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30 March

University Roll No.------------------------------------------

II Mid Term Examination, 2014-15

**Mathematics - II**      **Paper Code – AHM 102**

**Time: - 90 Min.**      **Max. Marks:-20**

**Section - A**

**Note: Attempt All Questions.** **($1\times5=05$ Marks).**

1) A particle moves on the curve $x=2t^2, y=t^2-4t, z=3t-5$ where t is the time. Find its speed at $t=1$.

2) If $\vec{F}$ and $\vec{G}$ are irrotational, show that $\vec{F}\times\vec{G}$ is solenoidal.

3) Find a vector in the direction in which $F(x,y,z)=xyz^2$ decreases most rapidly at the point P (1,0,3)

4) A particle moves so that its position vector is given by $\vec{r}=\cos\omega t\,\hat{i}+\sin\omega t\,\hat{j}$. Find the angle between velocity $\vec{v}$ of the particle and position vector $\vec{r}$.

5) Find '$a_n$' in the Fourier series of the function $f(x)=\begin{cases}-k & \text{if } -\pi<x<0\\ k & \text{if } 0<x<\pi\end{cases}$

**Section -B**

**Note: Attempt Any Three questions.** **($3\times2=6$ Marks)**

1) Show that the gradient field describing a motion is irrotational.

2) Find directional derivative of $\phi(x,y,z)=x^2yz+4xz^2$ at the point P(1,-2,-1) in the direction $\vec{v}=2\hat{i}-\hat{j}-2\hat{k}$.

3) 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).

4) Evaluate $\oint_c \vec{F}.\vec{dr}$ by Stoke's theorem, where $\vec{F}=y^2\hat{i}+x^2\hat{j}-(x+z)\hat{k}$ and C is the boundary of the triangle with vertices at (0,0,0),(2,0,0),(2,3,0).

**Section - C**

**Note: Attempt Any Three questions.** **($3\times3=9$ Marks)**

1) Prove that: $div(grad\,r^n)=n(n+1)r^{n-2}$ where $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$.

2) Vector field is given $\vec{A}=(y+z)\hat{i}+(z+x)\hat{j}+(x+y)\hat{k}$. Show that the field is irrotational and find the scalar potential.

3) Verify Green's theorem in the plane for $\oint_c (x^2+xy)dx+(x^2+y^2)dy$ where C is the square formed by the line $x=\pm1$ and $y=\pm1$

4) Obtain the Fourier series for $f(x)=x^2$, for $-\pi\le x\le\pi$.