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	: 42351101
Name of the Paper	: Calculus and Matrices
Semester	: I
Duration	: 3 Hours
Maximum Marks	: 75

Attempt any four questions. All questions carry equal marks.

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

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 $g(x) = \frac{1}{2x-1}$ about x= 1 assuming the validity of the expansion. Let $w(x,y) = e^{2y} sin 3x$, evaluate $w_{xyx}(0, \frac{\pi}{6})$.

(5+5+5+3.75)

2. Given $f(x) = (x - 1)^3$. Determine whether f(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 $A = \begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$.

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

Given $h(x, y) = (y + 1)e^{5x}$, 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 $\begin{bmatrix} 1\\1 \end{bmatrix}$ under the anticlockwise rotation of 75^o about the origin.

Find the n^{th} derivative of the function $(2x - 1)^2 e^{3x} + e^x cos 2x$.

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 \mathbb{R}^4 .

$$(6.25+6.25+6.25)$$

4. If T: R² → R² be a linear transformation such that T([¹₁]) = [³₂] and T([¹₂]) = [⁴₅], then find matrix representation for T.
Find the rank of the matrix [⁹₅ -1 4 1 6 8 2 4] 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 $\begin{bmatrix}
3 & -2 & 0 & -1 & -1 \\
0 & 2 & 2 & 1 & -5 \\
1 & -2 & -3 & -3 & 1 \\
0 & 1 & 1 & 2 & 6
\end{bmatrix}$ (6.25+(4.25+2)+6.25)

5. Let $w(x, y) = 2x^2y + 9y^3x$, find the slope of the surface in the y-direction at the point (1, 5).

Graph the function y = 5sin2x in $[0,2\pi]$. Determine its period as well.

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

(3+6+3.75+6)

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 - 4i), (-2 + 6i).

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