**M.Sc. Physics Semester IV Paper XXX**
**Computational Physics – II 22PHY24DB1**

Theory Marks:80
Internal Assessment Marks:20
Time: 3 Hours

**COURSE OUTCOMES**

CO1 Students would be able to understand framework of computer languages
CO2 Students would be able to solve numerically various physical problems
CO3 Students would gain the necessary basic knowledge of application of MATLAB for problem solving

**Unit - I**

Random numbers: Random number generators, Mid-square methods, Multiplicative congruential method, mixed multiplicative congruential methods, modeling of radioactive decay. Hit and Miss Monte-Carlo methods, Monte-Carlo calculation of π, Monte-Carlo evaluation of integration, Evaluation of multidimensional integrals, chaotic dynamics: Some definitions, the simple pendulum, Potential energy of a dynamical system, Un-damped motion, Damped motion, Driven and damped oscillator.

**Unit-II**

Numerical solution of Radial Schrodinger equation for Hydrogen atom using Forth-order Runge-Kuttamethod(when Eigen value is given), Algorithms to simulate interference and diffraction of light, Simulation of charging and discharging of a capacitor, current in LR and LCR circuits, Computer models of LR and LCR circuits driven by sine and square functions, Simulation of Planetary motion, Simulation of projectile motion

**Unit –III**

MATLAB – I: Introduction, working with arrays, creating and printing plots, Interacting Computations: Matrices and Vectors, Matrices and Array Operations, built in functions, plotting simple graphs Programming in MATLAB: Script files, function files, Compiled files, p-code, variables, loops, branches, and control flow, Input/ Output, structures, cells

**Unit-IV**

MATLAB – II: Linear Algebra; solving a linear system, Gaussian elimination, finding eigenvalues and Eigen vectors, matrix factorization, Curve fitting and Interpolation; polynomial curve fitting, least square curve fitting, interpolation, Data analysis and statistics, Numerical integration; double integration, Ordinary differential equation; first order linear ODE, second order nonlinear ODE, tolerance, ODE suite

**Note:**The syllabus is divided into four units. Nine questions will be set in all. Question No.1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit. A student has to attempt five questions in all.

**Text & Reference Books:**


[1] Introduction to Numerical Analysis by F B Hildebrand (Tata McGraw Hill)
[2] Fortran Programming and Numerical methods by R C Desai (Tata McGraw Hill).
[3] Computer Applications in Physics by Suresh Chandra (Narosa Publishing House)
[4] Numerical Recipes in Fortran 77 By William H. Press, Saul A Teukolsky, William T Vellerling and Brain P. Flannery (Cambridge University Press)
[5] Introduction to Computation Physics by M L De Jong (Addison-Wesley).
[6] Computational Physics an Introduction by R C Verma, P K Ahluwalia and K C Sharma (New Age International).
[7] Computer Oriented Numerical Method by V Rajaraman (PHI).
[8] An introduction to numerical analysis by K E Atkinson (John Wiley and Sons).
[9] Getting Started with MATLAB by RudraPratap (Oxford University Press).
[10] A concise introduction to MATLAB by William J Palm III (McGraw Hill).