boundary condition, is unique, but not the potential.
2. A model of the nucleus of atoms proposes a charge distribution  $\rho(r) = \rho_0(1 - r/R)$  for the region inside the nucleus having a radius  $R$ . Outside it the charge goes down to zero. Obtain the expression and plot the electrostatic potential the electron lives in, due to this distribution.
3. A uniform linear charge density  $\lambda$  is placed between  $(x = a, y = 0, z = 0)$  to  $(x = 2a, y = 0, z = 0)$  in front of an infinite grounded conducting plane situated at  $x = 0$ . Obtain the electrostatic field configuration for this set up.
4. A grounded conducting shell has been put up with a uniform potential  $\phi_0$  across its northern hemisphere, while the southern hemisphere is at zero potential. Obtain the electrostatic potential in space due to this configuration.
5. A point charge  $q$  is put in front of a conducting sphere of radius  $R$  at a distance  $a$  from its center. If the sphere is maintained at a potential  $\phi_0$ , find out the electrostatic potential and field outside the sphere.