MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

I Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC01	Core	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course will discuss fundamental concepts in mathematics with emphasis on their applications to computer science. Topics include probability, distribution, multivariant statistical models, computer applications, trees and graphs. This course is appropriate for communications and networking, storage and retrieval of information.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The mathematical fundamentals that are 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. The mathematical and logical basis to many modern techniques in information technology.
III. Gain knowledge about various sampling and classification problems.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1	**Make use of** probability theory and distributions for depicting the expected outcome of possible values in the data generating process/experiment.	Understand
CO2	**Build** statistical models based on random sampling data for getting unbiased estimates in performing data analysis.	Understand
CO3	**Examine** regression and multivariate statistical models for solving classification and curve fitting problems in data analysis.	Apply
CO4	**Identify** appropriate techniques of graphs and combinatorial theory for finding solutions to shortest path and enumeration problems.	Apply
CO5	**Choose** appropriate mathematical and statistical techniques for solving applications in emerging areas of Information Technology.	Apply

IV. SYLLABUS

MODULE-I: INTRODUCTION (10)

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.

MODULE-II: RANDOM SAMPLES (10)

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.

MODULE-III: STATISTICAL INTERFACE (8)

Statistical inference, Introduction to multivariate statistical models: regression and classification problems,
principal components analysis, The problem of over fitting model assessment.

MODULE-IV: GRAPH THEORY (09)

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.

MODULE-V: COMPUTER SCIENCE AND ENGINEERING APPLICATIONS (08)

Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

V. TEXT BOOKS:

1. John Vince, "Foundation Mathematics for Computer Science", Springer 2015.
2. K. Trivedi. "Probability and Statistics with Reliability, Queuing, and Computer Science Applications". Wiley, 2016.
3. M. Mitzenmacher and E. Upfal." Probability and Computing: Randomized Algorithms and Probabilistic Analysis". Wiley, 2005.

VI. Reference Books:

1. Alan Tucker, "Applied Combinatorics", Wiley, 2012.

VII. 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.

VIII. 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.