LOK JAGRUTI UNIVERSITY (LJU)

L J INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Computer Engineering

Master of Engineering (M. E)

Semester: I

Branch: Computer Engineering (Software Engineering)

Course Code:	**20-CE-PG-049010101**
Course Name:	**Applied Mathematics**
Category of Course:	**Core**
Prerequisite Course:	**Basics of Linear Algebra Elementary Single Variable Calculus Fundamentals of Probability & Statistics**

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
3	**1**	**0**	**4**	**40**

Course Objectives	
1	To able to understand the fundamental concepts and methods of Mathematics applied in Computer engineering.
2	By the concepts and methods of linear algebra, Students are able to use them to think about problems arising in Computer engineering.
3	To Understand how to apply concept of linear algebra, Probability, Graph theory and statistics in computer programming languages.
4	To able to write small programs in the programming language Python to implement basic matrix and vector functionality and algorithms.
5	To able to understand Concept of Applied Mathematics connected with the other subjects of Computer engineering.
6	To able to think about How to apply the fundamental concepts and methods of Applied Mathematics in other branches of Computer engineering.

Syllabus

Unit No.	Topic	Prerequisite Topic	Teaching Hours
01	**Linear Algebra I**		**5 (11.5%)**
	1.1 Row reduction and echelon forms- uniqueness of echelon forms -Matrix operations including inverses	**---**	
	1.2 Systems of linear equations		
	1.3 linear transformations and its algebra and representation by matrices		
02	**Linear Algebra II**		**4 (10%)**
	2.1 Eigen values and Eigen vectors - Cayley Hamilton's theorem	**---**	
	2.2 Diagonalization		
	2.3 Principal Component Analysis - PCA		
03	**Multivariate Calculus I**		**5 (11.5%)**
	3.1 Functions of Two or More Variables - Limits and Continuity in Several Variables	**---**	
	3.2 Partial Derivatives – Total Derivative -The Chain Rule		
	3.3 Tangent Planes - Gradient and Directional Derivatives		
04	**Multivariate Calculus II**		**4 (10%)**
	4.1 Tangent Plane and Normal Lines for Function of Several Variables	**---**	
	4.2 Optimization in Several Variables		
	4.3 Lagrange Multipliers-Optimizing with a Constraint		
05	**Graph Theory**		**3 (8.5%)**
	5.1 Isomorphism-Planar graphs	**---**	
	5.2 Graph Coloring-Hamilton circuits - Euler cycles		
	5.3 Permutations and Combinations with and without repetition		
06	**Probability Theory I**		**4 (10%)**
	6.1 Random variable and sample space - notion of probability	**---**	
	6.2 Axioms of probability - Empirical approach to probability-Joint Probability		
	6.3 Conditional probability - Independent events - Bayes' Theorem with Contingency table and exercise.		
07	**Probability Theory II**		**4 (10%)**
	7.1 Mathematical Expectation-Moment Generation Function	**---**	
	7.2 Bernoulli Distribution - Binomial Distribution-Poisson Distribution		
	7.3 Normal Distribution – Student's T Distribution-Chi Squared Distribution-Exponential Distribution- Gaussian Distribution – Beta Distribution-Gamma Distribution		
08	**Statistics I**		**4 (10%)**
	8.1 Mean - Median – Mode - Skewness - Variance - Standard Deviation - Coefficient of Variation – Correlation - Coefficient of Correlation	**---**	
	8.2 Conditional probability - Central limit theorem		
	8.3 Hypothesis Testing – Null and Alternative -Rejection Region and Significance Level- Type I & II Errors		
09	**Statistics II**		**4 (10%)**
	9.1 Bayesian hypothesis testing - Loss function - Confidence interval	**---**	

	9.2 Naive Bayes - Tree Augmented Naive Bayes - Gaussian mixture models		
10	**Time Series Forecasting**		**3 (8.5%)**
	10.1 Moving Averages - Exponential Smoothing	**---**	
	10 .2 ARIMA Models in Time Series Analysis		
	10.3 Multivariate Time Series		

Course Outcome	
1	Fluency with matrix algebra, including the ability to put systems of linear equation in matrix format and solve them using matrix multiplication and the matrix inverse.
2	A comprehensive understanding of the gradient, including its relationship to level curves (or surfaces), directional derivatives, and linear approximation.
3	The ability to set up and solve optimization problems involving several variables, with or without constraints
4	Compute conditional probabilities directly and using Bayes' theorem, and check for independence of events.
Suggested Reference Books	
1	Introduction to Linear Algebra , Strang Gilbert 5th ed. Wellesley, MA: Wellesley-Cambridge Press
2	Thomas Calculus Early Transcendentals ,Thomas 14th ed. Pearson
3	Probability and Statistics with Reliability, Queuing, and Computer Science Applications, K. Trivedi, Wiley.
4	Introduction to Linear Regression Analysis by Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining (Wiley)
5	An Introduction to Probability theory and Mathematical Sciences, V.K.Rohatgi and A.K.Md.Ehsanes Saleh Wiley, 2001
6	Graph Theory with Applications in Engineering and Computer Science, Narshing Deo,Prentce Hall,Inc
7	Introduction to Time Series Analysis and Forecasting, Douglas C. Montgomery. Cheryl L. Jennings. Murat Kulahci. (Wiley)

Proposed Evaluation Scheme by Academicians (Percentage of Weightage out of 100%)					
Theory Descriptive Test		**MCQ Test**		**Hands on Project**	
Formulas and Derivation Test		**Numerical Test**		**Seminar**	

List of Recommended MOOC Courses:

1) https://www.coursera.org/learn/linear-algebra-machine-learning
2) https://www.coursera.org/learn/graphs?specialization=discrete-mathematics
3) https://www.coursera.org/learn/probability-theory-statistics
4) https://www.udemy.com/course/master-linear-algebra-and-probability-2-in-1-bundle/?utm_source=adwords&utm_medium=udemyads&utm_campaign=DSA_Catchall_la.EN_cc.INDIA&utm_content=deal4584&utm_term=_._ag_82569850245_._ad_437477497173_._kw__._de_c_._dm__._pl__._ti_dsa-392284169515_._li_9061769_._pd__._&matchtype=b&gclid=Cj0KCQiAwf39BRCCARIsALXWETyKtq6Fme7FMfqN0BPRBWeHmlpbxzKx2dzSX3gv_SIeXFKBmYy1DZIaAsrNEALw_wcB