Tut-2

1) The position vector $\vec{r} = x\hat{x} + y\hat{y} + z\hat{z}$

Show that (i) $\vec{\nabla} r^n = n r^{n-2} \vec{r}$

(ii) $\vec{\nabla} \cdot \vec{r} = 3$

(iii) $\vec{\nabla} \cdot (r^n \vec{r}) = (3+n) r^n$

iv) Divergence of a vector $\vec{E} = \frac{1}{r^2}\hat{r}$ is zero (if $r \neq 0$)

(v) $\vec{\nabla} \times \vec{r} = 0$

(vi) Curl of a vector $\vec{A} = r^n \vec{r}$ is zero

vii) calculate Gradient of function ~~$f(r) = r^2 \hat{i} + z$~~ r^n ; i.e. $\vec{\nabla}(r^n) = ?$

(2) If $\phi = x^2 y z^3$ & $\vec{A} = xz\hat{x} - y^2 x \hat{y} + x^2 y^2 \hat{z}$

Find out (i) $\vec{\nabla}\phi$ (ii) $\vec{\nabla} \cdot \vec{A}$ (iii) $\vec{\nabla} \times \vec{A}$

(iv) Divergence of $(\phi \vec{A})$

(3) (i) If $\phi = r^3 \sin\theta + r\cos^2\phi$ in (r, θ, ϕ) co-ordinates.

Calculate. (i) $\vec{\nabla}\phi$

(ii) If $\vec{A} = \vec{r}\theta + r\cos\theta\hat{\theta} + \sin\theta\cos\phi\hat{\phi}$

calculate $\vec{\nabla} \cdot \vec{A} = ?$ $\vec{\nabla} \times \vec{A} = ?$