Applied Mathematics-II

1.1 Course Number: MA 124

1.2 Contact Hours: 40 (L) Credits: 11 [LTP: 3-1-0]

1.3 Semester-offered: Even (IInd)

1.4 Prerequisite: Applied Mathematics-I

1.5 Syllabus Committee Member:

2. **Objective:** The objective of this course is to expose student to understand the basic importance of linear algebra, ordinary and partial differential equations in engineering.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	**Laplace Transformation and Fourier Series**	Laplace transforms & properties, inverse Laplace transforms, convolution theorem, applications. Fourier series.	06
2	**Power Series Solution of Second order ODEs**	Power series solutions: ordinary points, Legendre equation. Legendre polynomials and properties. Method of Frobenius: Solution of ODEs with regular singular points (Example: Bessel equation).	04
3	**Partial Differential Equation**	Partial Differential Equation: introduction, linear, nonlinear (semi-linear, quasi-linear) examples, well-posedness. First order linear PDEs, method of characteristics. Classification of second order PDEs, hyperbolic, parabolic and elliptic. Wave equations: d'Alembert's formula, Duhamel's principle. Heat equations: Solutions for initial boundary value, method of separation of variables. Solutions of Laplace's and Poisson's equation.	14
4	**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
5	**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.	05
		Total	**40**

4. Readings

4.1 Textbook:

- *Applied Partial Differential Equations: An Introduction* by A. Jeffrey.
- *Numerical Linear Algebra* by J. H. Kwak and S. Hong; Birkhäuser Publisher.
- *Linear Algebra and its Applications* by G. Strang; Cengage Learning.

4.2 Reference books:

- ✓ *Differential Equations with Applications and Historical Notes* by G.F. Simmons.
- ✓ Differential Equations by Shepley L. Ross, John Wiley & Sons.
- ✓ An Elementary Course in Partial Differential Equations by T. Amaranth.
- ✓ Partial Differential Equations by Fritz John.
- ✓ *Linear Algebra* by Kenneth Hoffman and Ray Kunze: PHI publication
- ✓ *Linear Algebra Done Right* by Sheldon Axler, Springer.

5 Outcome of the Course:

Addressing a specific category of ordinary and partial differential equations pertaining to the fields of Science and Engineering. The other part of this course Linear Algebra equips students with a solid understanding of the subject and its applications, providing a valuable mathematical toolkit for future academic and professional endeavors.