SRM Institute of Science and Technology
Department of Mathematics
18MAB102T-Advanced Calculusand Complex Analysis
2020-2021 Even
Unit – II: Vector Calculus
Tutorial Sheet - I

S.No.	Questions	Answers
	Part – A [3 Marks]	
1	If $\phi(x,y,z)=x^2y+y^2x+z^2$, find $\nabla\phi$ at the point (1,1,1).	$3\vec{i}+3\vec{j}+2\vec{k}$
2	Find the directional derivative of $f(x,y,z)=x^2-2y^2+4z^2$ at the point (1,1,-1) in the direction of $2\vec{i}+\vec{j}-\vec{k}$	$\frac{8}{\sqrt{6}}$
3	Find the angle between the surfaces $x^2+yz=2$ and $x+2y-z=2$ at (1,1,1)	$\frac{\pi}{3}$
4	The temperature of points in space is given by $T(x,y,z)=x^2+y^2-z$. A mosquito located at (1,1,2) desires to fly in such a direction that it will get warm as soon as possible .In what direction should it move?	$\nabla T=2\vec{i}+2\vec{j}-\vec{k}$
5	If $\vec{F}=(x+y+1)\vec{i}+\vec{j}-(x+y)\vec{k}$ show that $\vec{F}.\text{curl}\,\vec{F}=0$	$\vec{F}.\text{curl}\,\vec{F}=0$
	Part – B[6 Marks]	
6	Find the constants a,b,c so that $\vec{F}=(x+2y+az)\vec{i}+(bx-3y-z)\vec{j}+(4x+cy+2z)\vec{k}$ may be irrotational. For these values of a,b,c find its scalar potential.	$a=4,b=2,c=-1$ $\phi=\frac{x^2}{2}-3\frac{y^2}{2}+z^2+2xy+4zx-yz+c$
7	Prove that $\text{div}(r^n\vec{r})=(n+3)r^n$. Deduce that $r^n\vec{r}$ is solenoidal if and only if n= -3	
8	i) If $\vec{A}$ and $\vec{B}$ are irrotational, Prove that $\vec{A}\times\vec{B}$ is solenoidal ii) Prove that $\vec{A}=(2x+yz)\vec{i}+(4y+zx)\vec{j}-(6z-xy)\vec{k}$ is solenoidal as well as irrotational. Also find the scalar potential of $\vec{A}$.	i) $\nabla.(\vec{A}\times\vec{B})=0$ ii) $\phi=x^2+2y^2-3z^2+xyz+a$
9	Find the angle between the normals to the surface $x^2=yz$ at the points (1,1,1) and (2,4,1)	$\theta=\cos^{-1}\left(\frac{13}{3\sqrt{22}}\right)$
10	Find a and b so that the surfaces $ax^2-byz=(a+2)x$ and $4x^2y+z^3=4$ cut orthogonally at (1,-1,2)	$a=\frac{5}{2},b=1$