**Mathematics 3305 – Discrete Mathematics II**

**Student Learning Outcomes**

**1. Students will demonstrate factual knowledge of the mathematical notation and terminology used in this course.** Students will demonstrate the ability to read, interpret, and use the vocabulary and methods related to weak and strong induction, algorithms, combinatorics, probability, graph theory, and decision trees.

**2. Students will demonstrate knowledge of fundamental principles used in decision making and problem solving.** Students will demonstrate the ability to read and comprehend combinatoric methods applied to problems in decision making and graph theory. Students will also demonstrate the ability to apply combinatoric methods as well as weak and strong induction to develop algorithms and basic mathematical proofs.

**3. Students will apply course material along with techniques and procedures covered in this course to solve problems.** Students will use the knowledge gained in this course to determine appropriate techniques for specific problems in decision theory, and graph theory and to develop and apply algorithms to those problems.

**4. Students will develop specific skills, competencies, and thought processes sufficient to support** **further study or work in this field or related fields.** Students will acquire proficiency in the fundamental concepts of graph theory, induction, and combinatorics, at a level necessary for more advanced mathematics courses such as Numerical Analysis, and Probability & Statistics.

**Course Content**

**Textbook:** *Foundations of Combinatorics with Applications* Edward A. Bender and S. Gill Williamson, Dover Publications Inc., 2006. (ISBN 0-486-44603-4). This book is also available for free at the following website. <http://www.math.ucsd.edu/~ebender/CombText/index.html>

Most of the course material will be drawn from this book. Supplemental material will be taken from a variety of sources.

*Chapter 1: Basic Counting, Lists with Repetition Allowed, Lists with Repetition Forbidden, Sets, Recursion, Multisets*

*Chapter 2: Functions, Permutations, The Pigeonhole Principle, Boolean Functions*

*Chapter 3: Decision Trees*

*Chapter 4: Sieving Methods, The Principles of Inclusion and Exclusion, Structures with Symmetries*

*Chapter 5: Graph Theory, Labeled and Unlabeled Graphs, Paths, Trees, Computer Representations,*

*Chapter 6: Spanning Trees, Graph Colorings, Planar Graphs, Network Flows, Finite State Machines*

*Chapter 7: Recursive Algorithms*

*Chapter 8: Sorting Theory, Limits on Speeds, Sorting Networks*

*Chapter 10: Generating Functions*

*Chapter 11: Systems of Recursion, Exponential Generating Functions, Polya’s Theorem, Asymptotic Estimates*