WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline-MATH 120**

**Fall 2022**

**Course Title:** Precalculus

**Number of Credits**: 4

**Prerequisites:** one of the following 6 requirements:

* A score of 24 on test ACT Math
* A score of 60 on test Accuplacer College Level Math
* A score of 255 on test Accuplacer NG Quantitative Reasoning
* A score of 263 on test Accuplacer NG Advanced Algebra Functions A score of 61 on test
* ALEKS PPL Math Placement
* A score of 3.5 on test Mathematics GPA

**Corequisites:** None

**MnTC Goals:** Goal 04 - Mathematical/Logical Reasoning

**Catalog Description:** A study of linear, polynomial, exponential, logarithmic, and trigonometric functions. Students develop computational proficiency, the ability to interpret equations and graphs, and a facility with modeling that is relevant to their chosen discipline and which prepares them for the possible completion of Calculus. Meets GOAL 4. Prerequisite: Qualifying score on the mathematics placement exam or MATH 115 - College Algebra.

**Possible Textbooks:** *Openstax Precalculus*, Abramson, OpenStax, Rich University (2017)

**Topics Covered:** This course serves a wide variety of majors and for many will be a terminal course. The goals are: (1) conceptual understanding, (2) computational proficiency, (3) mathematical interpretation of equations and graphs, and (4) ability to model.

1. Modeling and Solving Real-World Problems (integrated into this course throughout)
2. Functions and Functional Notation
   1. Rates of Change and Behavior of Graphs
   2. Composition of Functions
   3. Transformation of Functions
   4. Absolute Value Function
   5. Inverse Functions
3. Linear Functions
   1. Equations of Linear Functions
   2. Graphs of Linear Functions
   3. Modeling with Linear Functions
4. Polynomial and Rational Functions
   1. Quadratic Functions
   2. Power and Polynomial Functions
   3. Graphs of Polynomial Functions
   4. Rational Functions
   5. Modeling with Power and Polynomial Functions
5. Exponential and Logarithmic Functions
   1. Law of Logarithms and Exponents (as they pertain to solving equations)
   2. Meaning and Interpretation of Exponential and Logarithmic Functions
   3. Equations of Exponential and Logarithmic Functions
   4. Graphs of Exponential and Logarithmic Functions
   5. Modeling with Exponential and Logarithmic Functions
6. Trigonometry
   1. Right Triangle and Non-Right Triangle Trigonometry (Trigonometric Ratios, Pythagorean Theorem, Law of Sines, Law of Cosines)
   2. Unit Circle, Angle Measure, Radians
   3. Trigonometric Functions of Real Numbers
   4. Graphs of Trigonometric and Inverse Trigonometric Functions (including amplitude, phase shift, vertical shift, period, frequency)
   5. Modeling with Sine, Cosine and Tangent functions using right triangles
   6. Basic Trigonometric Identities (sufficient for students proceeding to Calculus II)
   7. Solving Trigonometric Equations with Inverse Trigonometric Functions
   8. Modeling Periodic Functions with Trigonometry
7. Other Topics as Time Permits
   1. Vectors
   2. Polar Coordinates
   3. Complex Numbers
   4. Instructor Chosen Topics

**Minnesota Transfer Curriculum:** *The following language should appear on each**instructor’s syllabus for the course:*

1. **Goal 4 under GEP:** ***Mathematics/Logical Reasoning*** – This is a General Education Program course that satisfies the Mathematics/Logical Reasoning requirement of the Minnesota Transfer Curriculum. The goal of this requirement is to increase students' knowledge about mathematical and logical modes of thinking. This will enable students to appreciate the breadth of applications of mathematics, evaluate arguments, and detect fallacious reasoning. Students will learn to apply mathematics, logic, and/or statistics to help them make decisions in their lives and careers. Minnesota's public higher education systems have agreed that developmental mathematics includes the first three years of a high school mathematics sequence through intermediate algebra.
2. Students will be able to:
3. Illustrate historical and contemporary applications of mathematics/logical systems.

Nearly all course topics have an application component to them, where students will need to use them to solve real-world problems. Many of these are word problems which force students to critically analyze given information and extract the important elements in order to construct algebraic expressions and equations that can then be solved. Another main focus of the course is the use of different representations of functions (graphical, tabular, symbolic, and verbal) to solve application (word/story) problems

1. Clearly express mathematical/logical ideas in writing.

Solving word problems forces students to extract from given information (or data) the important elements that can then be used to set up equations or other representations that allow them to solve the problem. Students will be required not only to use the data to solve the problems, but will be required to explain and intepret their solution and how they used that data and why their solution is appropriate.

1. Explain what constitutes a valid mathematical/logical argument (proof).

In solving the real-world problems student develop methods of mathematical argument. This involves logically leading from a problem’s statement to its solution through a sequence of mathematically valid steps.

1. Apply higher-order problem-solving and/or modeling strategies.

In working with the different forms of information and developing solutions to problems students will see connections between various approaches. The ability to approach a fresh problem and develop new approaches is stressed.

**MnSCU Learning Outcomes:**

* Students will use logical reasoning by studying mathematical patterns and relationships that includes functional notation and identities.
* Students will learn the combination of functions, such as sums, products and compositions.
* Students will understand the relationships between exponential and logarithmic functions.
* Students will use mathematical models to describe real-world phenomena and to solve real-world problems - as well as understand the limitations of models in making predictions and drawing conclusions.
* Students will learn to use linear models for bivariate functions, exponential models for growth or decay, and periodic models with trigonometric functions.
* Students will learn how to organize data, communicate the essential features of the data, and interpret the data in a meaningful way
* Students will know to express the relationships illustrated in graphical displays and tables clearly and correctly in words.
* Student will be able to express solution sets correctly with a number line graph by using interval notation and inequalities.
* Students will identify and express characteristics of the graphs of powers, polynomials, rational functions, exponential, and trigonometric functions.
* Students will identify functional characteristics including increasing/ decreasing intervals, curvature, local optima, long-term behavior.

**Last Revised:** Fall 2022 by the Mathematics Subgroup