

Electrodynamics(H2) (SC1.102a)
IIIT-H, Semester Winter 24, Assignment 1

Submission deadline: 25th March 2024

1. Consider a straight line segment of length L carrying a uniform line charge density λ . At one end of the line, and in the direction perpendicular to the line there is a point P at a distance z . Find the electric field (both magnitude and direction) at P . Also calculate the potential and from that obtain the field.
2. Find the electric field at a distance z above the center of a circular loop of radius r and a uniform line charge density λ . Also calculate the potential.
3. Suppose the electric field (in spherical polar coordinate system) in some region is $\vec{E} = kr^3\hat{r}$, where \hat{r} is some unit vector. Find the charge density ρ in that region, and the total charge contained in a sphere of radius R , centered at the origin.
4. Use Gauss's law to find the field inside and outside a long hollow cylindrical tube, which carries a uniform surface charge σ .
5. Find the energy stored in a uniformly charged hollow cylinder of radius R and length ℓ .
6. Find the capacitor per unit length of two coaxial metal cylindrical tubes of radii a and b .
7. There is a grounded conducting sphere of radius R . A point charge q is placed at a distance a from the center. Find the potential at any point outside the sphere. Also find the attraction between the charge and the sphere.
8. An uncharged metal sphere of radius R is placed in an uniform electric field $\vec{E} = E_0\hat{z}$. Using method of images find the potential outside the sphere.