WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Course Outline - MATH 306**

**Course Title:** Problem Solving in Math Classroom

**Catalog Description:**

The meaning, practices, teaching, and learning of mathematical problem solving for 5-12 grades mathematics teachers. Prerequisite: MATH 212 – Calculus I or MATH 140 – Applied Calculus. Offered every semester. Grade only.

**Number of Credits:** 3

**Readings:** To be determined by the instructor.

**Topics Covered:**

I. What Does It Mean to Think Mathematically? (Weeks 1-3)

A. Mathematical Thinking

B. Problems, Exercises, and Explorations

C. Problem Solving and Problem Posing

D. Problem Solving with Trigonometry and Trigonometric Identities

II. Problem Solving with Technology (Weeks 4-6)

A. Geometer Sketchpad and Excel Activities

B. Graphing Calculator Activities

III. Teaching and Learning of Mathematical Problem Solving (Weeks 7-10)

A. Problem Solving and Curricula

B. Problem Solving and Learning Theories

C. Examine Students’ Problem Solving Strategies (Algebra)

D. Examine Students’ Problem Solving Strategies (Geometry)

IV. Problem Solving and Mathematical Modeling (Weeks 11-13)

A. Mathematical Modeling

B. Connection between Problem Solving and Mathematical Modeling

V. Past, Present, and Future of Mathematical Problem Solving (Weeks 14-15)

A. Polya and How to Solve it

B. Problem Solving around the World

**Remarks on Standards Included:**

A teacher of mathematics must demonstrate an understanding of the teaching of mathematics that integrates understanding of mathematics with the understanding of pedagogy, students, learning, classroom management, and professional development.

**Method of Instruction:** Lecture presentation, discussion, group work

**Evaluation Procedure:** Homework, quizzes, presentations, tests, and a final examination.

**Requirements:** attendance, hands-on investigations, use of concrete manipulative materials and pictorial models, and discussions

**Student Learning Outcomes**Students who successfully complete this course will be able to:

* understand mathematics problem solving in relation to mathematical thinking and modeling,
* solve a variety of mathematical problems using technology,
* engage in independent mathematical investigations, and communicate mathematical ideas that arise from mathematics investigations,
* design problem solving contexts appropriate for 5-12 grades school children,
* identify critical issues associated with teaching and learning mathematical problem solving,

**Specific competencies addressed from the *relevant national guidelines*.**

The teacher of mathematics to preadolescent and adolescent students shall:

3.B.2.b: - application of systematic counting techniques in problem situations to include determining the existence of a solution, the number of possible solutions, and the optimal solution.

Assessment: Assessment: Mathematical modeling homework on systematic counting techniques and the type of solutions.

3.B.2.d: exploration, development, analysis, and comparison of algorithms designed to accomplish a task or solve a problem;

Assessment: Problem sets homework and writing assignment on reflection of their own thinking process.

3.D.15- extend work with two-dimensional right triangle including unit circle trigonometry

Assessment: Problem sets homework and Quiz on Unit Circle

**Last Revised:** Spring 2019 by the Math Ed Subgroup