MISSOURI WESTERN STATE UNIVERSITY

COLLEGE OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: MAT 315

COURSE NAME: Topics in Geometry

COURSE DESCRIPTION:

Synthetic projective geometry; basic symbolic logic; mathematical systems and finite geometries; algebraic geometry; non-Euclidean geometry. 3 credit hours. Spring even years only.

PREREQUISITE:

Credit or concurrent enrollment in MAT 306.

TEXT:

COURSE OBJECTIVE:

The objective of this course is to provide the student with a basic understanding of geometry as a field of mathematical study and knowledge of the interesting history of the study of a variety of geometries. In addition, students will develop and understanding of axiomatic systems and formal logic. Students will present formal arguments and will be able to read with comprehension such arguments.

STUDENT COMPETENCIES:

In order to meet the above objectives, successful students will:

1. Describe the role of axiomatic method in the development of a mathematical system.
   (MoStep Mathematics Competencies 6.2)

2. Describe the similarities and differences in the axioms for various geometries.
   MoStep Mathematics Competencies 6.2)

3. Read and comprehend formal proofs.
   (MoStep Mathematics Competencies 6.1)

4. Develop a logical argument.
   (MoStep Mathematics Competencies 6.1)

5. Develop a formal proof in a variety of geometries.
   (MoStep Mathematics Competencies 6.1, 6.2)

6. Present a formal argument in a way that can be comprehended by an appropriate audience.
   (MoStep Mathematics Competencies 6.1)

7. Identify several of the key individuals who have made significant contributions to the field of geometry and discuss the significance of their contributions.
   (MoStep Mathematics Competencies 1.7)

8. Develop a model for several different geometries, and use models to illustrate properties and counterexamples.
   (MoStep Mathematics Competencies 1.3, 3.2)

9. Identify differences between Euclidean geometry and non-Euclidean geometries.
   (MoStep Mathematics Competencies 3.2, 6.2)

10. State the definitions for the key terms introduced in the course.
    (MoStep Mathematics Competencies 1.2, 3.2)

11. Use the vocabulary of the course with accuracy and precision.
    (MoStep Mathematics Competencies 1.2, 3.2)

12. Explain key concepts introduced in the course and use these concepts both in formal proofs and in applications.
    (MoStep Mathematics Competencies 1.2)

13. Perform compass and straightedge constructions, and be able to communicate procedures for constructions to others.
    (MoStep Mathematics Competencies 1.1, 1.8, 3.3, 3.6)

14. Use Geometer's SketchPad to construct regular polygons.
    (MoStep Mathematics Competencies 1.11, 3.3)

COURSE OUTLINE:

1. Overview of the contributions of ancient civilizations (Egyptian, Babylonian, Hindu, Chinese, Greek) to the study of geometry

2. Axiomatic system, undefined terms, common notions, postulates

3. Logical inference, proof by contradition

4. Models of axiomatic systems

5. Incidence geometry

6. Hilbert's axioms of betweenness, congruence, continuity, and parallelism

7. Neutral geometry

8. History of the Parallel Postulate and its equivalences

9. Independence of the Parallel Postulate, non-Euclidean models