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| **B. TECH 1st SEMESTER** | **L** | **T** | **P** | **C** |
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| **19MA1T01: CALCULUS AND LINEAR ALGEBRA** |

**Course Objectives:**

* This course will illuminate the students in the concepts of calculus and linear algebra.
* To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

**Bridge Course:** Limits, continuity, Types of matrices

**Unit I: Matrix Operations and Solving Systems of Linear Equations**

Rank of a matrix by echelon form, Normal form - solving system of homogeneous and non-homogeneous linear equations- Gauss Elimination, Jacobi and Gauss Seidel methods - Eigen values and Eigen vectors and their properties (without proof).

**Learning Outcomes:**

At the end of this unit, the student will be able to

solve systems of linear equations, determine the rank, Eigen values and eigenvectors(K2).

**Unit II: Cayley-Hamilton theorem and Quadratic forms**

Cayley-Hamilton theorem (without proof), Finding inverse and power of a matrix by Cayley-Hamilton theorem - Reduction to diagonal form - Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

* reduce to diagonal form and identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (K3)

**Unit III:    Multivariable calculus**

Expansions of functions: Taylor’s and Maclaurin's series - Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

* Expand the given function as series of Taylor’s and Maclaurin’s (K3)
* Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (K3)
* Acquire the Knowledge in maxima and minima of functions of several variables (K1)
* Utilize  Jacobian of a coordinate transformation to deal with the problems in change of variables (K3)

**Unit IV: Multiple Integrals**

**Double Integrals**: change of order of integration, double integrals in polar coordinates, areas enclosed by plane curves.

**Triple Integral**: Evaluation of triple integrals, change of variables

**Learning Outcomes:**

At the end of this unit, the student will be able to

* evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (K3)
* apply double integration techniques in evaluating areas bounded by a region (K4)

**Unit V: Special Functions**

Beta and Gamma functions and their properties, relation between beta and gamma functions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

* Conclude the use of special functions in multiple integrals (K3)

**Textbooks:**

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012.

**References:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. B.V. RAMANA, Higher Engineering Mathematics, Tata McGraw Hill, 2007.

**Course Outcomes:**

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

1. develop the use of matrix algebra techniques that is needed by engineers for practical applications (K3)
2. familiarize with functions of several variables which is useful in optimization (K3)
3. learn important tools of calculus in higher dimensions. Students will become familiar with double integral(K3)
4. familiarize with triple integral and also learn the utilization of special functions