

COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS/SE/AI/CY)

A. Course Description

Course Code	CS1005
Course Title	Discrete Structures
Credit Hours	3+0
Prerequisites by Course(s) and Topics	None
Assessment Instruments with Weights (homework, quizzes, midterms, final, assignments etc.)	Midterm examination I: 15% Midterm examination II: 15% End-term examination: 50% Assignments (Home tasks / Class activities) and Quizzes: 20% Note: If a student misses a quiz , it will not be re-conducted. Marks will be deducted for assignments submitted after the due date. Additionally, if the course teacher has published the solution after the due date, then no marks will be awarded for that submission.
Course Coordinator	Dr. Muhammad Nouman Durrani
URL (if any)	Google Classroom – Link has been provided
Current Catalog Description	Logic, relations, functions, basic set theory, counting, proof techniques, mathematical induction, graph theory, recursion, recurrence relations, number theory, and sequence & series. All the topics will be taught in the perspective of their applications in computing.
Textbook	Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill, 8 th Edition, 2019.
Reference Material	Sussana S. Epp, Discrete Mathematics with Applications, Brooks Cole, Cengage Learning, 5th Edition, 2020.
Course Goals	A discrete mathematics course has more than one purpose. Students should learn a particular set of mathematical facts and how to apply them; more importantly, such a course should teach students how to think logically and mathematically. To achieve these goals, the focus of this course is on basic mathematical concepts in discrete mathematics and on applications of discrete mathematics in algorithms and data structures. The focus is also on teaching the problem-solving strategies, techniques, and tools and to show students how discrete mathematics can be used in modern computer science. In particular, this course is meant to introduce logic, proofs, sets, relations, functions, counting, and probability, with an emphasis on applications in Computer Science. Further, this course aims to develop understanding and appreciation of the finite nature inherent in most Computer Science problems and structures through study of combinatorial reasoning, abstract algebra, iterative procedures, predicate calculus, tree and graph structures.

A. Course Learning Outcomes (CLOs)						
CLO	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO	Tools	
01	Explain the key concepts of Discrete Structures such as Mathematical Logic, Sets, Permutations, Relations, Graphs and Trees etc.	Cognitive	C2 (Understanding)	1,6	A1, A2, A5, M1, F	
02	Construct 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.	Cognitive	C3 (Applying)	2,3,4,6	A6, M2, F	
03	Use discrete structures in solving other computing problems such as formal specification, verification, databases, artificial intelligence, and cryptography.	Cognitive	C3 (Applying)	1,2,3,4,5,6	A3, A4 M2, F	
04	Distinguish various discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular.	Cognitive	C4 (Analyzing)	1,2,3,4,5,6	A5, A6, F	
Tool: A = Assignment, M = Mid-term, F=Final (End-term)						
B. Program Learning Outcomes						
For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.						
1. Academic Education:	To prepare graduates as computing professionals					✓
2. Knowledge for Solving Computing Problems:	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.					✓

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		C. Relation between CLOs and PLOs (CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)									
		PLOs									
		1	2	3	4	5	6	7	8	9	10
CLOs	1	✓	✓				✓				
	2	✓	✓	✓	✓		✓				
	3	✓	✓	✓	✓	✓	✓				
	4	✓	✓	✓	✓	✓	✓				

1. Topics to be covered:			
List of Topics	No. of Weeks and Evaluations	Contact Hours	CLO
The Foundations: Logic and Proofs Introduction Propositional Logic, Applications of Propositional Logic Logical Equivalences Predicates and Quantifiers, Universal and Existential Quantifiers Negating Quantified Statements, Nested Quantifiers, Rules of Inference Sets, Functions, Sequences and Sums Sets: Set Operations, Characteristic Vectors: Sets as Bit-Vectors Multisets Functions: Ordered tuples and Cartesian Product, Function and Representations, Types of Functions, Composition and Inverse of Function, Numeric Functions Relations Relations and their Properties, Applications of Relations, Representing Relations, Combining Relations, Operations on Relations: Projection and Join Equivalence Relations, and Partial Orderings	5 (A1 = 3 w, Q1 = 3 w) = 6 w	15	1,3

Topics Covered in the Course, with Number of Lectures on Each Topic

(assume 15-week instruction and one-hour lectures)

===== MID 1 =====			
<p>Relations: Remaining topics of Relations before MID I will be covered in Week 7 (if any).</p> <p>Sequences and Sums Sequences and Series</p> <p>Graphs Graphs and Graph Models, Terminologies, Types of Graphs, Representing Graphs and Isomorphism, Connectivity, Euler and Hamiltonian Paths, Planar Graphs, and Graph Coloring</p> <p>Trees Introduction, Applications, Tree Traversal, Spanning Trees and Minimum Spanning Trees</p> <p>Introduction to Proofs and Proof Methods</p>	<p>5 (A2 = 3 w, Q2 = 3 w) = 6 w</p>	<p>15</p>	<p>1,2, 3, 4</p>
===== MID 2 =====			
<p>Remaining topics of Proofs and Proof Methods</p> <p>Number Theory and Cryptography Divisibility and Modular Arithmetic, Integer Representation, and Algorithms, Primes and Greatest Common Divisors, Congruences and Applications and Cryptography</p> <p>Induction and Recursion Mathematical Induction and Recursive Algorithms</p> <p>Counting & Counting Techniques Basics: Introduction and Applications The Sum Rule The Product Rule The Complement Rule</p>	<p>5 (A3 = 3 w, Q3 = 3 w, Grand Q= 2 w) = 8 w</p>	<p>15</p>	<p>2, 3, 4</p>

	Inclusion-Exclusion Principle Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients and Recurrence Relations							
	===== END-TERM (FINAL) EXAM =====							
	Review	0.5	1	1,2,3,4				
	Total	15	45					
Laboratory Projects/Experiments	No Labs and Projects in this course.							
Programming	None							
Class Time Spent on (in contact hours)	Theory	Problem Analysis	Solution Design	Social and Ethical Issues				
	10	15	20	03				
Oral and Written Communications	Students need to participate in class discussion and class assignments.							

Instructor Name Jamilusmani

Instructor Signature _____

Date: 15-08-2024