

23MA101	MATHEMATICS I	3/1/0
Nature of the Course: Theory (N/A)		
Pre-requisite(s):		
Course Objectives:		
1	To use logical notation to define the fundamental data types and structures used in computer algorithms and systems.	
2	To use the concepts of graph theory in practical situations.	
3	To acquire thorough knowledge of fundamental notions of proof's and its application in Cryptography.	
4	To analyse data pertaining to discrete and continuous random variables to interpret the results.	
5	To impart the knowledge of counting principles, to think critically and apply it in real world problems.	
Course Outcomes:		
CO1	Explain the basic concepts of logical laws and probability	U
CO2	Understand the concepts of proof techniques, structures and random variables.	U
CO3	Apply the logical and foundational structures of mathematics with an emphasis on writing proofs.	AP
CO4	Apply the concepts of graph and number theory in cryptography.	AP
CO5	Apply the probability concepts in transition from real problem to a probabilistic model.	AP

Course Content:		
Module 1: LOGICAL PROOF'S & FUNCTIONS		15 Hrs
Proofs: Definitions - Proof by cases - Proof by contradiction - Logical formulas - Propositions - Truth table - Logical operators - Tautologies and Contradictions – Contrapositive - Equivalences and implications - Predicates - Free and bound variables – Quantifiers - Universe of discourse - Sets: Basic sets - Operations on Sets – Law on Sets(without proof) - Cartesian product of sets. Relations: Binary relation-Types of relations and their properties - Relational matrix and graph of a relation - Equivalence relations - Partial ordering relation. Functions: Classifications of functions - Induction - Ordinary induction and Strong induction - Recursive data types - Definition of recursive and structural induction.		
Module 2: NUMBER THEORY & GRAPH THEORY		15 Hrs
Number Theory: Divisibility - Greatest common divisor - Euclid's algorithm - Prime numbers- Fundamental theorem of arithmetic - Modular arithmetic - Remainder arithmetic - Multiplicative inverses and cancelling - Relatively prime - Euler's theorem.- Chinese Remainder Theorem. Graph Theory: Vertices and Degrees - Types of graphs - Handshaking theorem - Adjacency matrices - Walks and paths -Connectivity -Isomorphism - Directed acyclic graphs and scheduling –Matchings - The Stable marriage problem –Forests and trees - Spanning trees - Minimum weight spanning trees –Prim's algorithm - Kruskal's algorithm.		
Module 3: COUNTING &PROBABILITY		15 Hrs
Sums and Asymptotics-Sums of Powers-Harmonic Numbers-Asymptotic Notation-The Division Rule-Counting Subsets-Sequences with Repetitions-The Pigeonhole Principle-Events and Probability Spaces-The Four Step Method-Conditional Probability-The Four-Step Method for Conditional Probability-The Law of Total Probability-Bayes's theorem-Random Variables–Discrete and continuous random variables - Distribution Functions-Bernoulli Distribution-Uniform Distribution-Binomial Distribution-Great Expectations-Conditional Expectation-Linearity of Expectation-Infinite Sums-Expectations of Products		
Total Hours(L):		45
Total Hours(T):		15
Total Hours(LT):		60
Text Book:		
1	Tremblay J.P and Manohar R, "Discrete Mathematical Structures with applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.	
2	Koshy. T, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, Second Edition, 2007.	
3	Eric Lehman, F.Thomson Leightonand Albert R.Meyer, "Mathematics for Computer Science", 14thEdition, MIT Open courseware, 2018.	
Reference Book:		

1	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", sixth edition, Pearson Education Pvt Ltd., New Delhi, 2017
2	Kenneth H. Rosen, "Discrete Mathematics and its Applications", Eighth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Eighth Edition, 2021.
3	Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2004.
Web Reference:	
1	https://onlinecourses.nptel.ac.in/noc23_cs109/preview
2	https://onlinecourses.nptel.ac.in/noc23_cs120/preview
Online Reference:	
1	https://www.coursera.org/specializations/discrete-mathematics
2	https://mathworld.wolfram.com/topics/DiscreteMathematics.html

COMPUTER SCIENCE AND ENGINEERING															
Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CO2	2	2	0	0	0	0	0	0	0	0	0	0	1	0	0
CO3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
CO4	3	3	0	0	0	0	0	0	0	0	0	0	1	0	0
CO5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0

CIVIL ENGINEERING														
Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	0	0	0	0	0	0	0	0	0	0	1	0
CO2	2	2	0	0	0	0	0	0	0	0	0	0	1	0
CO3	3	3	0	0	0	0	0	0	0	0	0	0	0	0
CO4	3	3	0	0	0	0	0	0	0	0	0	0	1	0
CO5	3	3	0	0	0	0	0	0	0	0	0	0	0	0

MECHANICAL ENGINEERING														
Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
CO2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
CO3	3	3	0	0	0	0	0	0	0	0	0	0	0	0
CO4	3	3	0	0	0	0	0	0	0	0	0	0	0	0
CO5	3	3	0	0	0	0	0	0	0	0	0	0	0	0

ELECTRONICS AND COMMUNICATION ENGINEERING														
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