Indian Institute of Technology Gandhinagar

PH101: Physics

Note:

1. Write your **name**, **roll number** and **section** clearly on the answer sheet <u>on the top-right corner</u>. Also put down assignment number and submission date.

2. Deadlines for assignment submission will be followed strictly.

3. Show all the necessary steps clearly and concisely. Avoid scratch work on the main answer sheet and <u>box the final answer</u>.

Problems

1. A thin non-conducting rod of infinite length has a linear charge density of λ coulomb per meter. Without using Gauss' law, calculate the electric field intensity at a point y from the rod.
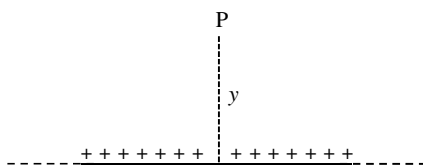
2. Two positive charges, each of magnitude q, are placed a distance l apart. Show that at the mid-point between them the rate of change of electric field intensity with distance is $-\dfrac{8q}{\pi\varepsilon_0 l^3}$

3. A pith ball covered with tin foil having a mass of m kg hangs by a fine silk thread l meter long in an electric field E. When the ball is given an electric charge of q coulomb, it stands out d meter from the vertical line. Show that the electric field is given by $E = \dfrac{mgd}{q\sqrt{l^2 - d^2}}$

4. Calculate the electric flux through a cube of side a as shown in figure below, where $E_x = bx^{\frac{1}{2}}$, $E_y = E_z = 0$, $a = 10\,\text{cm}$ and $b = 800\,\text{NC}^{-1}\text{m}^{-\frac{1}{2}}$. Also calculate the net charge within the cube.
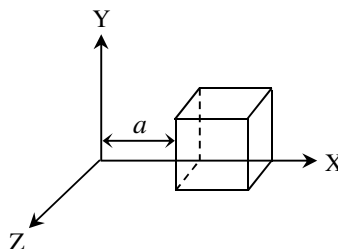
5. A spherical charge distribution is given by $\rho = \rho_0\left(1 - \dfrac{r^2}{a^2}\right)$, for $r \le a$ and $\rho = 0$, for $r > a$, where a is the radius of the sphere. Find the electric field intensity at a distance r from the center when $r > a$ and $r < a$. Show that the intensity of electric field will have its maximum value at $r = \sqrt{5}\dfrac{a}{3}$ inside the distribution.