

**Philadelphia University**

**Faculty of Science**

**Department of Basic Sciences and Mathematics**

**First Semester, 2022 – 2023**

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

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| **Academic Staff Specifics** | | | | |
| **Name** | **Rank** | **Office no. & location** | **Office hours** | **E-mail address** |
| **Dr. Rola alseidi** | **Assistant Professor** |  | **12:30-2:00**  **Sat. + Mon. 10:00 – 11:00 Sun. + Tues.** | [ralseidi@philadelphia.edu.jo](mailto: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)**:

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| 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 |
| 1. **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

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| **Allocation of Marks** | | |
| **Assessment Instruments** | **Expected Time** | **Mark** |
| Reports, research projects, quizzes, homework, and projects. | 5 at least | **20 – 30%** |
| Midterm examination | 04/12/2022 – 15/12/2022 | **30%** |
| Final examination | 05/02/2023 - 13/02/2023 | **40 – 50%** |
| Total |  | **100%** |

**Course/ academic calendar**

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| **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**

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

* **Journals**

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| 1. **Title** | The Mathematical Gazette |
| **Publisher** | The Mathematical Association of the United Kingdom |
| **Since** | 1917 |
| 1. **Title** | The College Mathematics Journal |
| **Publisher** | The Mathematical Association of America |
| **Since** | 1970 |
| 1. **Title** | Mathematics Magazine |
| **Publisher** | The Mathematical Association of America |
| **Since** | 1928 |
| 1. **Title** | The American Mathematical Monthly |
| **Publisher** | The Mathematical Association of America |
| **Since** | 1894 |

* **Websites**

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