

**Year: M. Tech. I (Semester – I)**

**Subject Name:** Mathematical Foundation in Computer Science      **Subject Code:** MTCO13102  
**Type of course:** Professional Core Course  
**Prerequisite (if any):** Discrete Mathematics

**List of Courses where this course will be prerequisite: --**

**Rationale:** Students in this course will gain a deep comprehension of a wide range of topics in mathematics and theoretical computer science, putting them in touch with the field's cutting-edge research.

**Teaching and Examination Scheme:**

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

**Content:**

Sr.No.	Content	Total Hrs
1	Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Central Limit Theorem, Probabilistic inequalities, Markov chains	10
2	Random samples, types of sampling, sampling distributions of estimators, Methods of Moments and Maximum Likelihood estimation	8
3	Statistical inference, Introduction to multivariate statistical models: regression and classification problems, problem of over fitting/under fitting model assessment	9



4	Graph Theory: Isomorphism, Planar graphs, graph colorings, Hamilton circuits and euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems	12
5	Application of Mathematics in various fields of computer science : Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning, Soft computing, Computer Vision.	6

**Reference Books:**

Sr.No	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Foundation Mathematics for Computer Science, Springer	John Vince	Springer Publication, ISBN 978-3-319-21436-8	2015	1
2.	Probability and Statistics with Reliability, Queuing, and Computer Science Applications.	K. Trivedi.	John Wiley & Sons, Inc, Print ISBN:9780471333418  Online ISBN:9781119285441	2016	1
3.	Probability and Random Processes	S. Palaniam mal	PHI Learning Pvt. Limited, ISBN: 978-81-203-4245-3	2012	1
4.	Probability and Computing: Randomized Algorithms and Probabilistic Analysis	M. Mitzenmacher and E. Upfal	Cambridge University Press, ISBN 978-3-319-21436-8	2005	1
5.	Applied Combinatorics	Alan Tucker	John Wiley & Sons, Inc., ISBN: 978-0-470-45838-9	2012	6



6.	Graph Theory with Applications to Engineering and Computer Science	Deo, Narsingh	Prentice Hall India Learning Private Limited ISBN-13 : 978-8120301450	1979	1
7.	Introduction to Graph Theory (Featured Titles for Graph Theory)	Douglas B. West	Pearson; ISBN-13 : 978-0130144003	2000	2

**Course Outcomes:**

Sr.No	CO statement	Marks % weightage
CO-1	To understand the basic notions of discrete/continuous probability and distributions	20%
CO-2	To understand the methods of statistical inference, and the role that classification/regression and sampling distributions play in those methods.	24%
CO-3	Integrate core theoretical knowledge of graph theory to test and validate intuition and independent mathematical thinking in problem solving.	28%
CO-4	To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.	28%

**List of Open learning website:**

**List of Open Source Software:** Open CV - Python

**FOR LAB SESSIONS:**

**List of Experiments:**

Sr. No	Practical
1	Implement a program to find Probability of getting each number when rolling a dice.
2	Write a program of getting the same number when rolling 2 dice.
3	Implement the Probability Mass Function of getting multiples of 3 and 5 on 2 dices





4	Implement a program to find Mean, Standard Deviation and Variance i) for any given data ii) for Discrete Random Variables
5	Write a program to solve the Crime Problem using graph theory.
6	WAP to Implement Linear Regression for given data.
7	Implement a program to perform KNN Classification.
8	Consider the website of your institute. Represent the link structure by directed graph. Apply and implement algorithms to traverse the graph and to reach a faculty's web page in your department.
9	Write a program that takes two inputs- size of the house (no of rooms) and location of the house and accordingly gives the price of the house. Classify the house as very costly, costly, affordable, and cheap.
10	Consider imbalanced classification data-set with given Confusion Matrix and calculate 1) Classification accuracy for skewed class distributions 2) precision-recall 3) F1 measure

