University of Asia Pacific (UAP)

Department of Computer Science and Engineering (CSE)

BSc in CSE Program

Course Outline – CSE 105 Discrete Mathematics

Part A – Introduction

1. **Course No. / Course Code:** CSE 105
2. **Course Title:** Discrete Mathematics
3. **Course Type:** Core
4. **Level/Term and Section:** 1st year 2nd semester
5. **Academic Session:** Spring 2025
6. **Course Instructor:** Prof. Dr. Bilkis Jamal Ferdosi
   Nuzhat Tabassum Progga
7. **Pre-requisite (If any):** Nil
8. **Credit Value:** 3
9. **Contact Hours:** 3
10. **Total Marks:** 100
11. **Course Objectives and Course Summary:**
12. **Course Learning Outcomes: at the end of the Course, the Student will be able to –**

CLO 1	**Recognize and manipulate** various types and properties of sets, relations, functions, graphs, and trees.
CLO 2	**Construct** mathematical reasoning using propositions, predicates, logical connectives, quantifiers, rules of inference, direct proof, proof by contradiction, proof by contraposition, and existence proof, among others.

CLO 3	**Utilize** counting principles, permutations, combinations, the pigeonhole theorem, and discrete probability to address related problems.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	**1**	1/Apply	Lecture, multimedia, Problem Solving,	Quiz, Written exam Assignment
CLO2	**1**	1/Apply	Lecture, Problem Solving, Group discussion	Quiz, Written exam, Assignment
CLO3	**1**	1/Apply	Lecture, Problem Solving,	Quiz, Written exam, Assignment

Part B – Content of the Course

14. Course Content:

Set Theory: Introduction to sets and set elements. Set operations, Algebra of sets. **Relations**: Product sets, relations, representing relations, n-ary relations, properties of relations, partial order and equivalence relations. **Functions**: Introduction to functions, Properties of functions, Inversion, composition, Recursive definition of a function, **Logic:** Proposition, logical

operators, logical equivalence, tautology, contradiction, Propositional Functions &

Predicates, Universal Quantification, Existential Quantification. Mathematical Reasoning: Valid arguments and Fallacies, Operational Method of Validation, Rules of Inference, Direct proof, proof by contradiction, proof by contraposition, proof by induction, etc. **Counting Principle**: Basic counting principle, permutations, combinations, the pigeonhole principle, the inclusion-exclusion principle, binomial coefficient, **Discrete Probability:** Basic definitions, Complementary Events, Conditional Probability, **Graph theory**: Graphs, types of graphs, different approaches, memory representation, application, **Trees**: Introduction, basic definitions, types of trees, application, etc.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Sets, relations, functions, graphs, and trees.	**CLO 1**

2	Propositions, predicates, logical connectives, quantifiers, rules of inference, proof,	**CLO2**
3	Counting principles, permutations, combinations, the pigeonhole theorem, and discrete probability	**CLO3**

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	**Specific Outcome(s)**	**Time Frame**	**Suggested Activities**	**Teaching Strategy(s)**	**Alignment with CLO**
Set Theory: Introduction to sets and set elements. Set operations, Algebra of sets.	Understanding Sets, Notation and Terminology, Set Cardinality, Set Operations, Venn Diagrams, Algebra of Sets, Applications	Week 1 & 2	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
Relations: Product sets, relations, representing relations, n-ary relations, properties of relations, partial order, and equivalence relations.	Understanding Product Definition and Representation of Relations Sets, Types of Relation, Identify Properties of Relations, Partial Order Relations, Equivalence Relations, Applications	Week 3	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1
Functions: Introduction to functions, Properties of functions, Inversion, composition, Recursive definition of a function	Understanding Functions, Properties of Functions: Mastery of properties such as injectivity, surjectivity, and bijectivity is crucial. Students should be able to identify whether a function exhibits these	Week 4 & 5	Quiz 1, problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1

	properties and understand their significance in terms of mapping elements between sets. Inversion of Functions, Composition of Function, Define functions recursively using base cases and recursive step.				
Logic: Proposition, logical operators, logical equivalence, tautology, contradiction, Propositional Functions & Predicates, Universal Quantification, Existential Quantification.	1. Understand the concept of a proposition 2. Recognize and apply logical operators to form compound propositions. 3. Identify when two propositions are logically equivalent. 4. Define a tautology and Contradiction. 5. Understand propositional functions and predicates. 6. Understand and apply quantification.	Week 6 & 7	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 2
MID-TERM EXAMINATION		Week 8			
Mathematical Reasoning	1. Apply deductive	Week 9 and 10	problem-solving, discussions,	lectures, Active Learning,	CLO 2

	reasoning to draw conclusions from given mathematical statements using logical rules and principles. 2. Determine the validity of mathematical arguments and proofs based on the rules of logic and mathematical reasoning. 3. Construct counterexamples to disprove incorrect mathematical conjectures or statements. 4. Develop critical thinking skills by evaluating the soundness and validity of mathematical arguments and proofs. 5. Understand and apply various proof techniques such as direct proofs, indirect proofs (proof by contradiction), mathematical induction, and		and group activities	Visualization, Concrete Examples, Peer Instruction	

	proof by contrapositive.				
Counting Principle: Basic counting principle, permutations, combinations, the pigeonhole principle, the inclusion-exclusion principle, binomial coefficient, **Discrete Probability:** Basic definitions, Complementary Events, Conditional Probability	1. Understanding the Fundamental Counting Principle 2. Understand permutations and Combinations 3. Apply the counting principle in probability problems involving the calculation of the total number of outcomes and the probability of specific events. 4. Apply the counting principle to solve various types of counting problems in real-world scenarios, such as permutations of letters in words, seating arrangements, and selecting items from a set.	Week 11 and 12	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 3
Graph theory Graphs, types of graphs, different approaches, memory representation, application	1. Understanding Graphs and types of graphs. 2. Understand various methods	Week 13	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples,	CLO 1

	for representing graphs. 3. Understand concepts of connectivity in graphs. 4. Understand algorithms for finding shortest paths in graphs, such as Dijkstra's algorithm. 5. Identify and analyze real-world applications of graph theory, such as in computer networks, social networks, transportation networks, circuit design, and recommendation systems.			Peer Instruction	
Trees: Introduction, basic definitions, types of trees, application, etc.	1. Define what a tree is and Understand and define key terms related to trees. 2. Understand and apply tree traversal algorithms. 3. Understand the properties and operations of different trees such as Binary Search trees	Week 14	problem-solving, discussions, and group activities	Lecture, Active Learning, Visualization, Concrete Examples, Peer Instruction	CLO 1

FINAL EXAMINATION		Week 15			

17. Teaching-Learning Strategies:

Active Learning: Encourage students to actively engage with the material through problem-solving, discussions, and group activities.

Visualization: Discrete mathematics often deals with abstract concepts that can be difficult to grasp. Utilize visual aids such as diagrams, graphs, and animations to illustrate key concepts like graph theory, combinatorics, and logic.

Concrete Examples: Relate abstract concepts to real-world applications whenever possible. Show how discrete mathematics is used in computer science.

Peer Instruction: Implement peer instruction techniques where students teach and learn from each other. Encourage peer tutoring, group study sessions, and peer evaluation of problem-solving approaches.

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. CT1, best of CT2 and CT3, best of CT4 and (Average marks on Assignment) will be considered. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment:

Problem-solving assignments (written) will be given throughout the semester. Average marks obtained in all given assignments will be considered as another CT. Late submission will result in a 50% deduction in the score.

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (30)**	**Assignments (10)**
Remember		
Understand		

Apply	**20**	**0**

Analyze	**10**	
Evaluate		
Create		

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Test**
Remember	
Understand	
Apply	**30**
Analyze	**30**
Evaluate	**10**
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75

50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25

40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book

1. Kenneth H. Rosen, Discrete Mathematics and its Application, 8th edition, 2021, McGraw-Hill.

Reference Books & Materials

2. Seymour Lipschutz, Discrete Mathematics, Last Edition, 2020, Schaum's outline Series.