ALA-TOO INTERNATIONAL UNIVERSITY

KYRGYZ REPUBLIC, BISHKEK

FACULTY OF ENGINEERING AND COMPUTER SCIENCE
DEPARTMENT OF APPLIED MATHEMATICS AND INFORMATICS

OUTLINE FOR THE DISCRETE MATHEMATICS I

Instructor:

Dr. Remudin Reshid MEKURIA

Program:　　　　　　　　　　**Undergraduate**

Year:　　　　　　　　　　　**Freshman and Junior**

Cr. hr.:　　　　　　　　　　**3.0 hrs/week**

Department taking the course:　　**Computer Science and Applied**

　　　　　　　　　　　　　　　　Maths and Informatics

Course Objectives

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, this course stresses on the mathematical reasoning and the different ways problems are solved. Five important themes are interwoven in this text: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful discrete mathematics course should carefully blend and balance all the five themes.

Course Descriptions

Mathematical Reasoning: Students must understand mathematical reasoning in order to read, comprehend, and construct mathematical arguments. This text starts with a discussion of mathematical logic, which serves as the foundation for the subsequent discussions of methods of proof. Both the science and the art of constructing proofs are addressed.

Learning Outcomes

The students will be able to

- **express** a logical sentence interms of predicates, quantifiers, and logical connectives.

- **write** an argument using logical notation and determine if the argument is or is not valid.

- **prove** basic set inequalities.

- **apply** counting principles to determine probabilities.

- **demonstrate** an understanding of relations and functions and able to determine their properties.

- **apply** the rules of inference and methods of proof including direct and indirect proof strategies, proof by contradictions, and using the principles of mathematical inductions.

Structure of the Lectures

Week 1:

- Lecture 1: Introduction to the course: Logic, proof and propositional statement.

- Lecture 2: Forming new propositions using logical operators and connectives

Week 2:

- Lecture 1: Propositional Equivalences

- Lecture 2: Predicates and Quantifiers

Week 3:

- Lecture 1: Existential Quantifiers and Binding Variables

- Lecture 2: Methods of Proofs

Week 4:

- Lecture 1: Introduction to Algorithms

- The Growth of Functions and Complexity of Algorithms

Week 5:

- Lecture 1: Division, Computer arithmetic using binary expan-

sions and the Division Algorithm

- Lecture 2: Application to computer arithmetic, cryptography, secret messages.

Week 6:

- Lecture 1: Base b expansion and modular exponentiation, as well as their importance in cryptography

- Lecture 2: The Euclidean algorithm

Week 7:

- Lecture 1: Matrix Arithmetic

- Lecture 2: Zero-one matrices: the Boolean Operation

Week 8: Preparation for the mid term Exam: revision of previous lessons and solving problems.

Week 9: Exam Week

Week 10:

- Lecture 1: Proof Strategy

- Lecture 2: Sequences and Summations

Week 11:

- Lecture 1: Mathematical Induction

- Lecture 2: Strong Induction and Well-Ordering

Week 12:

- Lecture 1: Recursive Definitions and Structural Induction

- Lecture 2: Solving examples

Week 13:

- Lecture 1: Recursive Algorithms and Program Correctness

- Lecture 2: Solving examples

Week 14:

- Lecture 1: The Basics of Counting

- Lecture 2: The Pigeonhole Principle

Week 15:

- Lecture 1: Permutations and Combinations

- Lecture 2: Solved Problems

Week 16: Preparation for the final term Exam: course revision and solving problems.

Teaching Materials

Text Book: Discrete Mathematics and Its Applications 7th Edition by Kenneth H. Rosen.

Reference Books:

1. Essentials of Discrete Mathematics 3rd Edition by David J. Hunter

2. Journey into Discrete Mathematics by Owen D. Byer, Deirdre L. Smeltzer, and Kenneth L. Wantz

3. Discrete Mathematics: A First Course by Alexander Stanoyevitch

Lecture Videos and Web Pages:

All lectures have been recorded and they are accessible from OCS.

Several web page links are also available on the OCS for the respective lessons.

Evaluation and Assessment Types

- Mid Term Exam   25%

- Final Term Exam   35%

- Quizzes and Attendances   20%

- Assignments   20%