## Unit V

**Tutorial No. 2**

1. If a force $\bar{F} = 2x^2y\,\hat{i} + 3xy\,\hat{j}$ displaces a particle in the $xy$-plane from $(0,0)$ to $(1,4)$ along a curve $y = 4x^2$. Find the work done. Ans. $\frac{104}{5}$

2. A vector field is given by $\bar{F} = (\sin y)\hat{i} + x(1+\cos y)\,\hat{j}$. Evaluate the line integral over a circular path $x^2 + y^2 = a^2, z = 0$. Ans. $\pi a^2$

3. Using Green's Theorem, evaluate $\int_C (x^2 + 2xy)\,dx + (y^2 + x^3y)\,dy$ where $C$ is a square with the vertices $P(0,0), Q(1,0), R(1,1)$ and $S(0,1)$. Ans. $\frac{-1}{2}$

4.Using Green's Theorem, evaluate $\int_C (2y^2\,dx + 3x\,dy)$ where $C$ is the boundary of the closed region bounded by $y = x$ and $y = x^2$. Ans. $\frac{27}{4}$

5. Using Stoke's theorem, find the circulation of the field $F = (x^2 - y)\hat{i} + 4z\hat{j} + x^2\hat{k}$ around the curve $C$ in which the plane $z = 2$ meets the cone $z = \sqrt{x^2 + y^2}$ counter clockwise when viewed from above. Ans: $4\pi$.

6. Using Stoke's theorem, find the circulation of the field $F = y\hat{i} - x\hat{j}$ around the curve $C: x^2 + y^2 = 9,\ z = 0$ counter clockwise when viewed from above. Ans: $-18\pi$.

7. Using Stoke's theorem, calculate the circulation of the field $F = (y^2 + z^2)\hat{i} + (x^2 + z^2)\,\hat{j} + (y^2 + x^2)\hat{k}$ around the curve $C$: the square bounded by the lines $x = \pm 1$ *and* $y = \pm 1$ in the $xy$ plane counter clockwise when viewed from above.

Ans: 0.

8. Find the Flux of $F = xy\hat{i} + yz\hat{j} + xz\hat{k}$ outward through the surface of the cube cut from the first octant by the planes $x = 1, y = 1$ *and* $z = 1$. Ans: $\frac{3}{2}$.

9. Find the Flux of $F = x\hat{i} + y\hat{j} + z\hat{k}$ outward over the sphere $x^2 + y^2 + z^2 = a^2$. Ans: $4\pi a^3$.