SRM Institute of Science and Technology

College of Engineering and Technology

Kattankulathur-603 203

Department of Mathematics

21MAB102T-Advanced Calculus and Complex Analysis

Tutorial Sheet-1

Sl.No.	Part-B (8 Marks)	Answers
Q1.	Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point P in the direction of PQ, where P is (1,-2,-1) and Q is (3,-3,-2).	$\frac{27}{\sqrt{6}}$
Q2.	Find the angle between the surfaces **(i)** $x^2 - y^2 - z^2 = 11$ and $xy + yz - zx = 18$ at the point (6,4,3) **(ii)** $x^2 - y^2 + z^2 = 9$ and $x^2 + y^2 - z = 3$ at the point (2,-1,2).	$\theta = \cos^{-1}\left(\frac{24}{\sqrt{5246}}\right)$, $\theta = \cos^{-1}\left(\frac{8}{3\sqrt{21}}\right)$
Q3.	**(i)** Find the work done by the force $\vec{F} = z\vec{i} + x\vec{j} + y\vec{k}$, when it moves a particle along the arc of the curve $\vec{r} = \cos t\vec{i} + \sin t\vec{j} + t\vec{k}$ from $t = 0$ to 2π. **(ii)** Find the work done by the force $\vec{F} = (x^2 - y^2 + x)\vec{i} - (2x + y)\vec{j} + y\vec{k}$, when it moves a particle from origin to $(1,1)$ along $y^2 = x$.	$3\pi, /2/3$
Q4.	Show that $\vec{F} = (y^2 - 2xz^2)\vec{i} + (2xy - z)\vec{j} + (2x^2z - y + 2z)\vec{k}$ is irrotational and hence find its scalar potential.	$\phi = xy^2 + x^2z^2 - yz + z^2 + c$
Q5.	Show that $\vec{u} = (2x^2 + 8xy^2z)\vec{i} + (3x^3y - 3xy)\vec{j} - (4y^2z^2 + 2x^3z)\vec{k}$ is not solenoidal, but $\vec{v} = xyz^2\vec{u}$ is solenoidal.	
Sl.No.	**Part-C (15 Marks)**	**Answers**
Q6.	Verify Gauss's Divergence theorem for $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$, where S is the surface of the cuboid formed by the planes $x = 0, x = a, y = 0, y = b, z = 0$ and $z = c$.	