2nd Assignment
Subject: Physics II (Electrodynamics)
Date: 21st Jan 2016

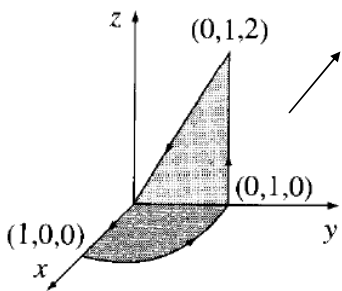1. **Compute the divergence and curl of the following vector fields.**

(i) $\vec{F} = \rho(2 + \sin^2 \phi)\hat{\rho} + \rho \sin \phi \cos \phi \,\hat{\phi} + 3z\hat{z}$

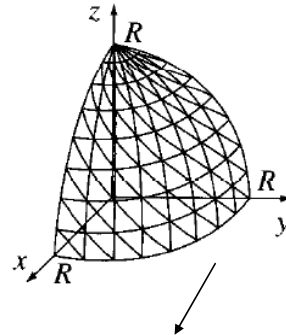(ii) $\vec{F} = (r\cos\theta)\,\hat{r} + (r\sin\theta)\,\hat{\theta} + (r\sin\theta\cos\phi)\,\hat{\phi}$

2. **The vector field is given in Cartesian co-ordinate system, $\vec{A} = xy\,\hat{i} + (3x^2 + y)\hat{j}$. Write down the vector field in cylindrical co-ordinate system with $\hat{s}, \hat{\phi}$ unit vectors.**

3. Compute the line integral of

$$\mathbf{v} = (r\cos^2\theta)\,\hat{\mathbf{r}} - (r\cos\theta\sin\theta)\,\hat{\boldsymbol{\theta}} + 3r\,\hat{\boldsymbol{\phi}} \quad \text{around the path shown in Fig.}$$

Check your answer, using Stokes' theorem

(0,1,2)

(0,1,0)

(1,0,0)

4. Check the divergence theorem for the function

$$\mathbf{v} = r^2\cos\theta\,\hat{\mathbf{r}} + r^2\cos\phi\,\hat{\boldsymbol{\theta}} - r^2\cos\theta\sin\phi\,\hat{\boldsymbol{\phi}},$$

using as your volume one octant of the sphere of radius R Make sur the *entire* surface.

5. **Sketch the following vector fields on XY plane.**

(i) $\vec{V} = s^2 \sin\phi\,\hat{\phi}$ (ii) $\vec{V} = \sin\phi\,\hat{s} + \cos\phi\,\hat{\phi}$

6. **Find out the total flux of the following vector field passing through the closed surface of the object shown in Fig.3.**

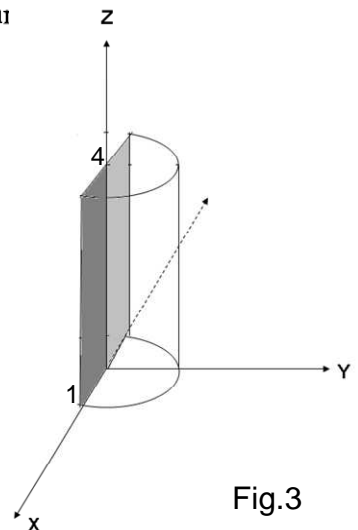(i) $\vec{V} = \hat{\rho} + \sin\phi\,\hat{\phi} + z\hat{z}$

Fig.3