

Lecture Plan		
Name of the College: Government College of Arts, Science and Commerce, Sanquelim-Goa		
Name of Faculty: Prajyot Maruti Patil	Subject: Mathematics	
Paper code: MAT-6403 Mathematics for Machine Learning	Program: M.Sc.	Division: -
Academic year: 2026-27	Semester: IV	Total Lectures: 30
Course Objectives: 1. To introduce core mathematical foundations of Machine Learning — including linear algebra, calculus, probability, and optimization — fostering a rigorous understanding of their definitions, properties, and interconnections. 2. To develop the learner’s capacity to formulate and verify mathematical results and proofs that underpin algorithms and models in Machine Learning. 3. To train learners to identify, select, and apply appropriate mathematical techniques such as matrix factorizations, gradient-based optimization, and probabilistic reasoning to solve structured computational problems. 4. To encourage analytical reasoning, creativity, and mathematical precision in formulating, analyzing, and solving new or unfamiliar problems in Machine Learning		
Expected Course Outcome: 1) Demonstrate conceptual understanding and familiarity with the fundamental mathematical principles — including matrix decompositions, vector calculus, probability, and optimization — that form the basis of Machine Learning. 2) Construct and validate mathematical derivations and proofs for results such as decomposition properties, gradient identities, and optimization conditions relevant to Machine Learning. 3) Select, modify, and implement appropriate mathematical and computational methods — including SVD, backpropagation, optimization, and Bayesian inference — to solve structured problems. 4) Analyze and synthesize mathematical models and formulate precise arguments to solve unseen or ill-structured problems in Machine Learning contexts, demonstrating originality and logical rigor.		

Month	Lecture From	Lecture To	No. of Lectures	Topic / Subtopic to be Covered	ICT Tools	Reference Books
June	22/06/2026	27/06/2026	2	Introduction to the course; Review of linear algebra basics: vectors, matrices, operations; Overview of syllabus and learning objectives	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	29/06/2026	04/07/2026	2	Matrix Decomposition – Eigenvalues and Eigenvectors; Cholesky Decomposition	Smart Board PDF	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
July	06/07/2026	11/07/2026	2	Diagonalization; Singular Value Decomposition (SVD)	Smart Board PDF	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	13/07/2026	18/07/2026	2	Matrix Approximation; Matrix Phylogeny · [Module 1 complete] — Revision & Problem Solving: Module 1 — Differentiation of Univariate Functions	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	20/07/2026	25/07/2026	2	Partial Differential Equations; Gradients of Vector-Valued Functions	Data Projector	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
Jul / Aug	27/07/2026	01/08/2026	2	Gradients of Matrices; Backpropagation and Automatic Differentiation	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
August	03/08/2026	08/08/2026	2	Higher-Order Derivatives; Linearization and Multivariate Taylor Series · [Module 2 complete] — Revision & Problem Solving: Module 2 —	Smart Board PDF	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	10/08/2026	15/08/2026	2	Probability and Distribution – Construction of Probability Space; Discrete and Continuous Probabilities [Independence Day – 15 Aug: Saturday, no lecture impact]	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	17/08/2026	22/08/2026	2	Bayes' Theorem; Gaussian Distribution	Smart Board PDF	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	24/08/2026	29/08/2026	2	Conjugacy and the Exponential Transformation; Change of Variables / Inverse Transformation · [Module 3 complete]	Smart Board PDF	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
Aug / Sep	31/08/2026	05/09/2026	2	— Revision & Problem Solving: Module 3 — Continuous Optimization – Optimization Using Gradient Descent	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)

Sep	07/09/2026	12/09/2026	2	Constrained Optimization and Lagrange Multipliers; Convex Optimization · [Module 4 complete] — Revision & Problem Solving: Module 4 —	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	14/09/2026	19/09/2026	—	GANESH CHATURTHI BREAK		
	21/09/2026	26/09/2026	2	Linear Regression – Problem Formulation; Parameter Estimation	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
Sep / Oct	28/09/2026	03/10/2026	2	Bayesian Linear Regression; Maximum Likelihood as Orthogonal Projection · [Module 5 complete] [Gandhi Jayanti – 2 Oct: 1 lecture cancelled]	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
Oct	05/10/2026	10/10/2026	2	— Comprehensive Revision: Modules 1–3 — Problem Solving, Past Question Discussion	Smart Board PDF	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)
	12/10/2026	14/10/2026	02	— Comprehensive Revision: Modules 4–5 — Unit Test Preparation · [Semester ends 14 Oct]	Smart Board	Deisenroth, M. P., Faisal, A. A., & Ong, C. S.: Mathematics for Machine Learning (Cambridge University Press)

*** Assessment Rubrics**

Component	Max Marks
ISA 1	10
ISA 2	10
Practical	Nil
Project	Nil
Semester End Exam	80