Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NPHC505	NUMERICAL METHODS AND COMPUTER PROGRAMMING	3	0	0	3

Course Objective

- To introduce students with the numerical procedures of fundamentals of mathematical operations and tools for computer programming.
- To prepare them for coding in any language for applications in any physical field or subject.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- design computer programming for various physical problems and solve it numerically.
- improve programming skills with hands on experience with a computer programming language.
- accomplish the methods of approximation and errors, roots of equations, curve fitting, interpolation methods, calculus and Fourier approximation

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Methods of approximation and errors**: Truncation and round-off errors; Accuracy and precision.	3	Understand the cause of numerical errors and estimating numerical errors and idea about accuracy and precision.
2	**Computer Programming**: Computer programs in suitable languages, based on above topics.	6	Understand the basics of computer programs and learn coding.
3	**Roots of Equations**: Bracketing methods (false position and bisection), Iteration methods (Newton-Raphson). Systems of linear algebraic equations: inversion and LU decomposition methods. Gauss elimination method.	5	Learn the solution of system of linear equations by various numerical methods
4	**System of Nonlinear equations**: Bisection method; Newton's method; Fixed-point iteration method;	3	Learn to solve of system of non- linear equations by numerical methods
5	**Curve fitting**: Least squares regression, linear and nonlinear regressions	4	Helps for numerical estimate the roots of equations using various method
6	**Interpolation Methods**: interpolating polynomials. Newton's divided difference	4	Helps in the understanding of interpolation method
7	**Numerical differentiation**: Finite difference approximation; Finite difference using Taylor series; Differentiation using Curve fitting;	4	Learn the Numerical differentiation by various numerical methods
8	**Numerical integration**: Rectangle and midpoint methods; Trapezoidal method; Simpson's method; Gauss quadrature;	4	Learn the Numerical integration by various numerical methods.
9	**Ordinary differential equations**: Euler's method, Runge-Kutta methods. Boundary value and Eigenvalue problems. Partial differential equations: Laplace's equation and solutions. Few applications	5	Helps to solve ordinary differential equations using various numerical methods.
10	**Fourier approximation**: Introduction, Discrete Fourier and Fast-Fourier transforms	4	Helps to understand the numerical approximation using Fourier method.
	Total	**42**	

Text Books:

1. Shastry, S.S., "Numerical Methods", Prentice Hall Inc., India, 1998.
2. Richard L. Burden and J. Douglas Faires, "Numerical Analysis", Brooks/Cole, Cengage Learning, 1993.
3. Santanu Saha, "Numerical Analysis with Algorithms and Programming"; CRC press, 2016

Reference Books:

1. Noble Ben, "Numerical Methods", New York International Publications, New York, 1964.
2. Buckingham R.A., "Numerical Methods", Sir Isaac Pitman Sons. Ltd., London, 1957.
3. Uri M. Ascher and Chen Greif, "A first Course in Numerical Methods" SIAM, 2011.
4. Bakhvalov, N.S., "Numerical Methods", Mir. Pub., Moscow, 1977.
5. Amos Gilat and Vish Subramiam, "Numerical Methods for Engineers and Scientists: An Introduction with Applications Using MATLAB"; Wiley, 2014