Linear Algebra and Complex Analysis

1.1   Course Number: MA 211

1.2   Contact Hours: 2-1-0   Credits: 8

1.3   Semester-offered: 2nd Year -Odd

1.4   Prerequisite: Real Analysis & Calculus

1.5   Syllabus Committee Member: Dr. Manoj K Rajpoot (Convener), Dr. Chanchal Kundu and Dr. Alpesh Kumar

2.   **Objective:** To fulfill the fundamental requirements of knowledge of Mathematics for learning Science and Engineering subjects.

3.   **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Matrix algebra, Vector Space and Linear Transformations	Introduction to matrix algebra. Vector spaces and linear transformation: Vector spaces and subspaces, linear dependence, linear span, bases, dimensions, sum and direct sum of spaces. Inner product, norm, Gram-Schmidt orthogonalization process. Linear transformations, kernel and image, rank, nullity, matrix associated with linear transformation, change of bases.	11
2	Eigenvalues and Eigenvectors	Characteristic equation, eigenvalues and eigenvectors, Cayley-Hamilton theorem, properties of eigenvalues and eigenvectors of symmetric, orthogonal, Hermitian and unitary matrices, diagonalization of matrices.	5
3	Complex Algebra and Analytic Functions	Algebra of complex numbers, function of a complex variable, limit, continuity and differentiability, Analytic functions, Cauchy-Riemann equations, Harmonic functions.	6
4	Complex Integrations	Line and Contour integrals, Cauchy's theorem and Cauchy's integral formula for simply and multiply connected regions, Morera's theorem, power series, zeros and singularities of a complex function, residues.	6
		Total	**28**

4.   Readings

4.1 Textbook:

    i.   *Numerical Linear Algebra* by J. H. Kwak and S. Hong; Birkhäuser Publisher.
   ii.   *Linear Algebra and its Applications* by G. Strang; Cengage Learning.
  iii.   *Complex Variables and Applications* by J. W. Brown and R.V. Churchil; McGraw-Hill Education.

4.2 Reference books:
    i.   *Advanced Engineering Mathematics* by E. Kreyszig. Wiley-India Ed.
   ii.   *Linear Algebra* by Kenneth Hoffman and Ray Kunze: PHI publication.

5   Outcome of the Course:

Students will learn about the fundamental Mathematics, which will foster the mathematical base for the understanding of Science and Engineering concepts.