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. Prerequisites**:** MTH 161 or MTH 166 or MTH 167. 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:
Prerequisites**:** MTH 161 or MTH 166 or MTH 167

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

Effective Date of Course Content Summary: February 8, 2018