

Prepared by: Mathematics Education Subgroup
April 23, 2009

WINONA STATE UNIVERSITY
COLLEGE OF SCIENCE AND ENGINEERING
DEPARTMENT OF MATHEMATICS AND STATISTICS

Course Outline-Mathematics Education 322

Course Title: Modern Geometry

Frequency of Offering: Yearly, Spring Semester Prerequisite(s): MATH 165 and MATH 210

Grading: Secondary majors and minors Grade Only basis; P/NC option available to others

Course Applicable: MTHT—Secondary Mathematics, required.

Catalog Description: This course is designed to give the prospective teacher of secondary mathematics an exposure to the concepts of non-Euclidean geometries, their relation to, and their impact on secondary school geometry. Additional topics include historical development of geometry concepts and examination of the role of reasoning and proof in geometric settings. Prerequisites: MATH 165 and MATH 210. Offered Spring semester. (Winona State University Undergraduate Catalog 2008-2010)

Number of Credits: 4 Semester Hours

Select from the following required textbooks:

- 1) Hvidsten, Michael. (2005). *Geometry with Geometry Explorer*. New York, NY: McGraw-Hill.
- 2) Smart, James R. (1998). *Modern Geometries*. (5th Edition). Pacific Grove, CA: Brooks/Cole.

Additional Requirements: None

Course Objectives: This course will focus on three major areas of importance to the prospective 5-12 mathematics teacher.

- 1) To facilitate the student's construction of a broad perspective of geometry and its nature.
- 2) To develop a perspective of the place and emphasis geometry had historically in the world.
- 3) To add depth to the student's current level of knowledge, skills, appreciation, and understanding of geometry, including proof skills, understanding of axiomatic systems, and a deeper appreciation of the geometry of the world that surrounds them.

Course Outline of the Major Topics and Subtopics:

Suggested Timeline for; Hvidsten, Michael. (2005). *Geometry with Geometry Explorer*. New York, NY: McGraw-Hill.

Introduction: The Importance of Proofs
Chapter 1: Axiomatic Systems
Chapter 2: Euclidean Geometry
Chapter 3: Analytic Geometry, including “The Three Famous Greek Problems,”
Impossibility Proofs (Smart, 5.4)
Chapter 4: Constructions with Straight-Edge and Compass
Constructions with Dynamic Geometry Software (Geometer's Sketchpad)
Chapter 5: Transformational Geometry
Chapter 8: Non Euclidean Transformations
Section 6.4: Tessellations; Systems of Differential Equations (Optional)
Chapter 7 & 9: Non-Euclidean Geometry; Fractal Geometry (Optional)
Solid Geometry concepts

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| Week 1 | Introduction |
| Week 2 | 1.1 - 1.4 |
| Week 3 | 1.5 - 1.7 |
| Week 4 | 2.1 - 2.4 |
| Week 5 | 2.5 - 2.7, 3.1 - 3.2 |
| Week 6 | 3.3 - 3.6 |
| Week 7 | 4.1 - 4.4 |
| Week 8 | Geometer's Sketchpad |
| Week 9 | 5.1 - 5.4 |
| Week 10 | 5.6 - 5.7 |
| Week 11 | 8.1, 7.1 - 7.2, |
| Week 12 | 8.2, 8.3 |
| Week 13 | 7.3 - 7.6 |
| Week 14 | 7.7 - 7.8 |
| Week 15 | 9.1 - 9.2 |

General Expectations: All students are expected to complete at least one major project to be selected by instructor.

Additional References:

Coxeter, H.S.M. (1989). *Introduction to Geometry*. (2nd Edition). New York, NY: Wiley.

Greenberg, Marvin Jay. (2008). *Euclidean and Non-Euclidean Geometries: Development and History*. (4th Edition). New York, NY: W.H. Freeman.

Hvidsten, Michael. (2005). *Geometry with Geometry Explorer*. New York, NY: McGraw-Hill.

- Smart, James R. (1998). *Modern Geometries*. (5th Edition). Pacific Grove, CA: Brooks/Cole.
- Eves, Howard. (1972). *A Survey of Geometry*. (Revised Edition). Boston, MA: Allyn and Bacon.
- Sibley, Thomas Q. (1998). *The Geometric Viewpoint: A Survey of Geometries*. Reading, MA: Addison Wesley Longman.
- Serra, Michael. (2008). *Discovering Geometry: An Investigative Approach*. (4th Edition). Berkeley, CA: Key Curriculum Press.
- Posamentier, Alfred S. (2002). *Advanced Euclidean Geometry: Excursions for Secondary Teachers and Students*. Emeryville, CA: Key College Publishing.
- Albrecht, Masha, Ed. (1999). *Exploring Geometry with the Geometer's Sketchpad*. Emeryville, CA: Key Curriculum Press.