LNMIIT, Jaipur Department of Computer Science & Engineering	LNMIIT The LNM Institute of Information Technology

Programme: B. Tech. (CSE)	Course Title: Discrete Mathematical Structures (DMS)			Course Code: CSE 219
Type of Course: Institute Core	Prerequisites: Mathematics of Higher Secondary level			Total Contact Hours: 40
Year/Semester: 1/Even	Lecture Hrs/Week: 3	Tutorial Hrs/Week: 0	Practical Hrs/Week: 0	Credits: 4

Learning Objective:

Discrete mathematics is the study of mathematical structures that are fundamentally discrete rather than continuous. In contrary to real numbers that have the property of varying smoothly, the objects studied in discrete mathematics (such as integers, graphs, and statements in logic) do not vary smoothly, but have distinct, separated values. Research in discrete mathematics substantially increased in the late twentieth century partly due to the development of digital computers, which operate in discrete steps and store data in discrete bits. The objective of this course is to introduce the students to the fundamentals of discrete mathematics as used in the field of computer science. It will be attempted to teach the subject in such a way that is interesting and fruitful for both the students having a natural affinity for the beauty of abstract reasoning as well as for the students who are primarily interested in its practical applications.

Course outcomes (COs):

On completion of this course, the students will have the ability to:		Bloom's Level
CO-1	Understand and apply problem solving techniques.	**1, 2, 3**
CO-2	Design and apply mathematical ideas in both written and oral form for a variety of audiences	**4**
CO-3	Understand and apply the mathematical induction principle and will be able to apply this approach to prove mathematical statements.	**3, 4**
CO-4	Apply fundamental counting algorithms to solve applied problems, particularly those found in the area of computer science.	**2**
CO-5	Identify the basic properties of graphs and trees and use these concepts to model simple applications.	**1, 4**

Course Topics	Lecture Hours	
UNIT – I (SET THEORY, FUNCTIONS AND RELATIONS)		
Set Theory: Definition of Sets, Venn Diagrams, Cartesian products, Power sets, Cardinality and Count ability (Countable and Uncountable sets) **Function:** Domain, Range, One-to-One, Onto Inverses and Composition One-to-One Correspondence **Relation:** Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation. **Matrix Algebra:** Introduction to Matrix, Inverse, Adjoint, Rank, Linear Equation		**8**
UNIT – II (COMBINATORICS-I)		
Foundations of Counting: Basic rules of Counting, Pigeon hall principle, Permutations, Derangements, Combinations, Permutations and combinations with repetitions, The Binomial Theorem, The generating Inclusion Exclusion Principle, Binomial coefficients and Pascal triangle.	4	**4**
UNIT – III COMBINATORICS-II (Advanced Counting)		
Inductions & Algorithms: The division algorithm, Divisibility Properties, Mathematical Inductions (Weak & Strong), Algorithms Correctness, The growth of functions, Modular Arithmetic **Recursion:** Recursively defined functions, solving recursive relations, solving recursive relations revisited, **Generating Functions** **Correctness of recursive algorithms**		**8**
UNIT-IV (MATHEMATICAL LOGIC AND DESCRETE STRUCTURES)	**6**	
Propositional logic: Proposition logic, logical connectives, truth tables,	**3**	
tautologies, contradiction, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity **Predicate logic:** Universal and existential quantification.	**3**	**6**

Notion of proof: Proof by implication, converse, inverse, contrapositive, negation and contradiction, direct proof, proof by using truth table, proof by counter example. Induction over natural numbers **Discrete Structures:** Partially ordered sets, lattices, finite Boolean, algebras, circuit design.		
UNIT-V (GRAPHS AND TREES)		**7**
Graph Theory: Graph and subgraphs, paths, cycles, Euler and Hamiltonian graphs, bipartite graphs, graph isomorphism, trees and its properties, planar graphs on graphs, undirected graph, directed graphs, spanning tree/forests, graph Isomorphism.		
UNIT-VI (DISCRETE PROBABILITY)		**4**
Finite probability space, events, Axiom of probability and probability measures, conditional probability, Bayes's Theorem, Independence, Integer random variables (Bernouilli, binomial),		

Textbook References:
Text Book:

Discrete mathematics and its applications , Kenneth H. Rosen. Tata McGraw Hill Education Private Limited, 2012, Seventh editions.
For Unit-V (Discrete Probability)- Fifth editions

Reference books:

- *Discrete Mathematics with Applications*, Thomas Koshy. Elsevier.
- *Discrete mathematical structures*.Bernard Kolman, Robert C. Busby, and Sharon Cutler Ross: Prentice Hall PTR, 2005.
- *Foundations of Discrete Mathematics* Joshi K. D.:. New Age International (P) limited.
- *Number Theory* David M. Burton:. 6th Edition, Tata McGraw Hill Education Private Limited, 2007.
- *An Introduction to the Theory of Numbers* G.H. Hardy, and Edward M. Wright:. Oxford University Press. ISBN: 9780198533108.
- *Graph Theory with Applications to Engineering and Computer Science* Deo Narsingh:. Prentice Hall of India Private Limited, 2001.

Additional Resources:

Follow NPTEL lecture series on Discrete Mathematics

Evaluation Method	
Item	**Weightage (%)**
Quiz-1	15
Quiz-2	15
Quiz-3	15
Midterm	25
Endterm	30

*Please note, as per the existing institute's attendance policy the student should have a minimum of 75% attendance. Students who fail to attend a minimum of 75% lectures will be debarred from the End Term/Final/Comprehensive examination.

CO and PO Correlation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1						2	1		3	3	1	
CO2	3	3	2		1				2	1		3	3	1	
CO3	3	3	1		1				2	1		3	3	1	
CO4	3	2	1						2	1		3	3	1	
CO5	3	3	1						2	1		3	3	1	

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Updated By:

Approved By: