GUJARAT TECHNOLOGICAL UNIVERSITY

Mathematical Foundation of Computer Science
SUBJECT CODE: 3710214

Type of course: Core

Prerequisite: Discrete Mathematics

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No	**Content**	**Total Hrs**	**% Weightage**
1	Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains	**7**	**15**
2	Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood	**7**	**15**
3	Statistical inference**,** Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** The problem of overfitting model assessment	**8**	**16**
4	Graph Theory: Isomorphism, Planar graphs, graph colouring, hamilton circuits and euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems	**11**	**23**
5	**Computer science and engineering applications:** Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning	**10**	**21**
6	Recent Trands in various distribution functions in mathmatical field of computer science for varying fields like bioinformatic, soft computing, and computer vision	**5**	**10**

Reference Books:

1. John Vince, Foundation Mathematics for Computer Science, Springer
2. K. Trivedi.Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis

4. Alan Tucker, Applied Combinatorics, Wiley

Course Outcome:

After learning the course the students should be able to:

- To understand the mathematical fundamentals that is prerequisites for avariety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning
- To developthe understanding ofthe mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency
- To study various sampling and classification problems.

List of Experiments:

1. Analyze the concpt of randomization. Implement a program in a language that supports graphics to Push the balls from left and right allowing random movement and then let them fall in rectangle bins.Show graphically how they form curve
2. Consider that there are two parties party1 and party2 contesting for elections. Consider candidate from either party1 or party2. Consider voting population and ask them about their likelihood to vote for the candidate from party1. Now Ask the population again to show their likelihood for candidate after candidate gives speech. Now again rate the candidate through voting population. Implement a program to do this. Use WEKA tool to simulate this.
3. Write a program that takes two inputs- size of the house(no of rooms) and location of the house and accordingly give price of the house. Classify the house as very costly,costly,affordable,cheap.
4. Consider website of your institute. Represent the link structure by directed graph. Apply and implement algorithm to traverse the graph and to reach a faculty's web page in your department
5. Graph theory problem – there are k aircrafts and have to be assigned n flights. The time interval of ith flight is (ti1,ti2). If the time interval overlaps for the flights the same aircraft cannot be assigned to both the flights.Vertices of the graph are flights.Two vertices are connected if the corresponding time intervals overlap. Simulate the problem by applying graph theory. Use simulation tool to simpulate or programming language to implement graph