SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF MATHEMATICS
18MAB102T – ADVANCED CALCULUS AND COMPLEX ANALYSIS (2021 -2022 EVEN)

MODULE – 2 : VECTOR CALCULUS

TUTORIAL SHEET – I

S.No.	Questions	Answers
	Part - A	
1	Find the gradient of ϕ, where ϕ is $(x^2+y^2+z^2)^{\frac{3}{2}}$	$3\vec{r}$
2	Find the directional derivative of $\phi = x^2yz + 4xz^2$ at $(1,2,3)$ in the direction of $2\vec{\imath} + \vec{\jmath} - \vec{k}$	$\frac{86}{\sqrt{6}}$
3	If $\vec{r}$ is the position vector of the point (x,y,z), find $\nabla\left(\frac{1}{r}\right)$	$-\frac{\vec{r}}{r^3}$
4	Find a unit vector normal to the surface $x^2+y^2-z=10$ at $(1,1,1)$	$\hat{n} = \frac{2\vec{\imath}+2\vec{\jmath}-\vec{k}}{3}$
5	Find 'a' such that $(3x-2y+z)\vec{\imath} + (4x+ay-z)\vec{\jmath} + (x-y+2z)\vec{k}$ is solenoidal.	$a=-5$
	Part - B	
6	Prove that $\vec{F} = (y^2\cos x + z^3)\vec{\imath} + (2y\sin x - 4)\vec{\jmath} + 3xz^2\vec{k}$ is irrotational and find its scalar potential.	$\phi = y^2\sin x + xz^3 - 4y + c$
7	Find the angle between the surfaces $x\log z = y^2 - 1$ and $x^2y = 2 - z$ at the point $(1,1,1)$	$\theta = \cos^{-1}\left(\frac{1}{\sqrt{30}}\right)$
8	Prove that $\nabla^2(r^n) = n(n+1)r^{n-2}$, where $\vec{r} = x\vec{\imath} + y\vec{\jmath} + z\vec{k}$ and $r = \lvert\vec{r}\rvert$ and hence deduce $\nabla^2\left(\frac{1}{r}\right)$	
9	Prove that $\vec{F} = (2x+yz)\vec{\imath} + (4y+zx)\vec{\jmath} - (6z-xy)\vec{k}$ is solenoidal and find its scalar potential.	$\phi = x^2 + 2y^2 - 3z^2 + xyz + c$
10	Find the constants a,b,c so that $\vec{f} = (x+2y+az)\vec{\imath} + (bx-3y-z)\vec{\jmath} + (4x+cy+2z)\vec{k}$ is irrotational.	$a=4, b=2, c=-1$