Programme: **M. Sc.**	Year: **II**	Semester: X
Subject: **Physics**		
Course Code: **B011002T**	Course Title: **Computational Physics with Python**	

Course Outcomes (COs)

1. have fundamental understanding of different operating systems and working on Linux preferably Ubuntu.
2. have knowledge of different features of Python programming language including module, package and libraries.
3. can manage and manipulate data in different datafiles for desired calculations and draw 2D and 3D plots and graphs for data sets and functions.
4. be able to write computer programs for different numerical methods and perform numeric integration and differentiation.
5. can generate random numbers and solve waves equations including Schrödinger 's equation using programming.

Credit: **4**	Elective I
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical-Research (in hours per week): L-T-P-R: 3-1-0-0

Unit	Topics	**No. of Lectures**
I	Introduction to Operating systems, Linux, Python Basics: Interpreter, statements, variables, mathematical operators, loops, functions, libraries and modules, class and object, and simple applications.	9
II	Python libraries: NumPy, SciPy, matplotlib, pandas; extracting data from datafiles, managing datasets. 2D and 3D plots and graphs	9
III	Programming for Newton-Raphson method, iterative method, Newton's forward and backward interpolation.	9
IV	Numeric integration and differentiation, Euler's methods, Runge-Kutta methods for ODE, matrix manipulation	9
V	Programming for the motion of real pendulum, Random numbers, Monte-Carlo method, the random walk, Ising model and solution of wave equations, Schrödinger 's equation.	9

Suggested Readings

1. Computational Physics with Python, Eric Ayars (California State University, 2013).
2. Computational Physics: Problem Solving with Python, 3rd edition, Rubin H. Landau, Manuel J. Paez, (Wiley-VCH, 2015).
3. Introducing Python: Modern Computing in Simple Packages, B. Lubanovic, (O'Reilly Media, Inc, 2015).
4. A Primer on Scientific Programming with Python, Hans Petter Langtangen (2014)

Suggested Digital Platforms/Web Links

1. Swayam – Government of India, https://swayam.gov.in/explorer?category=Physics
2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html
3. Uttar Pradesh Higher Education Digital Library, https://heecontent.upsdc.gov.in/SearchContent.aspx
4. MIT Open Learning – Massachusetts Institute of Technology, https://openlearning.mit.edu/
5. edX, https://www.edx.org/course/subject/physics

Course Prerequisites

Physics in M. Sc. Physics I Year