| Name of the Course | $:$ CBCS (LOCF) B.Sc. (Math.Scie.) -I, |
| :--- | :--- |
|  | B.Sc.(Phy.Sci.) -I, B.Sc. (Life Sci.) -I; BSc AplSci-I |
| Unique Paper Code | $: \mathbf{4 2 3 5 1 1 0 1}$ |
| Name of the Paper | $:$ Calculus and Matrices |
| Semester | $: \mathbf{I}$ |
| Duration | $: \mathbf{3}$ Hours |
| Maximum Marks | $: \mathbf{7 5}$ |
| Attempt any four questions. All questions carry equal marks. |  |

1. Evaluate $\lim _{x \rightarrow+\infty} \frac{7 x^{3}-3 x^{2}+1}{1-5 x}$ and use definition to prove $\lim _{x \rightarrow 0} \frac{1}{4 x^{2}}=+\infty$.

Find the points at which the function g is not differentiable, where

$$
g(x)=|x+1|+|x-2| .
$$

Find the Taylor series for the function $g(x)=\frac{1}{2 x-1} \quad$ about $\mathrm{x}=1$ assuming the validity of the expansion.
Let $w(x, y)=e^{2 y} \sin 3 x$, evaluate $w_{x y x}\left(0, \frac{\pi}{6}\right)$.
2. Given $f(x)=(x-1)^{3}$. Determine whether $\mathrm{f}(\mathrm{x})$ is odd, even or neither (State the reason for the same). What symmetries, if any, do the graph have. Give the equation of the shifted graph when it is shifted 2 units up and 3 units left followed by the reflection across $y$-axis.

Is it possible to diagonalise a matrix with repeated Eigen values? Diagonalise a matrix A, if possible, where $A=\left[\begin{array}{lll}1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4\end{array}\right]$.

Sketch the contour plot of the surface $g(x, y)=\sqrt{25-x^{2}-y^{2}}$ using level curves of height $\mathrm{k}=0,1,2$.

Given $h(x, y)=(y+1) e^{5 x}, \quad$ find an equation of the level curve that passes through the point ( 0,4 ).
$(6+6+4+2.75)$
3. Find the image of the point $\left[\begin{array}{l}1 \\ 1\end{array}\right]$ under the anticlockwise rotation of $75^{\circ}$ about the origin.

Find the $n^{\text {th }}$ derivative of the function $(2 x-1)^{2} e^{3 x}+e^{x} \cos 2 x$.
Examine for linear dependence or linear independence, the vectors $(1,0,2,1),(3,1,2,1)$, $(4,6,2,-4)$ and $(-6,0,-3,-4)$ in $\mathrm{R}^{4}$.
4. If $\mathrm{T}: \mathrm{R}^{2} \rightarrow \mathrm{R}^{2}$ be a linear transformation such that $\mathrm{T}\left(\left[\begin{array}{l}1 \\ 1\end{array}\right]\right)=\left[\begin{array}{l}3 \\ 2\end{array}\right]$ and $\mathrm{T}\left(\left[\begin{array}{l}1 \\ 2\end{array}\right]\right)=\left[\begin{array}{l}4 \\ 5\end{array}\right]$, then find matrix representation for T .
Find the rank of the matrix $\left[\begin{array}{cccc}9 & 7 & 3 & 6 \\ 5 & -1 & 4 & 1 \\ 6 & 8 & 2 & 4\end{array}\right]$ after converting it into reduced echelon form.
Also write pivot columns, pivot elements.

Find the general solution of the system of equations whose augmented matrix is $\left[\begin{array}{rrrrr}3 & -2 & 0 & -1 & -1 \\ 0 & 2 & 2 & 1 & -5 \\ 1 & -2 & -3 & -3 & 1 \\ 0 & 1 & 1 & 2 & 6\end{array}\right]$
5. Let $w(x, y)=2 x^{2} y+9 y^{3} \mathrm{x}$, find the slope of the surface in the y -direction at the point $(1,5)$.

Graph the function $\mathrm{y}=5 \sin 2 x$ in $[0,2 \pi]$. Determine its period as well.

Find the function $h(x)$ whose derivative is $3 x^{2}-1$ and the graph passes through the point $(1,3)$.

Find the fifth root of $z=1+i \sqrt{3}$.
6. Solve the equation $z^{7}+z^{6}+z^{5}+z^{4}+z^{3}+z^{2}+z+1=0$.

Find the value $(1-\cos \theta+i \sin \theta)^{n}-(1-\cos \theta-i \sin \theta)^{n}$.

Find an equation of the circle described on the diameter with end points $(8-4 i),(-2+6 i)$.

Find an equation of the straight line joining the points $(3+2 i)$ and $(2-i)$. $(6+4.75+5+3)$

