SARVAJANIK UNIVERSITY
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SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Master of Technology

Year: M. Tech. I (Semester – I)

Subject Name: Mathematical Foundation for Machine Learning **Subject Code:** MTCO23101
Type of course: Professional Core
Prerequisite (if any): –

Rationale: Students in this course will gain a deep comprehension of a wide range of mathematics and theoretical topics related to machine learning, allowing them to connect with the field's cutting-edge research.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Content	Total Hrs
1	Probability Theory: Probability Concept, Random Experiment, Conditional Probability, Bayes Theorem. Random Variables: Probability Mass Function, District Distributed Function, Continuous Random Variable, Probability Density Function, Cumulative Distribution Function. Standard Distributions: Discrete Distributions – Bernoulli Trials and Bernoulli Distribution, Binomial Distribution, Poisson Distribution, Continuous Distribution – Uniform Distribution, Normal Distribution. Central Limit Theorem	10
2	Random samples, types of sampling, sampling distributions of estimators, Methods of Mor ents, and Maximum Likelihood estimation.	07
3	Solution of linear systems – systems of linear equations, matrices, solving systems of linear equations.	05

4	Vector spaces: linear independence, basis and rank, affine spaces, Norms, inner products, Lengths and distances, Angles and orthogonality, and Orthonormal basis.	08
5	Matrix Decomposition methods: Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky decomposition, Eigen-decomposition and diagonalization, singular value decomposition, and matrix approximation.	07
6	Vector Calculus - Differentiation of univariate functions, Partial differentiation, gradients, Gradients of vector-valued functions, Gradients of matrices, and some useful identities for computing gradients.	08

Reference Books:

Sr No	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Mathematics for Machine Learning,	M.P. Diesenroth, A. Aldo Faisal, Cheng Soon Ong,	Cambridge University Press	2020	-
2	Linear Algebra and Optimization,	Charu C. Aggarwal	Springer Nature Switzerland AG,	2020	
3	Probability and Random Processes	S. Palaniammal	PHI Learning Pvt. Limited, ISBN: 978-81-203-4245-3	2012	1
4	Statistical Inference	George Casella, Roger Berger	Duxbury / Cengage India Private Limited	2007	2

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To understand the basic notions of discrete/continuous probability and distributions	20

CO-2	To understand the methods of statistical inference and the role that classification/regression and sampling distributions play in those methods.	15
CO-3	To apply concepts in linear algebra and to use it as a platform for machine learning.	15
CO-4	To integrate techniques for analytical and numerical solutions of linear equations.	20
CO-5	To solve problems of multivariate calculus and vector calculus.	20

List of Open learning websites:

List of Open Source Software:

FOR LAB SESSIONS:

List of Experiments:

Sr. No.	Practical
1	Implement a program to find the Probability of getting each number when rolling a dice.
2	Write a program of getting the same number when rolling 2 dice.
3	Implement the Probability Mass Function of getting multiples of 3 and 5 on 2 dices
4	Visualize the data using probability density function of a random sample
5	Implement a program to find Mean, Standard Deviation and Variance i) for any given data ii) for Discrete Random Variables
6	Study of various python libraries: • Numpy • Matplotlib • Pandas • Scikit-learn • TensorFlow

Major Equipment Needed: NA