Semester 5

Core Course (Minor)

Course Code: 5MTMMIC1 (Credit: 4, Lectures: 60 Hours; Full Marks: 100)

Course Name: Linear Algebra and Calculus 1

Marks and Credit distribution:

Theory: 3 Credits, Tutorial: 1 Credit

End Semester exam: 50 Marks, Continuous Assessment: 20 Marks, Attendance: 5 Marks, Tutorial: 25 Marks

Course Outcome: Upon Successful completion of this course, students will develop foundational knowledge in linear algebra, including vector spaces, linear transformations, the algebraic structure of matrices and their eigenvalues. They will also gain a solid understanding of calculus concepts such as limits, continuity and differentiability. Students will also learn some computational technique like bisection method, Newton Raphson method, Lagrange interpolation and Simpson's one-third rule.

Course Content:

Group A: Linear Algebra (Marks assigned for end semester: **25, 30L)**

1. Review of elementary theories of matrices and determinants.
2. Matrices and elementary row operations, row reduced echelon matrices.
3. Determinant as a function of matrices, solution of system of linear equations - Cramer's rule.
4. Vector spaces, subspaces, row spaces and column spaces, bases and dimension.
5. Linear transformations, algebra of linear transformations, isomorphism of vector spaces, Matrices of linear transformations.
6. Eigen-value and eigen-vectors: simple problems

References:

1. Algebra- R. M. Khan
2. Abstract and linear algebra- S. K. Mapa
3. Linear Algebra Geometric Approach
4. Linear Algebra – Hoffman and Kunze.

Group B: Calculus 1 (Marks assigned for end semester: **25, 30L)**

1. Real valued functions, limit of a function, algebra of limits, continuity of a function at a point and in an interval, algebra of continuous functions, properties of continuous functions on closed intervals.

2. Differentiability of a function at a point**,** differentiability and continuity, successive differentiation, Leibnitz's theorem, Rolle's theorem, Lagrange's mean value theorem and their geometric interpretations, L' Hospital's Rule (statement and problems only), extreme values of real valued functions, Taylor's and Mclaurin's series expansion.

3. Topics from Numerical Analysis:

a) Root finding methods for solving transcendental equations: Bisection method, Newton-Raphson method
b) Lagrange Interpolation.
c) Integration: Trapezoidal, Simpson's one – third rule

References:

1. Integral Calculus- Maity and Ghosh
2. Differential Calculus- Maity and Ghosh
3. Advanced Engineering Mathematics-E. Kreyszig