Semester	I
Course	Major
Paper Code	C1PH230112T / C1PH230112P
Paper Title	Mathematical Methods I and Computation Lab I
No. of Credits	4 (Theory – 3 and Lab – 1)
Theory / Practical / Composite	Composite
Minimum No. of preparatory hours per week a student has to devote	4
Number of Modules	2
Syllabus	<u>Math Methods 1(Theory- 3 credits)</u> **[36 L]** Vectors: essentials, Scalar and vector products. Coordinate systems and transformation, Transformation of vectors under rotation and reflection: Pseudo scalars and pseudo vectors, examples. Triple products: expression using *suffix notation,* Reciprocal space. Vector equations of planes and surfaces. Vector functions of a scalar variable: trajectories as parametric curves, tangent and normal vectors, curvature and radius of curvature, kinematics. [12 L] Coordinate systems: Cartesian, cylindrical and spherical systems. Distribution functions: elementary properties of the Dirac delta function and Heaviside step functions: interrelationship. Fields of Physics: Gradient, divergence, curl: properties, Vector integrals and Integral theorems (heuristic proof only). Proving related identities by algebraic manipulation and also using the suffix notation. [18 L] Formulation of Physics problems using first order derivatives. Isoclines and Direction fields [6 L]

Learning Outcomes	(1) Will be able to handle Scalar and Vector Fields Comfortably (module A) (2) Will be able to translate between various coordinate systems (module A) (3) Will be able to visualize solutions to differential equations as direction fields (module A) (4) Development of visual techniques for curves and surfaces (module B) (5) Develop basic capabilities in handling data (module B) (6) Will be able to write small scripts using Python (module B) (7) Will be able to help in future study of GPS, Geo-sciences and Mathematical Modelling in diverse fields of studies. (module A) (8) Will complement (7) through computer aided techniques and programming (module B)	
Reading/Reference Lists	**Module A** 1. Online refs.: Kreyszig 2. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7thEdn., Elsevier. 3. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications. 4. Mathematical Physics, Goswami, 1st edition, Cengage Learning 5. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India. 6. Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press 7. Mathematical methods in the Physical Sciences, M. L. Boas, 2005, Wiley 8. Vector Analysis, Murray R. Spiegel, Schaum Series 9. Introduction to Electrodynamics by David J. Griffiths **Module B** 1. Main online Refs: Langtangen, Kong et al 2. Computational Physics, D.Walker, 1st Edn., 2015, Scientific International Pvt. Ltd. 3. Computational Physics Mark Newman, CreateSpace Independent Publishing Platform (2012) 4. Computational Physics: Problem Solving with Python, 3rd Edition, Rubin Landau, Manuel J. Paez, Cristian C. Bordeianu 5. Learning Scientific Programming with Python, Christian Hill, CUP 6. Scientific Computing in Python (Revised edition, Python 3), Abhijit Kar Gupta	
Evaluation	Theory: 60	Practical: 40

	CIA: 15 (10 + 2/assgn + 3/attn.) Semester Exam: 45	CA: 30 Semester Exam: 8 + 2/attn.
Paper Structure for Theory Semester Exam	15 Marks from 3 marks questions (5 out of 7) 30 Marks from 10 marks questions (3 out of 4)	