WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline - MATH 202**

**Course Title:** Elements of Mathematics

**Catalog Description:** The purpose of this course is to develop mathematical reasoning, problem solving, and communication through performing and interpreting experiments, thinking analytically, and incorporating practical applications that are important aspects of real world phenomena. Prerequisite: Score of 18 or higher on ACT Mathematics or MATH 050 or MATH 100 or MATH 110 or MATH 112 or MATH 115 or MATH 120 or MATH 142 or MATH 140 or MATH 212 or STAT 100. Meets GOAL 4. Offered every semester. Grade only.

**Number of Credits**: 3

**Text:**  *A Problem Solving Approach to Mathematics for Elementary School Teachers,* ***12th edition*** by Billstein, Libeskind, and Lott

**Topics Covered**

1. An Introduction to Problem Solving
2. Mathematics and Problem Solving
3. Explorations with Patterns
4. Reasoning and Logic: An Introduction
5. Networks
6. Decimals and Applications to Finance
7. Operations on Decimals
8. Nonterminating Decimals
9. Percent and Interest
10. Real Numbers and Algebraic Thinking
11. Real Numbers
12. Variables
13. Equations
14. Functions
15. Equations in a Cartesian Coordinate System
16. Using Real Numbers in Equations
17. Probability
18. How Probabilities Are Determined
19. Multistage Experiments with Tree Diagrams and Geometric Probabilities
20. Using Simulations in Probability
21. Odds, Conditional Probability, and Expected Value
22. Using Permutations and Combinations in Probability
23. Data Analysis/Statistics: An Introduction
24. Designing Experiments/Collecting Data
25. Displaying Data: Part I
26. Displaying Data: Part II
27. Measures of Central Tendency and Variation
28. Abuses of Statistics

**Listing of Sections in Departmental Text to be Covered**

Chapter 1 - An Introduction to Problem Solving – all sections

Chapter 2 – Introduction to Logic and Sets - – only sections 2-1

Chapter 11 – Introductory Geometry - only Module C

Chapter 8 – Real Numbers and Algebraic Thinking – all sections

Chapter 9 – Probability – all sections

Chapter 10 – Data Analysis/Statistics: An Introduction – all sections

**Approximate pace of coverage:**

Two to three 50 minute class period should be sufficient time for each section.

**Method of Instruction:** Lecture/presentation, discussion, question and answer sessions, use of calculators and/or computers, extended and in-class group work.

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

**Rationale for GEP: Goal Area 4:** The major focus of the course is on problem solving and the tools necessary to problem solve. These tools include analyzing data, expressing ideas in mathematical notation including logic and algebraic systems, understanding the theory of chance and how it relates to problem solving. A major emphasis of the course is emphasizing inquiry through a cyclical learning process of prediction, data collection, analysis, and communicating results.

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

**Student Learning Outcomes and Assessment:**

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| --- | --- | --- |
| **Learning Outcome****Read as “Students will be able to”** | **Learning Opportunity** | **Assessment** |
| **Illustrate historical and contemporary applications of mathematics/logical systems. More specifically:**-investigate situations that involve counting finite sets, calculating probabilities, tracing paths in network graphs, and analyzing iterative procedures -relate patterns in one strand of mathematics to patterns across the discipline-investigate and analyze data-understand the history of mathematics and the interaction between different cultures and mathematics-understand the connections among mathematical concepts and procedures as well as the relationship between mathematics and other fields | * Students will have many opportunities to work with data including collecting, interpreting, analyzing, and building models.
* Students will analyze patterns to determine mathematical results. They will work with both geometric and arithmetic sequences.
* Students will calculate probabilities based on real-life phenomena.
* Students will determine Eulerian and Hamiltonian circuits to determine the most efficient paths in applications such as a salesman’s route, bussing, or snowplowing.
* Students will explore the history of math as it relates to sequences, number theory, networks, and statistics
 | Students will be assessed through a series of projects, group work, and exams. They will need to collect and analyze data in order to build models and present their results.  |
| **Clearly express mathematical/logical ideas in writing. More specifically:**-identify and generate patterns to demonstrate a variety of relationships-use a variety of conceptual and procedural tools for collecting, organizing, and reasoning about data-communicate mathematics at different levels of formality | * After collecting data on real-life applications including probability, finance, population growth, students will analyze the data by creating graphs and models. They will need to communicate the results of their findings.
* Students will explore how logic, mathematical symbols, and algebra help explain results in a concise manner.
 | One of the main emphases in the course will be to assess the ability of the student to problem solve and communicate their findings in terms of equations, graphs, tables, and written summaries. |
| **Explain what constitutes a valid mathematical/logical argument (proof). More specifically:**-solve problems and use mathematical notation with concepts and techniques of discrete math from areas such as graph theory, combinatorics, and recursion-interpret and draw inferences from data and make decisions in a wide range of applied problem situations-know how to reason mathematically and communicate the results | * Students will analyze statements to determine their logical validity. They will use truth tables, simple mathematical proofs, and mathematical symbols to determine conclusions.
* Students will reason mathematically in many situations and understand how to determine the reasonableness of their solutions.
* Students will explore both experimental and theoretical probability through a series of labs. They will understand the difference between their results and how Bernouilli’s Law of Large Numbers helps in probabilistic situations.
 | Students will be assessed through a series of projects that utilize logic and mathematical reasoning. They will be assessed over their ability to problem solve and determine reasonable mathematical results.  |
| **Apply higher-order problem-solving and/or modeling strategies. More specifically:**-apply problem solving methods in setting such as finance, population dynamics, and optimal planning-apply numerical and graphical techniques for representing and summarizing data | * Students will explore finance applications including interest, population applications including geometric and arithmetic sequences, and optimal planning through network graphs.
* Students will use logic, mathematical proof, and multiple representations to communicate results.
 | Students will be assessed through a series of projects on real-life applications that include collecting and analyzing data, modeling random events, and networks. Students will be assessed over their ability to problem solve and determine reasonable mathematical results. |

**Last Revised:** Spring 2018 by the Math Ed Subgroup