Geometry

Syllabus Number 4B206
Basic Major Subjects
Elective 2 credit
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1. Course Description

Euclidean geometry and projective geometry are explained based on the following theorems: (1) Ceva's theorem, (2) Menelaus' theorem, (3) Pascal's theorem, (4) Brianchon's theorem, and (5) Desargues' theorem. An introduction to analytic geometry (Cartesian geometry) is given based on the following items: (1) conic sections (ellipse, parabola and hyperbola) and (2) quadric surfaces (ellipsoid, hyperboloid of one/two sheet(s), elliptic paraboloid, etc.). Some cutting-edge topics on modern geometry (topology, graph theory, and computational geometry) are introduced.

2. Course Objectives

The aim of this course is to understand the following items: (1) basic theorems in Euclidean geometry and projective geometry, (2) some applications of these basic theorems, (3) basic properties of conic sections, (4) standard forms of conic sections, (5) basic properties of quadric surfaces, and (6) history and types of modern geometry.

3. Grading Policy

Students are evaluated by a term examination, some midterm examinations, and some quizzes.

4. Textbook and Reference

Textbook
No textbook. The original slides and video contents are used.
Reference
No reference. The original slides and video contents are used.

5. Requirements(Assignments)

The slides of the lecture should be read. The video contents of the lecture should be viewed.

6. Note

LMS is used in this course.

7. Schedule

[1] Introduction: Outline of this course. History of geometry.
[2] Euclidean geometry (1): Parallel postulate (Euclid's fifth postulate).
[3] Euclidean geometry (2): Pythagorean theorem and its variants.
[4] Euclidean geometry (3): Triangle centers. Euler line.
[5] Euclidean geometry (4): Ceva's theorem. Menelaus' theorem.
[6] Projective geometry (1): Points at infinity. Fundamental theorem of projective geometry. Desargues' theorem.
[7] Projective geometry (2): Principle of duality. Pascal's theorem. Brianchon's theorem.
[8] Projective geometry (3): Menelaus' theorem reconsidered. Midterm examination.
[9] Analytic geometry (1): Basic concepts of analytic geometry.
[10] Analytic geometry (2): Cartesian coordinate system. Lines and planes.
[11] Analytic geometry (3): Conic sections. Ellipse. Parabola. Hyperbola.
[12] Analytic geometry (4): Quadric surfaces. Ellipsoid. Hyperboloid. Elliptic paraboloid.
[13] Modern geometry (1): Topics on topology.
[14] Modern geometry (2): Topics on graph theory.
[15] Modern geometry (3): Topics on computational geometry. Term examination.