Semester	AUG 2023
Open to semester	3
Course code	**PH2123**
Course title	**Mathematical Methods for Physics (Elective)**
Credits	3 /
Course Coordinator & participating faculty (if any)	Bijay Kumar Agarwalla *, Sachin Jain
Nature of Course	Lectures and Tutorials
Pre-requisites	Basic knowledge of mathematics and physics
Objectives (goals, type of students for whom useful, outcome etc)	To provide the key mathematical tools needed for a physics student. This is a key course for students wanting to study physics. Students from other disciplines will also find it useful if they plan to study any quantitative science.
Course contents (details of topics /sections with no. of lectures for each)	Infinite series, power series: 4 lectures Convergent and divergent series, convergence tests, alternating series and conditional convergence, Taylor expansion, radius of convergence, expanding functions in power series, error in series expansions. Complex Algebra: 2 lectures Complex numbers and functions, Algebraic properties of complex numbers, polar representation, power and roots of complex numbers, derivatives, Linear Algebra: 6 Lectures Linear simultaneous equations, row operations, rank, determinants, minors and cofactors, inverse, Cramer's rule. Functions of matrices, Baker-Campbell-Hausdorff relation. Special types of matrices: linear conditions (symmetric, anti-symmetric, Hermitian) and quadratic conditions (orthogonal, unitary). Basis for matrices satisfying linear conditions. Lie algebra and Lie group for U(2) and SU(2). Eigenvalues and eigenvectors, diagonalization of matrices, change of basis. Degenerate eigenvalues and Gram-Schmidt Orthogonalization, Cayley-Hamilton theorem. Fourier Series and transformation: 4 lectures Periodic functions, Orthogonality of trigonometric functions,

	Expansion of functions in Fourier series, complex form of Fourier series, Perseval's identity, Fourier integral, Inverse transformation. Probability and statistics: 3 lectures Sample space, probability axioms, conditional probability and Bayes theorem, Probability distribution of a random variable, discrete and continuous random variables, moments and generating functions, multiple random variables, some special distributions, large sample theory, Central limit theorem. Differential Equations: 5 lectures Linear differential operators, 1st order ODE, 2nd order ODE, Number of independent sol, Wronskian, homogeneous and inhomogeneous ODE, power series solution, Fourier transform to solve differential equation.
Evaluation /assessment	End-Sem Examination-35% Mid-Sem Examination-35% Others-30%%
Suggested readings (with full list of authors, publisher, year, edn etc.)	1. Mathematical Methods for Physicists: G. Arfken and H. Weber (2012) 7th edition, Academic Press 2. Mathematical Physics, Mary L. Boas, 2nd edition, John Wiley & Sons (1983). 3. Mathematics for Physicists – Dennery and Krzywicki, Dover. 4. Mathematical Methods for physics and engineering-- Riley, Hobson, and Bence