Course Title:	Mathematics for Electrical and Electronics Engineering		
Course Code:	22MATE11	CIE Marks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Credits	04

Course objectives: The goal of this course (22MATE11)

- Familiarize the importance of series expansion and Vector calculus and Linear Algebra essential for electrical and electronics engineering.
- Analyze electrical and electronics engineering problems applying Partial derivatives and understand the value of limit (continuity) of function by using indeterminate forms.
- Develop the knowledge of polar curves to trace different types of curves.
- Applications of first order first degree differential equations.
- To develop the knowledge of matrices and linear algebra in a comprehensive manner.

Teaching-Learning Process

Pedagogy(General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show related short video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Express the different types of functions in power series form.
CO2	Learn the notion of partial differentiation to compute rate of change multivariate functions and understand the concept of Indeterminate forms
CO3	Apply the knowledge of calculus to solve problems related to polar curves and graphical representation of different curves.
CO4	Solve first order linear/nonlinear differential equation analytically using standard methods and express the solution in graphical form.
CO5	Make use of matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors by using computational softwares.
CO6	Learn with modern mathematical tools namely SCILAB /PYTHON /MATLAB /

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1				1			1			
CO2	3	2	2		1				1			1			
CO3	3	2	2		1				1			1			
CO4	3	2	2		1				1			1			
CO5	3	2	2		1				1			1			

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

MODULE-1 SEQUENCE AND SERIES

Introduction of Sequence and series in EE & EC Engineering
Infinite series, tests for convergence/divergence, Limit comparison test, Ratio test, root test, Raabe's test, Alternating series, Absolute convergence and conditional convergence.

Self-study: Gauss's test, Cauchy integral test.

Applications: Sequence and Series expansion in communication signals.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-2: INDETERMINATE FORMS AND PARTIAL DIFFERENTIATION

Introduction of Indeterminate forms and partial differentiation in EE & EC Engineering applications. Indeterminate forms - L'Hospital's rule. Problems.
Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.

Self-study: Euler's Theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Applications: Applications of maxima and minima in EE & EC Engineering.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-3 : DIFFERENTIAL CALCULUS

Introduction to polar coordinates and curvature relating to EE & EC Engineering applications.
Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems only.

Self-study: Center and circle of curvature, evolutes, involutes and envelopes
Applications: Communication signals, manufacturing of microphones and Image processing.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 4: LINEAR AND NON-LINEAR ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Introduction to first order ordinary differential equations pertaining to the applications for EE & EC Engineering.
Exact and reducible to exact differential equations -Integrating factors type-1, linear and reducible to linear. Applications of ODE's – Orthogonal trajectories, Rate of Decay and growth, L-R and C-R circuits. Problems.

Self-Study: Applications of ODE's, Solvable for x , y, p and Clairaut's form.

Applications of ordinary differential equations: L-R and C-R circuits, Newton's law of cooling, Conduction of heat.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 5 :LINEAR ALGEBRA

Introduction of liner algebra related to EE & EC Engineering applications.
Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - 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. Problems

Self-Study: Solution of system of equations by Gauss-Jacobi iterative method, Gauss-elimination method. Inverse of a square matrix by Cayley- Hamilton theorem.
Applications of Linear Algebra: Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution.
(RBT Levels: L1, L2 and L3) (8 Hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding the sum of the series up to infinity
2	Finding the given series convergent and divergent
3	Evaluating the limits
4	Finding the Partial derivatives of a given function Finding partial derivatives, Jacobian and plotting the graph
5	Applications to Maxima and Minima of two variables
6	2D plots for Cartesian and polar curves Finding of intersection between two polar curves
7	Finding the angle between the radius vector and the tangent
8	Finding the pedal equation of the polar curves
9	Finding radius of curvature of a given curve

10	Solution of first order differential equation and plotting the graphs
11	Program to compute area, volume and centre of gravity
12	Solving the Linear differential equations
13	Evaluating the rank of matrix
14	Numerical solution of system linear equations , test for consistency .

Suggested software's : Mathematica/MatLab/Python/Scilab

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (22.5 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The CIE marks for the theory component of the IC shall be 30 marks and for the laboratory component 20 Marks. The CIE marks for the theory component shall be 50 marks and scored will be reduced to 30.As below

- Three Tests each of 15 Marks; after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively. Average of Best Two performances of the Internal Tests shall be considered for 15 Marks.
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

CIE for the practical component of the IC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 35 marks are for conducting the experiment and preparation of the laboratory record, the other 15 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 50 marks. Marks of all experiments' write-ups are added and scaled down to 20 marks.

Semester End Examination(SEE)

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of three sub questions) from each module
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)Text Books

1. **B.S.Grewal**:"Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. **V. Ramana:**"Higher Engineering Mathematics" McGraw-Hill Education,11th Ed.,2017
2. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rdEd., 2016.
3. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications,10th Ed.,2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw–Hill Book Co., New York, 6thEd., 2017.
5. **C.B Gupta, S. R Singh and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India)Pvt.Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication, 3rdEd., 2014.
7. **James Stewart:** "Calculus" Cengage Publications, 7thEd., 2019.
8. **David CLay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.