**PH 524: Numerical Methods and Computational Physics (3-0-0: 3)**

**Errors**

The importance of estimating errors, systematic and random errors, absolute and relative errors, general formula for errors, error propagation, method of least squares, floating point errors, floating point complications, overflow and underflow. **[6L]**

**Matrices and Linear Algebraic Equations**

Addition, subtraction and multiplication of matrices, transpose of a matrix, Gauss-Jordan elimination, Gauss-Seidel elimination, LU Decomposition, applications, eigen value problem. **[5L]**

**Root Finding and Nonlinear Sets of Equations**

Bisection method, Newton–Raphson method, Secant method, applications. **[4L]**

**Interpolation**

Lagrange polynomials. **[2L]**

**Modeling of Data**

Least square fitting of functions and its applications. **[4L]**

**Numerical differentiation**

Forward, backward and centred difference formula. **[4L]**

**Solution of ordinary differential equations**

Euler’s method, second and fourth order Runge-Kutta methods, finite difference method, boundary value problems. **[5L]**

**Numerical integration**

Trapezoidal, Simpson and Gaussian Quadratures rules, applications. **[3L]**

**Monte-Carlo methods**

Random number generation, checking the randomness of a sequence, Monte-Carlo integration. **[3L]**

**Text Books and References**

1. V. Rajaraman, “Computer Oriented Numerical Methods”, PHI Learning Publishers.
2. R. L. Burden and J. D. Faires, “Numerical Analysis”, Brooks Cole Publishing.
3. K. P. N. Murthy, “Monte-Carlo Methods in Statistical Physics”, University Press.
4. H. T. Davis and K. T. Thomson, “Linear Algebra and Linear Operators in Engineering with Applications In Mathematica”, Academic Press.
5. R. L. Burden and J. Douglas Faires, “Numerical Analysis”, Thomson Learning