25MT101 FOUNDATIONS OF ENGINEERING MATHEMATICS

Hours Per Week :

L	T	P	SL	C
0	3	2	0	1

PREREQUISITE KNOWLEDGE: Basics of set theory, Algebra.

COURSE DESCRIPTION AND OBJECTIVES:

This course aims to provide students with fundamental mathematical concepts essential for engineering applications. It covers topics such as set theory, functions, matrices, determinants, calculus, and vectors. Students will develop problem-solving skills and analytical reasoning to apply mathematical principles effectively in various engineering domains.

MODULE-1

0L+06T+04P+0SL=10 Hours

UNIT-1

SETS AND SET OPERATIONS:

Definition and representations of sets, Cardinality, Operations: union, intersection, complement, symmetric difference, Cartesian product, Venn diagrams (basic) and De Morgan's law.

UNIT-2

FUNCTIONS AND EQUATIONS:

Functions and their properties, Domain, Range, Composition of two functions, Types of functions, Inverse of a function.

Polynomials, Factorization, Quadratic equations, Inequalities (linear).

PRACTICES:

- Solve set operation problems using Venn diagrams.
- Compute the domain and range of given functions.
- Verify De Morgan's law with examples.
- Factorize quadratic equations and determine their roots.
- Identify and classify different types of functions.

MODULE-2

0L+12T+08P+0SL=20 Hours

UNIT-1

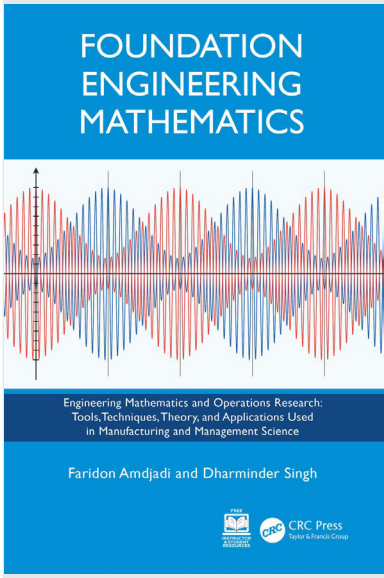
MATRICES AND DETERMINANTS:

Types of matrices, Basic matrix operations: addition, multiplication, transpose (up to 3×3). Determinants and their properties, Inverse of a matrix (if it exists) and its computation (up to 3×3).

UNIT-2

CALCULUS:

Limits and continuity: simple numerical approach, Basic differentiation rules (product, quotient, chain rules), Derivatives of elementary functions (polynomials, exponentials, logarithms, trigonometric functions), Basic integration techniques (substitution, by parts), Definite and indefinite integrals, Geometric interpretation of integrals (area under curves).



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SKILLS:

- ✓ *Mathematical problem-solving.*
- ✓ *Application of algebra, calculus and vectors in engineering.*
- ✓ *Logical reasoning and analytical thinking.*
- ✓ *Graphical and numerical representation of data.*

UNIT-3

VECTORS AND GEOMETRY:

Basic vector operations (addition, scalar multiplication, dot product, cross product, triple product), Geometric interpretation of vectors in 2D and 3D.

PRACTICES:

- Compute determinants and inverse of given matrices.
- Compute matrix operations.
- Solve differentiation problems using product and quotient rules.
- Evaluate definite and indefinite integrals using appropriate techniques.
- Perform vector operations and verify their geometric interpretations.
- Apply matrices to solve systems of linear equations.
- Matrix Multiplication Using the ***Urdhva-Tiryagbhyam Vedic Sutra.*** Compare results with standard methods and reflect on computational efficiency.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to

CO No.	Course Outcomes	Blooms Level	Mapping with POs
1	Solve set theory and function-related problems effectively.	Apply	1, 3
2	Utilize matrices and determinants for engineering applications.	Apply	1, 5
3	Analyze and solve differential and integral calculus problems.	Analyze	2, 6
4	Use vector analysis to interpret real-world problems.	Apply	1, 3
5	Implement mathematical problem-solving skills in engineering.	Apply	2, 10

MAPPING OF SUSTAINABLE DEVELOPMENT GOALS (SDGs) AND INDIAN KNOWLEDGE SYSTEM (IKS) :

TEXT BOOKS:

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Edition, 2011.

REFERENCE BOOKS:

1. R.K. Jain, S.R.K. Iyengar, “Advanced Engineering Mathematics”, Narosa Publishing, 5th Edition, 2016.
2. H.K. Dass, “Advanced Engineering Mathematics”, S. Chand Publishing, 28th Edition, 2018.
3. M.D. Greenberg, “Advanced Engineering Mathematics”, Pearson Education, 2nd Edition, 1998.