**THE EDUCATION UNIVERSITY OF HONG KONG**

**Course Outline**

**Part I**

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**Programme Title :** Master of Arts in Mathematics and Pedagogy

**Programme QF Level :** 6

**Course Title :** Foundations of Geometry

**Course Code :** MTH6129

**Department :** Mathematics and Information Technology

**Credit Points :** 3

**Contact Hours :** 39

**Pre-requisite(s) :** Nil

**Medium of Instruction :** English supplemented with Chinese

**Course Level :** 6

**Part II**

The University’s Graduate Attributes and seven Generic Intended Learning Outcomes (GILOs) represent the attributes of ideal EdUHK graduates and their expected qualities respectively. Learning outcomes work coherently at the University (GILOs), programme (Programme Intended Learning Outcomes) and course (Course Intended Learning Outcomes) levels to achieve the goal of nurturing students with important graduate attributes.

In gist, the Graduate Attributes for Undergraduate, Taught Postgraduate and Research Postgraduate students consist of the following three domains (i.e. in short “PEER & I”):

* **P**rofessional **E**xcellence;
* **E**thical **R**esponsibility; **&**
* **I**nnovation.

The descriptors under these three domains are different for the three groups of students in order to reflect the respective level of Graduate Attributes.

The seven GILOs are:

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| 1. Problem Solving Skills |
| 2. Critical Thinking Skills |
| 3. Creative Thinking Skills |
| 4a. Oral Communication Skills |
| 4b. Written Communication Skills |
| 5. Social Interaction Skills |
| 6. Ethical Decision Making |
| 7. Global Perspectives |

1. **Course Synopsis**

This course aims to introduce various approaches to the study of mathematical ideas, properties, and relationships in geometry with specific emphasis on Euclidean geometry and its insights extended to non-Euclidean geometries.

This course will broaden the students’ understanding of geometry and its implications, and provide a rigorous treatment on the foundation of Euclidean geometry. Topics in Euclidean Geometry including Euclid’s Elements, congruence, geometric inequalities, parallelism, the Pythagorean Theorem are studied from an advanced standpoint. The approach to the material will be axiomatic and proofs will be required throughout. Incidence Geometry will be introduced to show how axioms affect geometric structure.

A brief treatment on non-Euclidean geometry together with the historical development of these areas will provide students with a fuller understanding of the evolution and application of mathematical concepts.

This course will equip school teachers with a sound knowledge of geometry as well as a deep understanding of its important role in problem-solving. They will gain from this course both competence and confidence to teach school geometry.

1. **Course Intended Learning Outcomes** (CILOs)

*Upon completion of this course, students will be able to:*

CILO1 demonstrate an ability to prove results in axiomatic geometry.

* + - * 1. State and explain the concepts of geometrical reasoning.
        2. State and explain various fundamental axioms, theorems and techniques in various geometries.

CILO2 understand the concepts of the fundamentals of geometry

1. State and explain the concepts of geometrical reasoning under Euclidean Geometry
2. State and understand the definitions in Euclid’s Elements.
3. State and explain various fundamental axioms, theorems and techniques under Euclidean Geometry.

CILO3 explain the concepts of the basic Incidence Geometry

1. Explain the concepts of Incidence Geometry and its basic consequences.
2. State and explain the basic geometric differences in Euclidean and Incidence Geometries.

CILO4 use tools and dynamic software to sketch geometric objects

1. **Content, CILOs and Teaching & Learning Activities**

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| **Course Content** | **CILOs** | **Suggested Teaching & Learning Activities** |
| Introduction to axiomatic systems | *CILO1* | Lectures, group discussions, exploring by using dynamic geometry software and on-line learning. |
| Axiomatic approach and logical structure in Euclidean geometry: undefined terms and defined terms, postulates and axioms, common notions and definitions | *CILO1,2,4* |
| Euclid’s Elements: congruence, parallelism, the Pythagorean Theorem and its converse | *CILO1,2,4* |
| Incidence Geometry: Incidence Axioms, finite geometry, the parallel postulates in incidence geometry, theorem in incidence geometry | *CILO1,3,4* |
| Sketch geometric objects | *CILO1,2,3,4* |

1. **Assessment**

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| **Assessment Tasks** | | **Weighting (%)** | **CILO** |
| (a) | Assignment on solving problems using the techniques learned in the course | 20 | *CILO1,2,3,4* |
| (b) | Quiz | 20 | *CILO1,2,3* |
| (c) | Written examination on the content materials | 60 | *CILO1,2,3* |

1. **Required Text(s)**

Nil

1. **Recommended Readings**

Berele, A. & Golden, J. (2001). *Geometry: theorems and constructions*. Upper Saddle River, N.J.: Prentice Hall.

Greenberg, [M. J.](http://www.amazon.com/Marvin-J.-Greenberg/e/B001IOFFF2/ref=sr_ntt_srch_lnk_22?qid=1442995462&sr=1-22) [(2007). *Euclidean and Non-Euclidean Geometries: Development and History*, W. H. Freeman](http://www.amazon.com/Euclidean-Non-Euclidean-Geometries-Development-History/dp/0716799480/ref=sr_1_22?s=books&ie=UTF8&qid=1442995462&sr=1-22&keywords=plane+geometry).

Hartshorne, R. (2000). *Geometry: Euclid and beyond*. New York: Springer-Verlag.

Henle, M. (2001). *Modern Geometries: Non-Euclidean, Projective, and Discrete Geometry* (2nd ed.). Upper Saddle River, N.J.: Prentice-Hall.

[Libeskind](http://www.amazon.com/Shlomo-Libeskind/e/B001IGNPNO/ref=dp_byline_cont_book_1), S. (2007). *Euclidean and Transformational Geometry: A Deductive Inquiry*, Jones & Bartlett Learning.

Noronha, M. H. (2002). *Euclidean and Non-Euclidean Geometries*. New Jersey: Prentice Hall/ Pearson Education.

Stahl, S. (2003). *Geometry: from Euclid to knots*. Upper Saddle River, New Jersey: Prentice Hall/ Pearson Education.

Thomas, D. A. (2002). *Modern Geometry*. Pacific Grove, Calif.: Brooks/Cole.

Wallace, E.C. and West, S. F. (2004). *Road to geometry* (3rd ed.). Upper Saddle River, N.J.: Prentice Hall.

Venema, Gerard A. (2006). *The Foundations of Geometry*. New Jersey: Prentice Hall/ Pearson Education.

項武義 (2009)基礎幾何學基礎數學講義台北市五南圖書出版有限公司。

1. **Related Web Resources**AMS (American Mathematical Society)

<http://www.ams.org/mathweb/>

Elliptic Geometry Drawing Tools

<http://forum.swarthmore.edu/sketchpad/maa96/findell/>

Gateway to Educational Materials (GEM)

<http://www.thegateway.org/>

Geometry

<http://www.abc.se/~m9847/matre/geometr.html>

Geometry In Action

<http://www.ics.uci.edu/~eppstein/geom.html>

Geometry Center

<http://www.geom.umn.edu/>

Geometry Forum

<http://mathforum.org/>

JAVA Gallery of Interactive Geometry

<http://www.geom.umn.edu/java/>

Java Geometry Explorer

<http://sprott.physics.wisc.edu/pickover/omega.htm>

NonEuclid

<http://math.rice.edu/~joel/NonEuclid/>

Euclid’s Elements

<http://aleph0.clarku.edu/~djoyce/java/elements/elements.html>

WU Hung-Hsi's Home Page

<http://math.berkeley.edu/~wu/>

1. **Related Journals**

Nil

1. **Academic Honesty**

The University adopts a zero tolerance policy to plagiarism. For the University’s policy on plagiarism, please refer to the *Policy on Academic Honesty, Responsibility and Integrity with Specific Reference to the Avoidance of Plagiarism by Students* (<https://www.eduhk.hk/re/modules/downloads/visit.php?cid=9&lid=89>). Students should familiarize themselves with the Policy.

1. **Others**

Nil

Last update: 04-06-2018