MATH 420 – Geometry

Course Description from Bulletin: The course is focused on selected topics related to fundamental ideas and methods of Euclidean geometry, non-Euclidean geometry, and differential geometry in two and three dimensions and their applications with emphasis on various problem-solving strategies, geometric proof, visualization, and interrelation of different areas of mathematics. (3-0-3)

Enrollment: Elective for Mathematics Education, Applied Mathematics, and other majors. To be cross-listed with MSED 520.

Textbook(s): Robin Hartshorne (2000), *Geometry: Euclid and Beyond*, Springer-Verlag (ISBN 0-387-98650-2)
Andrew Pressley (2001), *Elementary Differential Geometry*, Springer Undergraduate Mathematics Series (ISBN 1-852-33152-6)
Benjamin Bold (1982), *Famous Problems of Geometry and How to Solve Them*, Dover Publications (ISBN 0-486-24297-8)
International mathematics Olympiads problem books
Instructor's selected handouts

Other required material: The course instructor may distribute various handouts during class meetings

Prerequisites: Consent of the instructor

Objectives:

1. Students will develop a deep conceptual understanding of fundamental ideas and methods related to topics in Euclidean geometry in two and three dimensions.
2. Students will develop various problem solving approaches and strategies emphasizing multi-level geometric reasoning.
3. Students will use formal axiomatic systems to construct and analyze proofs.
4. Students will be provided with visual interpretations of the results.
5. Students will be provided with non-trivial connections with the pre-college geometric concepts from an advanced viewpoint.
6. Students will practice their technical writing skills.

Lecture schedule: 1 150 minute (or 2 75 minute) lectures per week

Course Outline:	Hours
1. Classic Euclidean Geometry in Two and Three Dimensions	12
a. Axiomatic Foundations of Geometry	
b. Formal Proof in Geometry	
c. Geometric Constructions	
d. Area and Volume	
2. Classic Non-Euclidean Geometry	5
3. Geometry of Curves and Surfaces	22
a. Curves in the Plane and in Space	
b. Curvature of Curves	
c. Surfaces, Tangents, and Normals	

d. The First Fundamental Form
e. Lengths of Curves on Surfaces
f. Surface Area
g. The Second Fundamental Form
h. Curvature of Surfaces

4. Applications 5
    a. Problem Solving in Geometry
    b. Geometric Methods of Mathematical Modeling

Assessment:	Homework	20-30%
	Project	10-20%
	Tests	20-50%
	Final Exam	30-50%

Syllabus prepared by: Zaur Berkaliev and Shuwang Li
Date: Feb. 8, 2006 (modified July 9, 2015)