Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc.(Computer Science). (Sem II)
Subject: Mathematics
Course: Discrete Mathematics **Course Code:** COS-161-MN(MT)
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Course Objective:

1. Understand the fundamentals of propositional logic and be able to apply propositional equivalence to simplify logical expression.
2. Develop critical thinking skills and the ability to build logical arguments effectively.
3. Grasp the concept of ordered pairs and understand how to calculate the Cartesian Product of sets.
4. Understand the concept of transitive closure and be able to apply Warshall's Algorithm to find it.
5. Be able to represent Boolean functions in various forms, such as minterms, maxterms, disjunctive normal form, and conjunctive normal form.
6. Understand the concept of recurrence relations and their importance in mathematics and computer science.
7. Develop the ability to find the total solution for recurrence relations using initial conditions.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Students will demonstrate a thorough understanding of propositional logic, including the ability to apply propositional equivalences to simplify logical expressions.

CO2: Student will be proficient in using predicates and quantifiers to formalize mathematical statements and apply them to various domains.

CO3: Student will classify and apply different types of relations, including equivalence relations and partial ordering relations.

CO4: Student will master the representation of relations using digraphs and matrices and understand the composition of relations.

CO5: Students will gain a solid understanding of lattices, including completed, bounded and distributive lattices.

CO6: Students will have the skills to form and solve linear recurrence relations with constant coefficients.

CO7: Students will be capable of finding homogeneous and particular solutions for recurrence relations.

	Programme Outcomes (POs)						
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	1			2		
CO 2	3	2					
CO 3	2	3					
CO 4	3	3					3
CO 5	2	3			1		3
CO 6	2	3			1		
CO 7	2	3				1	

Justification for the mapping

PO1: Computer Knowledge

CO1: Student will demonstrate a thorough understanding of propositional logic by effectively applying propositional equivalences to simplify logical expressions, showcasing their practical competence in computer knowledge.

CO2: Student will exhibit proficiency in using predicates and quantifiers to formalize mathematical statements, allowing them to apply these skills effectively across diverse domains in computer knowledge, demonstrating their versatile competence.

CO3: Student will adeptly classify and apply various types of relations, including equivalence and partial ordering relations, within the context of computer knowledge, showcasing their ability to recognize and utilize these essential concepts effectively.

CO4: Student will master relation representation through digraphs and matrices, along with a profound understanding of relation composition in computer knowledge, demonstrating their comprehensive grasp of these fundamental concepts.

CO5: Student will develop a solid understanding of lattices, encompassing completed, bounded, and distributive lattices, enabling them to effectively apply these concepts in computer knowledge and problem-solving scenarios.

CO6: Student will possess the skills to successfully formulate and solve linear recurrence relations with constant coefficients, empowering them to tackle algorithmic and computational challenges in computer knowledge effectively.

CO7: Student will be equipped with the capability to find both homogeneous and particular solutions for recurrence relations, thereby demonstrating their proficiency in addressing complex computational problems in computer knowledge.

PO2: Design / Development of solution

CO1: Student will demonstrate a thorough understanding of propositional logic, showcasing their ability to apply propositional equivalences to simplify logical expressions, a skill crucial for effective problem-solving in the design and development of solutions.

CO2: Student will exhibit proficiency in using predicates and quantifiers to formalize mathematical statements, enabling them to apply these skills effectively across diverse domains in the design and development of solutions, emphasizing their versatility in problem-solving.

CO3: Student will adeptly classify and apply various types of relations, including equivalence and partial ordering relations, in the design and development of solutions, demonstrating their ability to utilize these fundamental concepts for effective problem-solving and system design.
CO4: Student will master relation representation through digraphs and matrices and comprehend relation composition, equipping them with essential tools for designing and developing solutions effectively.
CO5: Student will gain a solid understanding of lattices, encompassing completed, bounded, and distributive lattices, enhancing their ability to design and develop solutions with well-structured and efficient data representations and algorithms..
CO6: Student will acquire the skills to proficiently form and solve linear recurrence relations with constant coefficients, enabling them to design and develop solutions with optimized algorithms and resource management..
CO7: Student will be capable of finding both homogeneous and particular solutions for recurrence relations, equipping them with the expertise needed to optimize and fine-tune algorithms in the design and development of solutions.

PO5: Ethics
CO1: Student will demonstrate a thorough understanding of propositional logic, including the ability to apply propositional equivalences to simplify logical expressions, thereby enhancing their ethical decision-making and critical thinking skills.

CO5: Student will gain a solid understanding of lattices, including completed, bounded, and distributive lattices, providing them with a valuable framework to analyze ethical principles and moral reasoning in a structured and comprehensive manner.

CO6: Student will possess the skills to form and solve linear recurrence relations with constant coefficients, which can aid in ethical decision-making by facilitating the analysis of complex moral dilemmas and their consequences.

PO6: Individual and Team work

CO7: Student will possess the capability to find both homogeneous and particular solutions for recurrence relations, facilitating individual and team work in tackling complex problems and optimizing solution development.

PO7: Innovation, employability and Entrepreneurial skills
CO4: Student will master the representation of relations using digraphs and matrices, and understand relation composition, equipping them with essential problem-solving and analytical tools crucial for innovation, employability, and entrepreneurial success in various contexts.

CO5: Student will gain a solid understanding of lattices, including completed, bounded, and distributive lattices, enhancing their capacity for innovative problem-solving, employability, and entrepreneurial success through structured decision-making and effective organizational skills.

Topics and Learning Points

Teaching Hours

Unit 01: Logic **7**

1.1 Revision: Propositional Logic, Propositional Equivalences
1.2 Predicates and Quantifiers: Predicate, n-place Predicate or n-ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.
1.3 Rules of Inference: Argument in propositional Logic, Validity Argument (Direct and Indirect methods), Rules of Inference for Propositional Logic, Building Arguments.

Unit 02: Relation and Digraph **8**

2.1 Ordered pairs, Cartesian Product of sets
2.2 Relation, types of relation, equivalence relation, Partial Ordering relations.
2.3 Digraphs of relations ,matrix representation and composition of relations
2.4 Transitive Closure and Warshall's Algorithm

Unit 03: Lattices and Boolean Algebra **6**

3.1 Lattices, Complemented Lattice, Bounded Lattice and Distributive Lattice.
3.2 Boolean Functions: Introduction, Boolean Variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra.
3.3 Representation of Boolean Functions: Minterm, Maxterm, Disjunctive normal form, Conjunctive normal form.

Unit 04: Recurrence Relations **9**

4.1 Recurrence Relations: Introduction, Formation
4.2 Linear Recurrence Relations with constant coefficients
4.3 Homogeneous solutions.
4.4 Particular solutions
4.5 Total solutions

Text Book : Kenneth Rosen, Discrete Mathematics and its applications, McGraw Hill Education Pvt. Ltd. (7^{th} Edition).
Unit 1: Section 1.1to 1.5
Unit 4: Section 8.2
Text Book : Bernard Kolman, Robert Busby, Sharon Culter Ross, Nadeem-ur-Rehman, Discrete Mathematics Structure, Pearson Education, 5^{th} Edition.
Unit 2: Section 4.2, 4.4, 4.5, 4.8
Unit 3: Section 7.3 to 7.6

Reference Books:

1. C. L. Liu., Elements of Discrete Mathematics, Tata McGraw Hill.