

MODERN GEOMETRY
MATH 3640/8645

Page 1 of 2

1.0 Course Objectives

- 1.1 Overview of Content and Purpose:** (3 hours) Axiomatic systems, finite geometries, modern foundations of Euclidean geometry, hyperbolic and other non-Euclidean geometries, projective geometry.
- 1.2 For whom Intended:**
- 1.3 Prerequisite:** MATH 1960 and MATH/CSCI 2030, or equivalent mathematical maturity.

2.0 Objectives

- 2.1 Performance Objectives for the Students:** The objectives of the course are two fold: a) To introduce the student to the rich variety of geometric topics, beyond those studied at the high school level. This should prove valuable to the mathematics student in broadening his horizons, and specifically to the prospective high school teacher by increasing his knowledge in the area of geometry; and b) to help the student develop the skills of logical reasoning, use of the axiomatic method and careful presentation of proof. This course may help the student in the transition from the more manipulative courses at the freshman-sophomore level to abstract courses at the advanced level.

3.0 Content and Organization

3.1 Topics:

1. Axiomatic systems, finite geometries, consistency completeness, and independence in an axiomatic system.
2. Foundations of Euclidean geometry
 - a. A critique of Euclid's elements
 - b. A modern set of axioms for Euclidean geometry
3. The role of parallel postulate
 - a. Absolute geometry
 - b. The Euclidean parallel postulate
 - c. Discovery on non-Euclidean geometries
4. Hyperbolic and other non-Euclidean geometries
 - a. The Hyperbolic parallel postulate
 - b. Some theorems of Hyperbolic geometry
 - c. Poincare's model
 - d. Ecliptic geometries
5. Advanced topics in Euclidean geometry
 - a. Circles and theory of inversions
 - b. Verification of Poincare's model
6. Introduction to projective geometry

MODERN GEOMETRY
MATH 3640/8645

Page 2 of 2

4.0 Teaching Methodology

- 4.1 Methods to be Used:** The class will be presented in a lecture form with student questions and discussion encouraged.

5.0 Evaluation

- 5.1 Basis for Evaluating Student Performance:** The grade will be determined primarily from the examinations and problem assignments as determined by the instructor. Graduate students will be required to complete assignments not required of undergraduate students.

6.0 Resource Material

- 6.1 Textbook(s) or Other Required Readings:** Greenberg, *Euclidean & Non-Euclidean Geometry*, 3rd edition, 1993, Freeman Publishers. ISBN 0-7167-2446-4

6.2 Current Bibliography of Resources:

1. Adler, C.F., *Modern Geometry*, 2nd Edition, McGraw Hill, 1967.
2. Blumenthal, L.M., *A modern View of Geometry*, Freeman, 1961.
3. Eves, Howard, *A Survey of Geometry*, Revised edition, Allyn and Bacon, 1972.
4. Gemignani, M.C., *Axiomatic Geometry*, Addison-Wesley, 1971.
5. Golos, E.B., *Foundations of Euclidean and non-Euclidean Geometry*, Holt, Rinehart, Winston, 1968.
6. Greenburg, M.J., *Euclidean and non-Euclidean Geometries, Development and History*, 2nd edition, Freeman, 1980.
7. Heath, T.L., *The Thirteen Books of Euclid's Elements, Vol. I, II, III*, Dover.
8. Hilbert, D., *The Foundations of Geometry*, 2nd editions, Open-Court, 1921.
9. Kay, D.C., *College Geometry*, Holt, Rinehart, Winston, 1969.
10. Meserve, B.E., and Izzo, J.A., *Fundamentals of Geometry*, Addison Wesley, 1969.
11. Moise, E.E., *Elementary Geometry from an Advanced Stand Point*, Addison Wesley, 1969.
12. Prenowitz, W. and Jordan, M., *Basic Concepts of Geometry*, Blaisdell, 1965.
13. Smart, J.R., *Modern Geometries*, 2nd editions, Brooks Cole, 1978.
14. Tuller, A., *A Modern Introduction to Geometries*, Van Nostrand, Reinhold, 1967.