Semester: I			
Course Title	Applied Mathematics-I for CSE Stream	**CIE Marks**	50
Course Code	BCSMAT111	**SEE Marks**	50
Course Type	Integrated	**Total Marks**	100
Course Category	ASC	**SEE Duration**	03 hrs
Hours Per Week	2L: 2 T: 2P	**SEE Type**	Written
Total Hours	40 hrs of theory + 18-20 hrs of practical sessions	**Credits**	04

Course Learning Objectives
This course will enable the students to:
• Familiarize the importance of concepts of calculus associated with one variable and multivariable for computer science and Engineering.
• Analyze Computer science and Engineering problems using Vector calculus and Ordinary Differential Equations.
• Develop the knowledge of applying Linear Algebra referring to matrices.
Pre-Requisites
• Fundamental concepts of calculus and matrices.

Module-1: Differential Calculus	**(8 hrs)**
Taylor's and Maclaurin's series expansion for one variable (Statements only)-Problems. Partial differentiation, total derivative - differentiation of composite functions, Jacobian. Maxima and minima for a function of two variables.	
Module-2: Vector Calculus	**(8 hrs)**
Scalar and vector fields. Gradient, directional derivatives, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential. Introduction to polar coordinates and polar curves. Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality.	
Module- 3: Differential Equations of first and higher order	**(8 hrs)**
Linear and Bernoulli`s differential equations, Exact and reducible to exact differential equations with integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$. Homogeneous and non-homogeneous Differential equations of higher order with constant coefficients. Inverse differential operators: $e^{ax}, sin(ax+b), cos(ax+b)\ and\ x^n$.	
Module- 4: Linear Algebra -1	**(8 hrs)**
Elementary row transformations of a matrix, Row reduced echelon form and Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-Elimination method, Gauss-Jordon method and Gauss-Seidel method. Application to traffic flow.	
Module- 5: Linear Algebra -2	**(8 hrs)**
Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Modal matrix, Diagonalization of the matrix. Inverse of a matrix by Cayley-Hamilton theorem, Moore-Penrose pseudoinverse.	

Practical Components

Sl. No.	List of Lab Activities
1.	Partial derivatives and Jacobian
2.	Taylor's and Maclaurin's series
3.	Maxima and Minima for two variables
4.	Gradient, divergence and curl
5.	Solution of differential equations of first and higher order
6.	Echelon form and Rank of a matrix
7.	Consistency and graphical representation
8.	Solution of system of linear equations using Gauss elimination method
9.	Solution of system of linear equations using Gauss-Seidel method
10.	Eigenvalues and Eigenvectors and Rayleigh power's method

***Programs should be implemented using programming language - Python.**

Text Books:	
1.	"Higher Engineering Mathematics" by B. S. Grewal, 44th Edition, Khanna Publishers, 2021.
2.	"Advanced Engineering Mathematics" by E. Kreyszig, 10th Edition., John Wiley & Sons, 2018.
3.	"Linear Algebra and its Applications" by Gilbert Strang, Cengage Publications, 4th Edition, 2022.
Reference Books:	
1.	"Higher Engineering Mathematics" by B. V. Ramana, 11th Edition, McGraw-Hill Education, 2017.
2.	"A Textbook of Engineering Mathematics" by N.P Bali and Manish Goyal, 10th Edition, Laxmi Publications, 2022.
3.	"Linear Algebra and its Applications" by David C Lay, 4th Edition, Pearson Publishers, 2018.
4.	"Linear Algebra with Applications" by Gareth Williams, 6th Edition, Jones Bartlett, 2017.
5.	"Engineering Mathematics" by Dr. K S Chandrashekar, Sudha Publications, 2023-24.

Course Outcome Statements: After the successful completion of the course, the student will be able to	
CO1	Explain the basic concepts of Calculus for functions with single and multi-variables, Vector Calculus, Differential equations and Linear Algebra.
CO2	Apply the techniques of Calculus, concepts of Vector Calculus and Linear Algebra to solve Engineering problems.
CO3	Analyze the computations associated with Maxima and Minima, Vector fields and Orthogonality, first and higher-order Differential equations and Linear Algebra.
CO4	Use modern ICT tools to solve/visualize Engineering problems by applying principles of Calculus and Linear Algebra.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	--	--	--	--	--	--	--	--	--	1
CO2	3	2	--	--	--	--	--	--	--	--	1
CO3	3	2	--	--	--	--	--	--	--	--	1
CO4	--	--	--	--	2	--	--	--	--	--	2
Avg.	**3**	**2**	**--**	**--**	**2**	**--**	**--**	**--**	**--**	**--**	**1.25**

3: High, 2: Medium, 1: Low