MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

I Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB01	Core	3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OBJECTIVES:

The course should enable the students to:

I. Understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
II. Understand and apply the mathematical logics to many modern techniques in information technology like machine learning, programming language design, and concurrency.
III. Studying of various sampling and classification problems.

COURSE OUTCOMES (COs):

CO 1: Describe various concepts of probability theory and Distributions.
CO 2: Demonstrate sampling distributions of estimators and methods of moments.
CO 3: Explore statistical inference techniques and apply regression, PCA etc. for classification problems.
CO 4: Enrich the knowledge on applications of graph theory and combinatorial problem
CO 5: Identify the applications of mathematical and statistical techniques to emerging areas of Information Technology.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand basic concepts probability theory, mass, density etc.
2. Analyze various Distribution Functions and apply to real world problems.
3. Identify importance of the Central Limit Theorem, Markov chains
4. Apply random sampling theory and distribution of estimators to various computer science applications
5. Describe Methods of Moments and Maximum Likelihood to solve problems
6. Construct and evaluate Regression models for classification problems
7. Analyze importance of Principal component analysis in developing predictive models and exploratory data analysis.
8. Understand problem of over fitting model and choose correct model.
9. Analyze Euler's and Hamilton rule for a simple connected graph in NP-complete problems
10. Solve discrete probability and set problems using permutations and combination
11. Identify the solution for various combinatorial enumeration problems
12. Apply various graph theory concepts in Network protocol design, web traffic analysis and distributed systems
13. Understand the basic concepts of Software Engineering, Computer Architecture
14. Analyze applications of Statistics in Data mining , machine learning and Bioinformatics
15. Understand operating system and distributed system concepts principles

UNIT- I	INTRODUCTION	Classes: 08

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

UNIT - II	**RANDOM SAMPLES**	**Classes: 09**
Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood		
UNIT - III	**STATISTICAL INTERFACE**	**Classes: 09**
Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of over fitting model assessment.		
UNIT - IV	**GRAPH THEORY**	**Classes: 10**
Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.		
UNIT - V	**COMPUTER SCIENCE AND ENGINEERING APPLICATIONS**	**Classes: 09**
Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.		

Text 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". Wiley
4. Alan Tucker, "Applied Combinatorics", Wiley Publications.

Web References:

1. http://www.tutorialspoint.com/r/
2. https://en.wikipedia.org/wiki/R_programming_language.
3. http://www.r-bloggers.com/how-to-learn-r-2/#h.obx6jyuc9j7t.

E-Text Books:

1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2. https://www.cs.bris.ac.uk/~flach/mlbook/.
3. http://mylovelibrabry.com/emylibraryus/free.php?asin=1466583282.