Tennessee Technological University
Mathematics Department

MATH 3430: College Geometry

I. COURSE DESCRIPTION FROM CATALOG:

A rigorous development of geometry from first concepts using the metric approach. Topics include constructions and hyperbolic geometry. Lec. 3. Cr. 3.

II. PREREQUISITE(S):

C or better in MATH 3400. It is recommended that students complete MATH 2010 Matrix Algebra before taking this class.

III. COURSE OBJECTIVE(S):

To provide an introduction to various geometric systems using the axiomatic and synthetic approaches

To emphasize paragraph proofs

To present an analytical model of the Euclidean plane

To present and classify geometrical transformations of the Euclidean plane

To introduce students to technology such as *The Geometer's Sketchpad*

IV. STUDENT LEARNING OUTCOMES:

Upon successful completion of the course students will understand basic properties of axiomatic systems, including consistency, independence, and completeness, as well as the role of geometric models in establishing these properties; understand geometric and affine transformations of the Euclidean plane and understand an analytic model of the Euclidean plane; understand axioms of hyperbolic and elliptic geometries, including Playfair's Axiom and Dedekind's Axiom of Continuity, and how these axioms differ from those of Euclidean geometry; be able to prove propositions in hyperbolic geometry; understand the concept of duality and be able to check if a set of axioms satisfies the principle of duality; and be able to prove propositions in finite geometries on the basis of the given axioms using Aristotelian logic.

V. TOPICS TO BE COVERED:

Axiomatic systems and finite geometries:
Checking independence, completeness, and consistency of axioms via models. Finite geometries such as three-point geometry, four-point geometry, finite projective planes. Applications to error-correcting codes Desargues' Configurations (optional)

Non-Euclidean geometry:
Review of Euclid' s postulates and the First 30 propositions of *Elements, Book I* . The Fifth Postulate and its negation. Study of hyperbolic geometry (sensed parallels, asymptotic triangles, Saccheri quadrilaterals, area of triangles, ultra parallels). Brief study of single and double elliptic geometries through models. Geometric transformations of the Euclidean plane:
(a) Line and point reflections, rotations and finite symmetry groups exploration
(b) Translations and frieze pattern symmetries exploration
(c) An analytic (affine) model of the Euclidean plane

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