24IT501- MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:		**Continuous Evaluation:**	40
		Semester end Evaluation:	60
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Apply the basic concepts of linear algebra to singular value decomposition
	CO2	Calculate probabilities for continuous probability distributions
	CO3	Predict the joint probabilities for two random variables
	CO4	Explain the methods of point estimation of parameters and test the significance of regression analysis
	CO5	Analyze residuals to determine whether the regression model is an adequate fit to the data

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3- High)		PO1	PO2	PO3	PO 4	PO 5
	CO1	2			2	1
	CO2	2			2	1
	CO3	2			2	1
	CO4	2			2	1
	CO5	2			2	1

Course Content	**UNIT-I: Linear Algebra** Solving linear equations: Vectors and linear equations, Elimination Using Matrices, Rules of Matrix operations, Inverse Matrices, Elimination=Factorization: A=LU, Vector Spaces and Subspaces: Spaces of Vectors, The Null space of A: Solving Ax=0 and Rx=0, The complete solution to Ax=b, Independence, Basis and Dimensions, Eigenvalues and Eigenvectors, the Singular value Decomposition (2 by 2 matrices only)
	UNIT II: Continuous Random variable and Probability Distributions Probability Distributions and Probability Density Functions, Cumulative Distribution Functions, Mean and Variance of a Continuous Random Variable, Continuous Uniform Distribution, Normal Distribution, Normal Approximation to the Binomial and Poisson Distributions

	UNIT III: Joint Probability Distributions Joint Probability Distributions for Two Random Variables, Conditional Probability Distributions and Independence, Covariance and Correlation, Common Joint Distributions: Multinomial Probability Distribution, Bivariate Normal Distribution, Linear Functions of Random Variables, Moment-Generating Functions
	UNIT IV **Statistical Inferences and Regression Analysis** Point Estimation, Point estimation of Parameters: Method of Moments-Method of Maximum Likelihood, Hypothesis Testing, Empirical Models, Simple Linear Regression, Properties of the Least Squares Estimators, Hypothesis Tests in Simple Linear Regression: Use of t-Tests, Analysis of Variance Approach to Test Significance of Regression
	UNIT V: Confidence Intervals: Confidence Intervals on the Slope and Intercept, Confidence Interval on the Mean Response, Prediction of New Observations, Adequacy of the Regression Model: Residual Analysis, Coefficient of Determination(R^2), Correlation, Regression on Transformed Variables, Logistic Regression
Text books and Reference books	**Text Book(s):** [1]. Gilbert Strang, Introduction to Linear Algebra (5^{th} Edition),2016, Wellesley-Cambridge Press [2]. Douglus C. Montgometry, George C. Runger, Applied Statistics and Probability for Engineers (Seventh Edition) ,2018, John Wiley & Sons, Inc **Reference Book(s):** [1]. Kishor S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, John Wiley &Sons, 2016 [2]. M. Mitzenmacher and E. Upfal, Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge, 2005
E-resources and other digital material	Maggie Myers, Robert van de Geijn, (24.06.2019).Linear Algebra - Foundations to Frontiers, UTAustinX, https://www.edx.org/course/linear-algebra-foundations-to-frontiers-0 Prof. Philippe Rigollet(2016), Statistics For Applications https://ocw.mit.edu/courses/18-650-statistics-for-applications-fall-2016/pages/syllabus/