SARDAR VALLABHBHAI PATEL INSTITUTE OF TECHNOLOGY
VASAD
B. E. Second Semester (All Branch)
Subject: Vector Calculus and Linear Algebra (2110015)
Year 2016-2017

Tutorial: 9

1 Find $grad(\phi), if\ \phi = \log\left(x^2 + y^2 + z^2\right)$ at the point (1,0,-2)

2 Find divergence and curl of $V = xyz(x, y, z)$.

3 Show that $F = 2xyzi + (x^2 z + 2y)j + x^2 yk$ is irrotational and find a scalar function f such that $F = grad$f .

4 Find the directional derivative of the divergence of $F(x, y, z) = xy\,i + xy^2\,j + z^2 k$ at the point (2,1,2) in the direction of the outer normal to the sphere $x^2 + y^2 + z^2 = 9$.

5 Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ *and* $x^2 + y^2 - z = 3$ at the point (2,-1,2).

6 Find the work done when a force $F = (x^2 - y^2 + x)i - (2xy + y)j$ moves a particle in the *xy*-plane from (0, 0) to (1, 1) along the parabola $x^2 = y$?

7 Evaluate $\int F \bullet dr$ for $F=3x^2i + (2xz-y)j + z\,k$ along the paths.

a. The curve $x=2t^2$, $y=t$, $z=4t^2-t$ from t=0 to t=1.
b. Along the curve $x^2=4y$, $3x^3=8z$ from x=0 to x=2.

8 Applying Green's theorem, evaluate $\oint_C [(y - \sin x)dx + \cos x dy]$,where C is the plane triangle enclosed by the lines y=0,x= $\frac{\pi}{2}$ and y= $\frac{2x}{\pi}$.

9 Verify Stoke's Theorem for the hemisphere $S = x^2 + y^2 + z^2 = 9, z \geq 0$ its bounding circle $C = x^2 + y^2 = 9, z = 0$ and the field $F = y\hat{i} - x\hat{j}$.

10 State Gauss Divergence theorem. Evaluate $\iint_S F \cdot n\, dS$ where $F = 4xz\,i - y^2\,j + yz\,k$ and S is the surface of the cube bounded by $x = 0,\ x = 1, y = 0, y = 1, z = 0, z = 1$.