Philadelphia University
Faculty of Science
Department of Mathematics
Second Semester, 2023 – 2024

Course Syllabus	
Course Title: Modern Euclidean Geometry 1	**Course code:** 0250262
Course Level: 2+	**Course prerequisite:** Set Theory
Lecture Time: Sun.– Tue. 11:15 - 12:30	**Credit Hours:** 3
Location: S/21004	**Contact Hours:** 3

Academic Staff Specifics				
Name	**Rank**	**Office no. & location**	**Office hours**	**E-mail address**
Ahmad Hamdan	**Lecturer**	**819 / Faculty of Science**	**Sat. - Tue. 9:45 – 11:00**	ahamdan@philadelphia.edu.jo

Course description (According to the University Catalogue)

Axioms of Euclidean geometry, isomorphism and models, finite geometries, neutral geometry, equivalents of the parallel postulate, hyperbolic geometry, and projective geometry.

Course objectives:

This course presents, from a modern point of view, Books I, II, III, and VI, as well as parts of Books IV, XI, XII, and XIII of Euclid's *Elements*. These include thorough treatments of the geometry of the triangle, the geometry of the circle, and the theory of Platonic figures.

The presentation is modern in the following many ways. It pinpoints the inadequacy of Euclid's axioms and some imperfections in his proofs, together with remedies based on Hilbert's axioms of Euclidean geometry. It gives some equivalents of the fifth axiom and briefly describes the attempts at proving it that culminated in the creation of non-Euclidean geometries, such as hyperbolic geometry. It uses tools from modern branches of mathematics such as trigonometry and algebra and includes theorems of Euclidean geometry that were discovered after Euclid, such as the theorems of Ptolemy, Heron, Brahmagupta, Stewart, Euler, and others. It may also briefly overview extensions to three-dimensional space and some theorems that appear in Book I of Euclid's *Elements*.

The course takes into great consideration the needs of students who will eventually become school teachers.

Course resources

- **Textbook (and sites)**:

1) Title	Classical Geometry- Euclidean, Transformational, Inversive, and Projective
Authors	I. E. Leonard, J. E. Lewis, A. C. F. Liu, and G. W. Tokarsky
Publisher	John Wiley & Sons, Inc.
Edition	1
Year	2014
ISBN	978 – 1 – 118 – 67919 – 7
2) Title	Euclidean and Non-Euclidean Geometries – Part A (Informal Lecture Notes)
Authors	I. E. Leonard, J. E. Lewis, A. C. F. Liu, and G. W. Tokarsky
Publisher	Mowaffaq Hajja.
Edition	1
Year	2011
ISBN	None

- **Support material**: Polyhedral models made of cardboard.

Teaching methods

The course material is available to students in Textbook [2] mentioned earlier. The very same material will be presented in class using a data show, complemented with illustrations, explanations, and figures on the board. Textbook [2] is designed so that it can be used as a notebook also, with a lot of space and blank pages everywhere so that students can write their notes and draw their figures in the appropriate places. In due time, polyhedral models made of cardboard will be brought to class to illustrate the ideas pertaining to the geometry of three-dimensional solids.

Learning outcomes:

- **Knowledge and understanding**
  The students are expected to have an overview of the creation and development of geometry. They will learn a lot of formulas and theorems that will be useful to them in many other contexts.

- **Cognitive skills (thinking and analysis).**
  The various methods of proof and ways of thinking that students usually learn in courses on foundations and that they use in various courses are met and practiced in this course in natural contexts that are a beautiful blend of the concrete and the abstract.

- **Communication skills (personal and academic).**
  In practicing proofs, students are expected to develop their communication skills.

- **Transferable skills.**

- **Psychomotor skills (whenever applicable).**

Assessment instruments

- Exams (First, Second and Final Exams)
- Quizzes.
- Short reports and/or presentations, and/or short research projects.
- Homework assignments

Allocation of Marks		
Assessment Instruments	**Expected Time**	**Mark**
Reports, research projects, quizzes, homework, and projects.	5 at least	**30%**
Midterm examination	04/12/2022 – 15/12/2022	**30%**
Final examination	05/02/2023 - 13/02/2023	**40%**
Total		**100%**

Course/ academic calendar

week	Basic and support material to be covered
(1)	Mathematics Before Euclid
(2)	Euclid's Proof of the Pythagorean Theorems, and Content and Axiomatic Structure of Euclid's *Elements*
(3)	Euclid's Book I (a): The Neutral Theorems
(4)	Euclid's Book I (b): The Non-Neutral Theorems
(5-6)	Euclid's Book II: Law of Cosines, Theorems of Apollonius and Stewart
(7)	Euclid's Book VI: Similarity, Law of Sines, and Heron's Formula
(8-9)	Euclid's Book III: The Circle
(10)	Ptolemy's Theorem, Brahmagupta's Formula
(11)	Euclid's Book V: Constructability of Regular Polygons, and the Modern Theory of Euclidean Constructability
(12-13)	Platonic and Archimedean Solids
(14-15)	Euler's $V - E + F$ Formula
(16)	**Final examination**

Expected workload:

On average students need to spend 2 hours of study and preparation for each 50-minute lecture/ tutorial.

Documentation and academic honesty

- Documentation style (with illustrative examples). Documentation is a most important component of academic honesty. Thus, if you use any material from certain sources when writing homework, you should cite these sources and should clearly describe how you have used them.
- Protection by copyright. The rules of copyright should be completely respected when using copyrighted material.
- Avoiding plagiarism. All forms of plagiarism will be seriously taken and strongly penalized. These include cheating and trying to cheat in examinations and copying other students' work when preparing homework. Plagiarism will result in a failing grade and will be reported to the administration for disciplinary action.

Attendance policy:

Absence from lectures and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

Other Education Resources

- **Books**

1) Title	Geometry, from Euclid to Knots
Authors	S. Stahl
Publisher	Prentice Hall
Edition	1
Year	2003
ISBN	0 – 13 – 032927 – 4
2) Title	Introduction to Geometry
Authors	H. S. M. Coxeter
Publisher	John Wiley & Sons, Inc.
Edition	2
Year	1969
ISBN	471 – 18283 – 4
3) Title	Geometry for College Students
Authors	I. M. Isaacs
Publisher	American Mathematical Society
Edition	1
Year	2001
ISBN	978 – 0 – 8218 – 4794 – 7

- **Journals**

1) Title	The Mathematical Gazette
Publisher	The Mathematical Association of the United Kingdom
Since	1917
2) Title	The College Mathematics Journal
Publisher	The Mathematical Association of America
Since	1970
3) Title	Mathematics Magazine
Publisher	The Mathematical Association of America
Since	1928
4) Title	The American Mathematical Monthly
Publisher	The Mathematical Association of America
Since	1894

- **Websites**

https://mathcs.clarku.edu/~djoyce/java/elements/