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-2

Sl.No.	Part-B (8 Marks)	Answers
Q1.	If $\vec{r}$ is the position vector of the point (x,y,z) find **(i)** $\nabla\left(\frac{1}{r}\right)$. **(ii)** $\nabla(\log r)$.	$-\frac{r}{r^3}, \frac{\vec{r}}{r^3}$
Q2.	Prove that $\nabla^2(r^n) = n(n+1)r^{n-2}$, where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = \lvert\vec{r}\rvert$ and hence deduce $\nabla^2\left(\frac{1}{r}\right)$	
Q3.	Find the unit normal vector to the surface **(i)** $x^2 + xy + z^2 = 4$ at (1,-1,2). **(ii)** $xy^2z^3 = 1$ at (1,1,1).	$\frac{\vec{i}+\vec{j}+4\vec{k}}{3\sqrt{2}}, \frac{\vec{i}+2\vec{j}+3\vec{k}}{\sqrt{14}}$
Q4.	Evaluate $\int_C \vec{F}\cdot d\vec{r}$, for **(i)** $\vec{F} = 3xy\vec{i} - y^2\vec{j}$, C is curve in the xy plane $y = 2x^2$, from (0,0) to (1,2). **(ii)** $\vec{F} = 5xy\vec{i} + 2y\vec{j}$, C is the part of the curve in the xy plane $y = x^2$, from $x = 1$ to $x = 2$.	$-\frac{7}{6}, \frac{135}{4}$
Q5.	Determine whether the following vectors are conservative field. **(i)** $\vec{F} = (2xy+z^2)\vec{i}+x^2\vec{j}+3xz^2\vec{k}$ **(ii)** $\vec{F} = (e^xz-2xy)\vec{i}+(x^2-1)\vec{j}+(e^x+z)\vec{k}$	
Sl.No.	**Part-C (15 Marks)**	**Answers**
Q6.	Verify Stoke's theorem for $\vec{F} = (x^2 - y^2)\vec{i} + 2xy\vec{j}$ in the rectangular region in the xy plane bounded by the lines $x = 0, x = a, y = 0, y = b$.	