Course Type	Course Code	Name of Course	L	T	P	Credit
DC	GPC 206	Mathematical Geophysics	3	0	0	9

Course Objective
The primary objective of the course is to introduce mathematical methids concerned with problems of geoscientific relevance. The purpose of this course will be to understand and appreciate the symbiotic relationship that exists between mathematics and geophysics.
Learning Outcomes
Upon successful completion of this course, students will: • Gain a mathematical background for the study of the Earth's dynamics and interactions

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction**: Need for and role of theory and computation in geophysics, mathematics applied to geoscience.	2	Motivation for the course
2	**Vector fields:** Basics of vector algebra and vector Calculus	3	Exposure to fundamental properties of vector and vector calculus
3	**Linear Equations:** Vectors and Linear Equations, The Idea of Elimination, Elimination Using Matrices, Rules for Matrix Operations, Inverse Matrices, Elimination = Factorization: A = LU, Transposes and Permutations	7	Introduction to Linear Equations in linear algebra
4	**Vector Spaces and Subspaces:** Spaces of Vectors, The Nullspace of A: Solving Ax = 0, The Rank and the Row Reduced Form, The Complete Solution to Ax = b, Independence, Basis and Dimension, Dimensions of the Four Subspaces	7	Introduction to Vector Spaces and Subspaces
5	**Orthogonality:** Orthogonality of the Four Subspaces, Projections, Least Squares Approximations, Orthogonal Bases and Gram-Schmidt Fourier and Laplace transforms	7	Introduction Orthogonality in linear algebra
6	**Eigenvalues and Eigenvectors:** Introduction to Eigenvalues, Diagonalizing a Matrix, Applications to Differential Equations, Symmetric Matrices, Positive Definite Matrices, Similar Matrices, Singular Value Decomposition (SVD)	7	Learning basics of Eigenvalues and Eigenvectors
7	**Linear Transformations:** The Idea of a Linear Transformation, The Matrix of a Linear Transformation, Diagonalization and the Pseudoinverse	5	Learning basics of Linear Transformations
8	**Linear Optimization**, Necessary and sufficient conditions for optimality, convex analysis	4	Introduction to optimization techniques
	Total	**42**	

Text Books

1. Mathematical Methods for Physics and Engineering, Riley, K. F., Hobson, M. P., and Bence
2. Linear Algebra and Its Applications by Gilbert Strang
3. Mathematical Methods for Physicists, J. B. Arfken and H. J. Weber (7th edition, Indian reprint, 2017).
4. Luenberger D G, Introduction to Linear and Nonlinear Programming,2nd edition, Addison Wesley,1984