

**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)

(Common for ECE, EEE, MECH & CIVIL)

SYLLABUS FOR B.E IV-SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks : 60	Course Code: <b>U24OE420IT</b>
Credits : 3	CIE Marks : 40	Duration of SEE: 3 Hrs

<b>Course Objectives</b>	<b>Course Outcomes</b>
<p>The course will enable the students to:</p> <p>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.</p>	<p>At the end of the course student will be able to:</p> <ol style="list-style-type: none"> <li>Understand the fundamentals of linear algebra – vectors and matrices.</li> <li>Understand and apply various matrix norms, Eigenvectors and PCA techniques.</li> <li>Understand basics of derivatives, integrals and optimization.</li> <li>Understand various data distributions and apply probabilistic techniques to handle uncertainty.</li> <li>Define basic descriptive and inferential statistical measures.</li> </ol>

**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:**

- Mathematics for Machine Learning, by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020.
- Mathematical Foundation for Machine Learning and AI, <https://www.udemy.com/course/mathematical-foundation-for-machine-learning-and-ai/>
- Essential Mathematics for Machine Learning: [https://onlinecourses.nptel.ac.in/noc21\\_ma38/preview](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

05

3 No. of Quizzes:

02

Max. Marks for each Quiz Test:

05

Duration of Internal Test: **90 Minutes**

V  
2024