**Tutorial Sheet-1 (Even Semester, 2022) [Physics-2 (15B11PH211)]**

**Assignment 1:** Show the proof of Gauss's law for the charge inside and outside the Gaussian surface.

1. Find the gradient of the function $f(x,y,z) = x^2 + y^3 + z^4$ at the point (2, -3, -4).
2. If $A = y^2 i + (2xy + z^2)j + 2yz\hat{k}$, then calculate divergence of $A$ at point (1, 2, 3).
3. Obtain curl $\vec{A}$, where $\vec{A} = yzi + xzj + xy\hat{k}$.
4. A region is specified by the potential function, given by $\phi = 4x^2 + 3y^2 - 9z^2$. Calculate electric field strength at any point (3, 4, 5) in this region.
5. Find the charge in the volume defined by $0 \le x \le 1$ m, $0 \le y \le 1$ m and $0 \le z \le 1$ m if $\rho = 30x^2y$. What change occurs for the limits $-1 \le y \le 0$ m.
6. A spherically symmetric volume charge distribution of radius 'a' is described by
   $\rho(r \le a) = \rho_0 \frac{r}{a}$ (C/$m^3$) ; (r > a) = 0 . Calculate the total charge.
7. Three point charges $Q_1$ = 30 nC, $Q_2$ = 150 nC and $Q_3$ = -70 nC are enclosed by surface S. What net flux crosses S.
8. Five thousand lines of force enter a volume of space and three thousand lines leave it. How much charge is contained in it?
9. In the region of space electric field $E = 8i + 4j + \hat{k}$, calculate the electric flux through the surface $S = 100\hat{k}$.