J. Sargeant Reynolds Community College
Course Content Summary

Course Prefix and Number: MTH 288 **Credits:** 3

Course Title: Discrete Mathematics

Course Description: Presents topics in sets, counting, graphs, logic, proofs, functions, relations, mathematical induction, Boolean Algebra, and recurrence relations. Prerequisite: MTH 263 Calculus I with a grade of C or better or equivalent. Lecture 3 hours per week.

General Course Purpose: The goal is to give the student a solid grasp of the methods and applications of discrete mathematics to prepare the student for higher level study in mathematics, engineering, computer science, and the sciences. Methods of proofs and applications of proofs are emphasized throughout the course.

Course Prerequisites and Co-requisites:
Prerequisite: MTH 263 Calculus I with a grade of C or better or equivalent

Student Learning Outcomes:
Upon completing the course, the student will be able to

Logic - Propositional Calculus
a. Use statements, variables, and logical connectives to translate between English and formal logic;
b. Use a truth table to prove the logical equivalence of statements;
c. Identify conditional statements and their variations;
d. Identify common argument forms; and
e. Use truth tables to prove the validity of arguments.

Logic – Predicate Calculus
a. Use predicates and quantifiers to translate between English and formal logic; and
b. Use Euler diagrams to prove the validity of arguments with quantifiers.

Logic - Proofs
a. Construct proofs of mathematical statements - including number theoretic statements - using counter-examples, direct arguments, division into cases, and indirect arguments; and
b. Use mathematical induction to prove propositions over the positive integers.

Set Theory
a. Exhibit proper use of set notation, abbreviations for common sets, Cartesian products, and ordered n-tuples;
b. Combine sets using set operations;
c. List the elements of a power set;
d. Lists the elements of a cross product;
e. Draw Venn diagrams that represent set operations and set relations;
f. Apply concepts of sets or Venn Diagrams to prove the equality or inequality of infinite or finite sets; and
g. Create bijective mappings to prove that two sets do or do not have the same cardinality.

Functions and Relations
a. Identify a function's rule, domain, codomain, and range;
b. Draw and interpret arrow diagrams;
c. Prove that a function is well-defined, one-to-one, or onto;
d. Given a binary relation on a set, determine if two elements of the set are related;
e. Prove that a relation is an equivalence relation and determine its equivalence classes; and
f. Determine if a relation is a partial ordering.

Counting Theory
a. Use the multiplication rule, permutations, combinations, and the pigeonhole principle to count the number of elements in a set; and
b. Apply the Binomial Theorem to counting problems.

Graph Theory
a. Identify the features of a graph using definitions and proper graph terminology;
b. Prove statements using the Handshake Theorem;
c. Prove that a graph has an Euler circuit; and
d. Identify a minimum spanning tree.

Boolean Algebra
a. Define Boolean Algebra;
b. Apply its concepts to other areas of discrete math; and
c. Apply partial orderings to Boolean algebra.

Recurrence Relations
a. Give explicit and recursive descriptions of sequences; and
b. Solve recurrence relations.

Major Topics to Be Included:
a. Logic - Propositional Calculus
b. Logic - Predicate Calculus
c. Logic - Proofs
d. Set Theory
e. Functions and Relations
f. Counting Theory
g. Graph Theory
h. Boolean Algebra
i. Recurrence Relations

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