

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERBAD-500031,
DEPARTMENT OF INFORMATION TECHNOLOGY

Essentials of Mathematics for Machine Learning using Python
(AI&ML STREAM : OPEN ELECTIVE-II)
SYLLABUS FOR B.E. IV SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks : 60	Course Code: U22OE420IT
Credits : 3	CIE Marks : 40	Duration of SEE: 3 Hrs

Course Objectives	Course Outcomes
The course will enable the students to:	At the end of the course student will be able to:
Introduce the essential maths principles of linear algebra, vector calculus, probability theory and statistical methods along with exposure to Python libraries for understanding and applying machine learning to real-world problems.	<ol style="list-style-type: none"> 1. Understand the fundamentals of linear algebra – vectors and matrices. 2. Understand and apply various matrix norms, Eigenvectors and PCA techniques. 3. Understand basics of derivatives, integrals and optimization. 4. Understand various data distributions and apply probabilistic techniques to handle uncertainty. 5. Define basic descriptive and inferential statistical measures.

Unit-1 Basics of Linear Algebra

- Scalars, Vectors, Matrices, Tensors for Data Representation and Analysis
- Matrix Analysis (Rank, Determinant, Trace, Orthogonal basis & Inverse)
- Operations: Addition, Subtraction, Scalar Multiplication, Matrix Multiplication, Dot Product, Cross Product Feature Interactions for Data Manipulation
- Python experiments

Unit-2 Matrix

- Matrix Norms: L0 Norm, L1 Norm, L2 Norm; Linear Regression & Regularization
- Eigenvalues and Eigenvectors, Principal Component Analysis
- Python experiments

Unit-3 Vector Calculus

- Derivatives and Gradients
- Differential Operators - Laplacian operator, Gradient operator: for Gradient Descent in Optimization
- Integrals for cumulative distribution function
- Python Experimentation

Unit 4 Probability Theory

- Define Random Variables, Probability Distributions – Gaussian, Bernoulli, Binomial, and Poisson distributions model specific types of events
- Bayes' theorem, uncertainty modelling - updating beliefs based on observed evidence
- Python Experiments

Unit -5 Statistical Methods

- Descriptive Statistics - Expectation, Variance and Covariance
- Central Limit Theorem – Sampling distribution
- Inferential Statistics - Hypothesis Testing – Chi square test, T-Test
- Python Experiments

Learning Resources:

1. Mathematics for Machine Learning, by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020.
2. Mathematical Foundation for Machine Learning and AI, <https://www.udemy.com/course/mathematical-foundation-for-machine-learning-and-ai/>
3. Essential Mathematics for Machine Learning: https://onlinecourses.nptel.ac.in/noc21_ma38/preview

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max.Marks for each Internal Tests:	30
2	No. of Assignments:	02	Max. Marks for each Assignment:	05
3	No. of Quizzes:	02	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **90 Minutes**