

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

I Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCSB01	Core	L	T	P	C	CIA	SEE	Total
		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 covers the concepts of Probability theory, Sampling Techniques, Statistical Inference, Graph Theory and various applications of Mathematical and statistical concepts in different branches of Computer Science. This course helps the students in gaining the knowledge and apply the mathematical logics to many modern techniques of information technology like machine learning, programming language design etc.

II. COURSE OBJECTIVES:

The students will try to learn:

- I. 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. The mathematical logics to many modern techniques in information technology like machine learning, programming language design, and concurrency.
- III. The various sampling and classification problems.

III. COURSE OUTCOMES:

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

CO 1	Make use of probability theory and distributions for depicting the expected outcome of possible values in the data generating process/experiment	Apply
CO 2	Build statistical models based on random sampling data for getting unbiased estimates in performing data analysis.	Understand
CO 3	Examine regression and multivariate statistical models for solving classification and curve fitting problems in data analysis.	Analyze
CO 4	Identify appropriate techniques of graphs and combinatorial theory for finding solutions to shortest path and enumeration problems.	Remember
CO 5	Choose appropriate mathematical and statistical techniques for solving applications in emerging areas of Information Technology	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 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		
UNIT-II	RANDOM SAMPLES	Classes: 10
Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood		
UNIT-III	STATISTICAL INTERFACE	Classes: 08
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: 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.		
UNIT-V	COMPUTER SCIENCE AND ENGINEERING APPLICATIONS	Classes: 08
Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.		
Text Books:		
<ol style="list-style-type: none"> 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 		
Web References:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf 2. https://www.cs.bris.ac.uk/~flach/mlbook/. 3. http://mylovelibrary.com/emylibraryus/free.php?asin=1466583282. 		