WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline-MATH 247**

**Course Title:** Discrete Mathematics

**Number of Credits**: 3

**Catalog Description:** An introduction to the topics of discrete mathematics including elementary set theory, basic logic, sequence analysis, modular arithmetic, graphs and trees. Prerequisite: MATH 140 - Applied Calculus or MATH 212 - Calculus I.

**Possible Text(s):** “Discrete Mathematics” by Sandy Irani (via zyBooks.com)

“Applied Discrete Structures” by Doerr and Levasseur

**Topics Covered:**

* 1. Sets
     1. Set Operations
     2. Venn Diagrams
     3. Cartesian Product
     4. Power Set
     5. Extended Set Operations
     6. Proofs using Venn Diagrams
     7. Proofs using a table
  2. Propositional Logic
     1. Logic Operations
     2. Truth Tables
     3. Symbolic Logic
     4. Circuit Diagrams
     5. Quantifiers
  3. Basic Number Theory
     1. Binary Representation
     2. Division Algorithm
     3. GCD, LCM
     4. Factoring
     5. Modular Arithmetic
     6. Simple Linear and Quadratic Diophantine Equations
  4. Sequences
     1. Sequence Notation
     2. Recursively Defined Sequences
     3. Summation and Product Notation
     4. Mathematical Induction on Sequences and Series
     5. Homogeneous Linear Recursion
     6. Finite Difference Methods
  5. Relations and Digraphs
     1. Basic Definitions
     2. Relation/Digraph Properties
     3. Closures and Reductions
     4. Haase Diagrams
     5. Ford-Fulkerson Algorithm for Max-Flow/Min-Cut
  6. Graphs and Trees
     1. Basic Graph Properties
     2. Graph Isomorphism and Invariants
     3. Planar Graphs and Coloring
     4. Eulerian And Hamiltonian Paths and Circuits
     5. Dijkstra’s Algorithm for Shortest Path
     6. Trees in Problem Solving
     7. Minimal Spanning Trees (Prim’s Algorithm)

**Remarks:**

* The focus of this course should be on computation and forming familiarity with the concepts. Proofs (when given or assigned) should generally be visual/intuitive in nature.
* A full list of topics with sample problems is available upon request to the MATH subgroup.
* The following topics are beyond the scope of this course: Written Proof, Matrices, Advanced Modular Arithmetic, Combinatorics, Probability, Programming

**Method of Instruction:** Lecture-presentation, discussion, question-answer sessions,

use of calculators/computers, group work.

**Evaluation Procedure:** Homework, quizzes, projects, midterm exams, and a final exam.

**MnSCU Learning Outcomes:**

* Students will demonstrate a facility with basic set theory notation and analysis.
* Students will demonstrate the ability to recognize and use the basic forms of mathematical proof.
* Students will be able to recognize, analyze, and use explicitly and recursively defined sequences.
* Students will demonstrate a facility with modular arithmetic.
* Students will demonstrate a facility with elementary graph theory, including relations, digraphs, graphs, and trees.

**Last Revised:** Spring 2016 by Eric Errthum (unofficial, not department approved)