



UNIVERSITY OF NICOSIA ΠΑΝΕΠΙΣΤΗΜΙΟ ΛΕΥΚΩΣΙΑΣ

University of Nicosia, Cyprus

Course code EDUE-131	Course title Fundamental concepts of primary school mathematics	ECTS Credits: 6
Department Pedagogical Studies	Semester Fall/Spring	Prerequisites None
Type of Course Required	Field Mathematics	Language of Instruction Greek
Level of Course Undergraduate	Year of Study 1st	Lecturer Dr George Philippou
Mode of Delivery face-to-face	Work Placement N/A	Co-requisites None
Recommended Optional Programme Components: N/A		

Objectives of the course:

The aim of this course is to lead students to an advanced understanding of the basic concepts and methods of primary mathematics. More specifically, the objectives of the course are to facilitate students become able to:

- Discuss mathematics as a human activity which aims to satisfy real life needs or/and human mental curiosity.
- Notice that doing elementary mathematics and consequently learning mathematics, lies within the ability of all students, even though a demanding and time consuming process.
- Follow the historical development of elementary mathematics and particularly of concepts and processes related to primary school mathematics
- Locate epistemological obstacles during the development of mathematics that will probably trouble students and describe means and methods for surmounting them, which were proved efficient in practice.
- Apply elementary concepts and methods for the solution and for the construction of new problems.
- Provide arguments to justify relations and describe and apply the proving process

to simple arithmetic and geometric relations and theorems.

- Setup their own repertoire with activities and examples appropriate for teaching mathematics to primary students.

Learning outcomes:

By the end of the course, the students are expected to be able to:

- Refer to, discuss and apply the properties of different number systems (including additive and place-value systems, including bases other than 10) in solving related problems.
- Describe the meaning of “proof” and construct proofs of simple properties and theorems of arithmetic and geometry.
- Define basic kinds of numbers (i.e., prime and composite, perfect numbers, schematic numbers, etc.) list and prove some of their properties and apply them in problem solving.
- Define, describe and apply elementary and geometry concepts (i.e., angles and lines/parallelism, equality and similarity of triangles, the circle, the Pythagorean Theorem etc.) refer to relations and prove simple theorems.
- Refer to the axiomatic foundation of a mathematical theory and describe its effect on the development mathematics and science in general.
- Define the concept of divisibility, prove some of its properties and apply them for the solution of simple problems.
- Describe and apply Euclid’s algorithm for finding the GCD for two or more natural numbers.
- Describe the fundamental theorem of arithmetic and apply it for finding of the LCM and GCD of two or more numbers.

Course content:

The learning activities and class discussions of this course focus on the following content topics.

- The development of the first number systems and some elements from the Babylonian and the Egyptian mathematics. The sphenoid and the hieroglyphic numeration system in comparison to other systems, e.g., the Greek alphabetic and the Latin number system.
- Place value systems, the decimal as well as systems with other bases, with some emphasis on the binary system. Changing a given number from one base

to another.

- Early Greek mathematics and the concept of proof. Some elements from Pythagorean mathematics. Properties of the natural numbers and some categories i.e., prime and composite numbers, perfect numbers, amicable numbers, and schematic numbers.
- Pythagoras' theorem, Pythagorean triples and some proofs of the Pythagorean Theorem: Based on different partition of the area of a square, using similarity of triangles, Heron' formula of the area of a triangle, etc.
- The three famous problems of antiquity (squaring the circle, doubling the cube and trisecting the angle) and some their "solutions".
- A short introduction to Euclid's Elements. Defining the concepts, the set of axioms for geometry and some theorems. The fifth axiom and the theorems of parallelism.
- Divisibility: Definition, properties and applications. Divisibility by 2, by 5, and by 10, divisibility by 4, by 25, and by 100, divisibility by 3, and by 9 etc.
- Euclid's algorithm for the finding of the GCD. The fundamental theorem of arithmetic and its use for the computation of the GCD and the LCM of two or more numbers.

Learning activities and teaching methods:

Lecture, discussion and students' activities under the guidance of the instructor.

Assessment methods:

Class participation/individual study, Midterm exams (two), Written final exam.

Bibliography

Main text book

Philippou, G. N. (2004). An introduction to the foundations and the fundamental concepts of Mathematics. Athens: ATRAPOS

Complementary sources

Boyer, C.B. & Merzbach, U.C. (1989). *A history of Mathematics*. Singapore: John Wiley & Sons.

Bunt, L.N.H., Jones, P.S. & Bedient, J.D. (1981). *Historical of elementary mathematics*. Translation in Greek by A Phairentinou-Nikolakopoulou. Athens: Pnevmatikos.

Davis, P.J. & Hersh, R. (1981). *Mathematical Experience*. Translation G. Anastasiades. Athens: TROXALIA.

Eves, H. (1990). *An introduction to the History of Mathematics*, Sixth Edition. Saunders College Publishing.

Gundlach, B.H. (1993). The History of Numbers and Numerals. In J.K. Baumgart et al. (Eds.), *Historical Topics for the Mathematics Classroom* (pp. 36 - 87). The National Council of Mathematics. VA: The Council.

Jones, P. (1993). The History of Mathematics as a Teaching Tool, In J.K. Baumgart et al. (Eds.), *Historical Topics for the Mathematics Classroom* (pp. 1-18). The National Council of Teachers of Mathematics. VA: The Council.

Struik, D. J. (1987). *A Concise History of Mathematics*. New York : Dover Publications, Inc.

Swetz, F. et al. (Ed.) (1995). *Learn from the masters!* Washington, DC: Mathematical Association of America.

A list of addresses from the Internet on history of mathematics

DAVID JOYCE'S HISTORY OF MATHEMATICS WEB RESOURCES

<http://aleph0.clarku.edu/~djoyce/mathhist/webresources.html>

LINKS TO INFORMATION ON NUMBER SYSTEMS

<http://mathforum.org/alejandre/numerals.html>

TRINITY COLLEGE, DUBLIN, HISTORY OF MATHEMATICS ARCHIVE:
HISTORY OF MATHEMATICS WEB DIRECTORY

<http://www.maths.tcd.ie/pub/HistMath/Links.html>

DAVID JOYCE'S HISTORY OF MATHEMATICS HOME PAGE

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

A COMMON BOOK OF π

<http://ernie.bgsu.edu/^carother/pi/Pi1.html>

CALENDAR: A HISTORY

<http://www.ernie.cummings.net/calendar.htm>

BABYLONIAN MATHEMATICS

http://www.tmeg.com/bab_maVbab_mat.htm

EGYPTIAN MATHEMATICS PROBLEMS

<http://eyelid.ukonline.co.uk/ancient/maths1.htm>

<http://eyelid.ukonline.co.uk/ancient/maths2.htm>

<http://eyelid.ukonline.co.uk/ancient/maths3.htm>

SYMBOL, FORM AND NUMBER IN ANCIENT EGYPT

<http://www.seshat.ch>