Integrated MSc Electronics

Detailed Syllabus

Semester - 1

Course Name: **Mathematics**, Course Code: **IELEMJMA0124**, Course Type: **Foundation**

Hours			Total Credits	Maximum Marks				Time Allowed for Theory Examination
Lecture	Tutorial	Practical		Internal	End Term		Total	
					Theory	Lab		
4	0	0	4	20	80	0	**100**	2 ½ Hrs

Course Objectives:

The aim of this course is to solidify the foundational knowledge of mathematics necessary for advanced coursework in electronics. It will enable students to apply mathematical concepts to various fields such as signal processing, circuit design, and system modeling.

Expected Learning Outcomes:

After going through this course, the student shall be able to:

1. ***Solve algebraic equations*** *(linear, quadratic, simultaneous) using appropriate methods.*
2. ***Analyze graph and functions*** *(polynomial, exponential, logarithmic, trigonometric) and understand their key properties.*
3. ***Calculate limits, continuity, and apply differentiation*** *for solving optimization and rate-of-change problems.*
4. ***Apply integration techniques*** *to solve problems, including area calculation.*
5. ***Solve differential equations*** *and apply basic methods like separation of variables.*

Detailed Syllabus

Unit 1: Number System, Sets and Functions

- **Number System:** Review and properties of Natural numbers, Integers, rational and real numbers. Prime numbers and divisibility, complex numbers, basic operations and polar form.
- **Sets:** Definition, examples and properties of sets. Cartesian product, relations and equivalence relations.

  Functions: Domain, range, and types of functions (linear, quadratic, polynomial, exponential, logarithmic, and trigonometric functions). Composition of functions and plotting of graphs.

Unit 2: Matrices and Determinants

- **Linear Equations**: Solutions of linear equations in one and two variables. Applications in real-world problems.
- **Matrices and Determinants:** Definition, examples, Operations, inverse and rank of a matrix. Determinants and their properties. Consistency and solution techniques.
- **Simultaneous Equations**: Systems of linear equations, solutions using substitution, elimination, and matrix methods (including determinants and Cramer's rule and Gauss elimination method).

- **Matrix Equations:** Eigenvalues and Eigenvectors, characteristic equation and minimal equations. Examples and applications for the stability of the system.

Unit 3: Calculus

- **Limits and Continuity**: Concept of limits, examples and properties. Definition of continuity with basic properties.
- **Derivatives**: Definition of derivative, interpretation as a rate of change and slope of the tangent. Derivative of simple functions by power rule, product rule, quotient rule, and chain rule.
- **Integration**: Integration as the reverse process of differentiation, basic integration formulas. Rules of integration by; substitution, parts and partial fractions.
- **Definite Integrals**: Properties of definite integrals, evaluation of definite integrals, and applications in calculating area under curve.

Unit 4: Differential Equations

- **Basic differential equations:** Definition, Formation and examples. Order and degree of a differential equation. Linear and non-linear differential equations. Concept of elementary ordinary and partial differential equations.
- **Solution Methods:** solutions by variable separable method, integrating factor method. Solution of homogeneous and Bernoulli's type of differential equations. Solution of elementary second order differential equations using auxiliary equations.
- **Applications of Derivatives**: Rules for finding maxima and minima. Solution of simple problems arising in control system, circuit analysis, heat and energy dissipation.

Recommended Books

1. G. B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
2. E. Kreyszig, "Advanced Engineering Mathematics", 8th Ed., John Wiley, Singapore, (2001).
3. R. K. Jain, and S. R. K. Iyengar, "Advanced Engineering Mathematics", 2nd Ed., Narosa Publishing House, New Delhi (2003).
4. Ayres Frank, Schaum's outline of Theory and Problems of Differential and Integral Calculus, 1994.
5. Das & Mukherjee, "Differential Calculus", U.N. Dhur & Sons Pvt. Ltd.
6. Das & Mukherjee, "Integral Calculus", U.N. Dhur & Sons Pvt. Ltd.