Semester: I			
Course Title	Mathematics-I for Electrical & Electronics Engineering Stream	**CIE Marks**	50
Course Code	BEEMAT101	**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 (Differential and Integral) associated with one variable and multivariable for Electrical and Electronics Engineering.
● Analyze Electrical and Electronics engineering problems using Ordinary Differential Equations.
● Develop the knowledge of applying Linear Algebra referring to matrices.
Pre-Requisites
Fundamentals and concepts of calculus, matrices and ODE's.

Module-1: Calculus	**(8 hrs)**
Polar Coordinates and Curvature: Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms - Problems. **Self-study:** Center and circle of curvature, evolutes and involutes. **Applications:** Communication signals, Manufacturing of microphones, and Image processing.	
Module-2: Series Expansion and Multivariable Calculus	**(8 hrs)**
Series expansion and Partial differentiation: Taylor's and Maclaurin's series expansion for one variable (Statement only) – Problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables - Problems. Errors and approximations- Problems. **Self-study:** Euler's Theorem and problems. Method of Lagrange's undetermined multipliers with single constraint. Indeterminate forms - Hospital's rule - Problems. **Applications:** Series expansion in communication signals and vector calculus.	
Module-3: Ordinary Differential Equations (ODEs) of First Order	**(8 hrs)**
First-order Ordinary Differential Equations: Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations - Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. Orthogonal trajectories, L-R circuits - Problems. **Non-linear Differential Equations:** Introduction to general and singular solutions, Solvable for p only. **Self-Study:** Solvable for x and y. Clairaut's equations, reducible to Clairaut's equations. Problems. **Applications of Ordinary Differential Equations:** Rate of Growth or Decay, Conduction of heat.	
Module-4: Integral Calculus	**(8 hrs)**
Introduction to Integral Calculus: **Multiple Integrals:** Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by	

double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions - Problems.

Self-Study: Volume by triple integration, Center of gravity.

Applications: Antenna and wave propagation, Calculation of optimum power in electrical circuits, field theory.

Module-5: Linear Algebra (8 hrs)

Introduction to Linear algebra:

Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector.

Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.

Applications: Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution.

Practical Components

Sl. No.	Programs for Implementation
1.	2D plots for Cartesian and polar curves
2.	Finding angle between polar curves, curvature and radius of curvature of a given curve
3.	Finding partial derivatives and Jacobian
4.	Applications to Maxima and Minima of two variables
5.	Solution of first-order ordinary differential equation and plotting the solution curves
6.	Program to compute area, volume and centre of gravity
7.	Evaluation of improper integrals
8.	Numerical solution of system of linear equations, test for consistency and graphical representation
9.	Solution of system of linear equations using Gauss-Seidel iteration
10.	Compute Eigen values and Eigenvectors and find the largest and smallest Eigen value by Rayleigh power 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.
Reference Books:	
1.	"Higher Engineering Mathematics" by V. Ramana, 11th Edition, McGraw-Hill Education, 2017.
2.	"Engineering Mathematics" by Srimanta Pal & Subodh C.Bhunia, 3rd Edition, Oxford University Press, 2016.
3.	"A Textbook of Engineering Mathematics" by N.P Bali and Manish Goyal, 10th Edition, Laxmi Publications, 2022.
4.	"Advanced Engineering Mathematics" by C. Ray Wylie, Louis C. Barrett, 6th Edition Mc Graw Hill, 2017.
5.	"Engineering Mathematics" by Dr. K S Chandrashekar, Sudha Publications, 2023-24.

6.	"Engineering Mathematic for Semester I and II" by Gupta C.B, Singh S.R and Mukesh Kumar, Mc Graw Hill, 2015.
7.	"Higher Engineering Mathematics" by H. K. Dass and Er. Rajnish Verma, 3rd Edition, S. Chand Publication, 2014.
8.	"Calculus" by James Stewart, 7th Edition, Cengage Publications, 2019.
9.	"Linear Algebra and its Applications" by David C Lay, 4th Edition, Pearson Publishers, 2018.
10.	"Linear Algebra with Applications" by Gareth Williams, 6th Edition, Jones Bartlett, 2017

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, Ordinary Differential Equations, Multiple Integral and Linear Algebra.
CO2	Apply the techniques of Calculus and Linear Algebra to solve Engineering problems.
CO3	Analyze the variations associated with voltage, resistance power, Maxima and Minima using multi variable Calculus.
CO4	Use modern tool to solve/visualize Engineering problems by applying principles of Calculus, Differential Equations, Integral Calculus and Linear Algebra.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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