QR-101 Quantitative Reasoning-II

Credit Hours: 3-0
Prerequisites: None

Course Objectives: This course aims on establishing fundamental skills and building connection between basic concepts of discrete mathematics. Topics of discrete mathematics are covered in a specific context instead of more generally. The aim is to enhance the students understanding of the mathematical reasoning and intellectual growth of students. Although the content is discrete mathematics, the aim is learning to think and write mathematics.

Core Contents: Primer of Mathematical Writing, Basics of Sets and Boolean Algebra, Functions and Relations, Basic Combinatorics.

Detailed Course Contents: Number Puzzles and Sequences, Truth-tellers, Liars, and Propositional Logic, Predicates, Implications, Excursion Validity of Arguments, Mathematical Writing, Proofs about Numbers, Mathematical Induction, Contradiction and the Pigeonhole Principle, Excursion Representations of Numbers, Excursion Modular Arithmetic and Cryptography, Set Definitions and Operations, More Operations on Sets, Proving Set Properties, Numerical Functions in Discrete Math, Introduction to Combinatorics, Basic Rules for Counting, Combinations and the Binomial Theorem, Binary Sequences , Recursive Counting, Excursion Solving Recurrence Relations, Boolean Algebra, Excursion Logic Circuits. Definitions, Diagrams, and Inverses, The Composition Operation, Properties of Functions and Set Cardinality, Properties of Relations, Equivalence Relations.

Course Outcomes: Upon successful completion of the course, students should have the following skills:

- Understanding the proof writing,
- Understanding operations on sets and Boolean algebra.
- Understanding Functions and relations,
- Understanding basic combinatorics.

Textbook: Douglas E. Ensley, J. Winston Crawley, Discrete Mathematics: Mathematical Reasoning and Proof with Puzzles, Patterns, and Games, Wiley (2009)

Reference Books:

1. Susanna S. Epp, discrete mathematics an introduction to mathematical reasoning, brooks/cole cengage learning (2011)
2. Peter J. Eccles, An Introduction to Mathematical Reasoning: Numbers, Sets and Functions, Cambridge University Press (1998)

Weekly Breakdown		
Week	***Section***	***Topics***
1	1.1-1.3	**Puzzles, Patterns, and Mathematical Language:** Number Puzzles and Sequences, Truth-tellers, Liars, and Propositional Logic
2	1.4-1.6	Predicates, Implications, Excursion Validity of Arguments
3	2.1-2.2	**Primer of Mathematical Writing:** Mathematical Writing, Proofs about Numbers
4	2.3-2.5	Mathematical Induction, Contradiction and the Pigeonhole Principle
5	2.6, 2.7	Excursion Representations of Numbers, Excursion Modular Arithmetic and Cryptography
6	3.1-3.3	**Sets and Boolean Algebra:** Set Definitions and Operations, More Operations on Sets, Proving Set Properties,
7	3.4, 3.5	Boolean Algebra, Excursion Logic Circuits
8	4.1, 4.2	**Functions and Relations:** Definitions, Diagrams, and Inverses, The Composition Operation
9	**Mid Semester Exam**	
10	4.3, 4.4	Properties of Functions and Set Cardinality, Properties of Relations
11	4.5	Equivalence Relations
12	4.6	Numerical Functions in Discrete Math
13	5.1, 5.2	**Combinatorics:** Introduction to Combinatorics, Basic Rules for Counting
14	5.3	Combinations and the Binomial Theorem
15	5.4-5.5	Binary Sequences, Recursive Counting
16	5.6	Excursion Solving Recurrence Relations
17		Review
18	**End Semester Exam**	