Program	ADP Data Science	
Course Code	GE-167	
Course Title	Discrete Structures	
Credit Hours	**Theory**	**Lab**
	3	0
Lecture Duration	90 minutes (1.5 Hours), 2 lectures per week	
Semester	1	
Pre-requisites	**Courses**	**Knowledge**
	Nil	Python lab Setup
Follow Up Courses	Nil	

Course Learning Outcomes (CLOs)

CLO No	Course Learning Outcome	Bloom Taxonomy
CLO-1	Understand the key concepts of Discrete Structures such as Sets, Permutations, Relations, Graphs and Trees etc.	C2 (Understand)
CLO-2	Apply formal logic proofs and/or informal, but rigorous, logical reasoning to real problems, such as predicting the behavior of software or solving problems such as puzzles.	C3 (Apply)
CLO-3	Apply discrete structures into other computing problems such as formal specification, verification, databases, artificial intelligence, and cryptography.	C3 (Apply)
CLO-4	Differentiate various discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular	C4 (Differentiate)

Aims and Objectives	1. This course aims to equip the students with an understanding and appreciation of the discrete mathematical structures that

	appear in most computer science problems as well as in other related disciplines 2. In particular, this course seeks to develop critical thinking skills and the skills for comprehending mathematical arguments as well for writing rigorous proofs.
Learning Outcomes	• It seeks to polish basic problem solving skills through study of combinatorial problems, predicate calculus and logical reasoning, abstract algebra, and graph structures.
Syllabus	Logics and Proofs, Sets, Functions, Sequences, Algorithms, Recursion, Probability, Graphs and Trees
Contents	**Chapter 01: The Foundations: Logic and Proofs** 1.1 Introduction to Discrete Structures 1.2 Application of Propositional Logic 1.3 Propositional Equivalences 1.4 Predicates and Quantifiers 1.5 Nested Quantifiers 1.6 Rules of Inference **Chapter 02: Basic Structures: Sets, Functions, Sequences, Sums, and Matrices** 2.1 Sequences and Summations 2.2 Cardinality of Sets 2.3 Sets, Functions **Chapter 03: Algorithms** 3.1 Algorithms 3.2 The Growth of Functions 3.3 Complexity of Algorithms **Chapter 05: Induction and Recursion**

	5.1 Mathematical Induction 5.2 Recursive Algorithms **Chapter 06: Counting** 6.1 The Basic of Counting 6.2 The Pigeonhole Principle 6.3 Permutations and Combinations 6.4 Binomial Coefficients and Identities **Chapter 07: Discrete Probability** 7.1 An Introduction to Discrete Probability 7.2 Probability Theory **Chapter 09:** **Relations** 9.1 Relations and their properties 9.2 Closure of Relations 9.3 Equivalence Relation 9.4 Partial Ordering **Chapter 10:** **Graphs** 10.1 Graphs and Graph Models 10.2 Graph Isomorphism, Graph Connectivity 10.3 Eulerian, Hamiltonian paths and circuits 10.4 Shortest path problems (dijkstra algorithm) **Chapter 11: Trees** 11.1 Introduction to Trees, properties of trees 11.2 Applications of Trees 11.3 Tree Traversals
Assignments	• Late submissions will not be accepted. • Assignments should be turned in at the start of the class. • Zero credit for turning in questions other than the assigned questions.
Assessment and	Sr. # | Elements | Weightage | Details

Examinations	1	Quizzes + Assignment + Term Project	25%	There will be a graded quiz and assignments. The term project will be framed so as to test the concepts involved in the lectures.
	2	Midterm Assessment	35%	It takes place at the mid-point of the semester.
	3	Final Assessment	40%	It takes place at the end of the semester.
Textbooks	• Discrete Mathematics & its Applications with Combinatory and Graph Theory, 7th edition, Kenneth H. Rosen			
Reference Material/Suggested Readings	• N/A			

Detailed Lecture wise plan

Week	Lecture	Topic	SourceBook (Ch#)	Recommendation for Learning Activities
1	1	Introduction to discrete mathematics	Ch#(01)	
	2	Introduction to propositional logic	Ch#(01)	**Assign-1**
2	3	Application of propositional logic	Ch#(01)	**Quiz#1**
	4	Consistent System Specifications Propositional Equivalences	Ch#(01)	
3	5	Propositional Equivalences	Ch#(01)	**Quiz#2**
	6	Propositional Equivalences	Ch#(01)	

4	7	Predicates and Quantifiers	Ch#(01)	**Assign-2**
	8	Nested quantifiers Rules of inference	Ch#(01)	
5	9	Sets, Functions	Ch#(02)	**Quiz#3**
	10	Cardinality of Sets	Ch#(02)	
6	11	Sequences and Summations	Ch#(02)	
	12	Algorithms	Ch#(03)	

Week	**Lecture**	**Topic**	**SourceBook (Ch#)**	**Recommendation for Learning Activities**
7	13	The Growth of Functions	Ch#(03)	**Quiz#4**
	14	Complexity of Algorithms	Ch#(03)	
8	15	Mathematical induction	Ch#(05)	**Assign-3**
	16	Recursion and Recursive algorithms	Ch#(05)	
MID TERM				
9	17	The Basic of Counting	Ch#(06)	
	18	The Pigeonhole principle.	Ch#(06)	
10	19	Permutations and combinations	Ch#(06)	**Assign-4**

	20	Binomial coefficients and identities	Ch#(06)	
11	21	An Introduction to Discrete Probability	Ch#(07)	
	22	Probability Theory	Ch#(07)	**Quiz#5**
12	23	Relations, Closure of relations	Ch#(09)	**Assign-5**
	24	Equivalence Relation	Ch#(09)	
Week	**Lecture**	**Topic**	**SourceBook (Ch#)**	**Recommendation for Learning Activities**
13	25	Partial Ordering	Ch#(09)	
	26	Graphs and Graph representation	Ch#(10)	**Quiz#7**
14	27	Graph Isomorphism, Graph Connectivity	Ch#(10)	
	28	Eulerian, Hamiltonian paths and circuits	Ch#(10)	
15	29	Shortest path problems (dijkstra algorithm)	Ch#(10)	**Quiz#8**
	30	Shortest path problems (dijkstra algorithm)	Ch#(10)	
16	31	Introduction to trees, properties of trees	Ch#(11)	**Assign-6**
	32	Applications of Trees, Tree traversals	Ch#(11)	
FINAL TERM				