INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE								
I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSE01	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 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 distribution theory for depicting the expected outcome of products based on data related to supply and demand.
CO2 Apply Central Limit Theorem and Probability inequalities for estimating population parameters in the data generating process/experiment.
CO3 Build statistical models based on random sampling data for getting unbiased estimates in performing data analysis.
CO4 Examine regression and multivariate statistical models for solving classification and curve fitting problems in data analysis.
CO5 Identify appropriate techniques of graphs and combinatorial theory for finding solutions to shortest path and enumeration problems.
CO6 Choose appropriate mathematical and statistical techniques for solving applications in emerging areas of Information Technology.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate andmultivariate 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 evaluation and validation.

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 and counting problems. Graph representation for social networks, PageRank model, adjacency matrices, bipartite and weighted graphs, algorithmic complexity in graphs.

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 and ts aplications, Quantum computing fundamentals: qubits, superposition, and probabilistic computation.

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-TEXTBOOKS:

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.

IX. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open,Ended experiments

5. Definitions and terminology
6. Assignments
7. Model question paper, I
8. Model question paper, II
9. Lecture notes
10. Power Point presentation
11. E-Learning Readiness Videos (ELRV)