

MODULE OUTLINE

1. GENERAL INFORMATION

SCHOOL	SCHOOL OF SCIENCE AND TECHNOLOGY		
PROGRAM COURSE	MASTER IN MATHEMATICS (MSM)		
LEVEL OF STUDY	POSTGRADUATE		
MODULE CODE	MSM81	YEAR OF STUDY	2 nd
MODULE TITLE	Historical Evolution & Mathematical Education		
INDEPENDENT TEACHING ACTIVITIES		HOURS	CREDIS
<i>in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits</i>			
Weekly teaching hours 17,5*32 weeks		560	20 ECTS
COURSE TYPE	Optional mandatory. The course leads to the direction of "Mathematical Education" (C)		
Compulsory, Optional, Optional mandatory			
PREREQUISITE MODULES:	NO		
LANGUAGE OF INSTRUCTION AND EXAMS	GREEK		
THE MODULE IS OFFERED TO ERASMUS STUDENTS	No (due to annual duration of the module)		
MODULE WEBSITE (URL)	https://www.eap.gr/education/postgraduate/annual/postgraduate-studies-in-mathematics/topics/#m81 Each module has its own space in the Learning Management System of EAP (http://study.eap.gr), with controlled access (use of code) for students and teaching staff.		

2. LEARNING OUTCOMES

<p>Learning Outcomes</p> <ul style="list-style-type: none"> The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:
<p>Upon successful completion of MSMB81 "History and Teaching of Mathematics", students will have developed the following skills:</p> <ul style="list-style-type: none"> Ability to critically assess contemporary questions in Mathematics philosophy In-depth knowledge of the evolution of mathematical concepts, structures, and fields Knowledge of the factors driving the evolution of Mathematics <p>More particularly, learning outcomes are the following:</p> <ul style="list-style-type: none"> Ability to discern the differences between Logicism, Formalism, and Intuitionism, in addition to the influence of typical results of Logic on these philosophical schools of thought.

- Ability to analyze issues of ontology connected with the schools of mathematical philosophical thought.
- Ability to manage the truth values of mathematical claims within the philosophical school to which they belong.
- Ability to relate philosophical questions about the nature of Mathematics to their teaching practice.
- Ability to examine the structure of an axiomatic system, scrutinize its consistency, and understand the evolution of its axiomatic foundation.

Students are required to actively participate at two levels: a) in the search for reputable literature from free sources (open access journals) that supplements the arguments and critical assessment of their positions, and b) in the application of the knowledge they have obtained in practical teaching circumstances.

Students will obtain the ability to base their assertions not only on their existing experience, but also on references to reputable sources.

The unit offers students the opportunity to develop their ability to manage the knowledge they have obtained, edit scientific papers, and write critical, scientifically documented assertions.

Furthermore, students shall become acquainted with assessing scientific papers drawn from journals and drawing key positions and conclusions from them.

To better connect the aforementioned subjects, students will write “case studies”.

Finally, a separate part of the unit dedicated to the interaction between modern Mathematics and Cognitive Science.

General Competences

Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?

<i>Search for, analysis and synthesis of data and information by the use of appropriate technologies,</i>	<i>Project planning and management</i>
<i>Adapting to new situations</i>	<i>Respect for diversity and multiculturalism</i>
<i>Decision-making</i>	<i>Environmental awareness</i>
<i>Individual/Independent work</i>	<i>Social, professional and ethical responsibility and sensitivity to gender issues</i>
<i>Group/Team work</i>	<i>Critical thinking</i>
<i>Working in an international environment</i>	<i>Development of free, creative and inductive thinking</i>
<i>Working in an interdisciplinary environment (Other.....citizenship, spiritual freedom, social awareness, altruism etc.)</i>	<i>.....</i>
<i>Introduction of innovative research</i>	<i>.....</i>

- Search for, analysis and synthesis of data and information by the use of appropriate technologies,
- Adapting to new situations
- Decision-making
- Individual/Independent work

- Project planning and management
- Critical thinking
- Development of free, creative and inductive thinking

3. MODULE CONTENT

The objective of the module consists of three submodules- subsections.

MSM81_1: The subsection, "Foundations and Fundamental Concepts of Mathematics, Philosophy of Mathematics",

MSM81_2: The subsection, "Cognitive Sciences and Mathematics",

MSM81_3: The subsection, "Mathematical Education".

Cognitive Subjects of the module are:

- Historical Evolution of Fundamental Mathematical Concepts
- Diachronic and Contemporary Trends in Mathematics Education
- Foundations of Mathematics & Modern Mathematical Theories

More specifically, the syllabus of module MSM81 includes for each subsection the following:

- For the subsection, "Foundations and Fundamental Concepts of Mathematics, Philosophy of Mathematics", the above subjects are introduced and deepened through the books:

---Howard Eves, Foundations and Fundamental Concepts of Mathematics (Dover Books on Mathematics) 3rd Revised Boston: PWS-Kent, 1990

---Davis D, The Nature and Power of Mathematics. ED Univ Creta ,2001 (in greek)

---St. Shapiro, Thinking about Mathematics. The philosophy of Mathematics., Oxford University Press, New York , 2000 ISBN 978-0-19-289306-2

- For the subsection, "Cognitive Sciences and Mathematics", an acquaintance and deepening is made with the main content of the following tasks:

---Rafael Núñez and George Lakoff, The Cognitive Foundations of Mathematics: The Role of Conceptual Metaphor, Handbook of Mathematical Cognition.

---Rafael E. Núñez, Conceptual Metaphor and the Cognitive Foundations of Mathematics: Actual Infinity and Human Imagination.

---Rafael E. Núñez, Embodied Cognition and The Nature of Mathematics.

---Christophe Heintz, Psychologism and the cognitive foundations of mathematics.

---Reviews and criticisms about the book, "Where Mathematics Comes From: How the Embodied Mind Brings Mathematics Into Being", by George Lakoff and Rafael E. Núñez.

- For the subsection, "Mathematical Education", there is an acquaintance and

deepening with the main content from the book D. Tall, Mathematical growth: from Child to Mathematician. Journeys through Three Worlds of Mathematics, <http://www.davidtall.com/mathematical-growth/>

but also material from primary sources and links to Mathematical Education such as the following:

- Mathematics Education Forum <http://mathforum.org/mathed/>
- Mathematics Education Resources:
<http://newton.physics.wvu.edu:8082/jstewart/scied/math.html>
<http://www.mste.uiuc.edu/mathed/mathedlinks.html>
<http://archives.math.utk.edu/topics/mathEducation.html>
- Paul Ernest's page
<http://www.ex.ac.uk/~PErnest/>
- D. Tall: <http://www.warwick.ac.uk/staff/David.Tall/drafts.html>
<http://www.warwick.ac.uk/staff/David.Tall/downloads.htm>

4. TEACHING METHODS--ASSESSMENT

<p style="text-align: center;">MODES OF DELIVERY</p> <p><i>Face-to-face, in-class lecturing, distance teaching and distance learning etc.</i></p>	Distance education with five Group Counseling Meetings (OSS) during the academic year on weekends. (5OSS x 4 hours)						
<p style="text-align: center;">USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</p> <p><i>Use of ICT in teaching, Laboratory Education, Communication with students</i></p>	<p>We use :</p> <p>Remote meetings tools (cisco webex), Presentation software (e.g. power point), Regular communication via email with students</p> <p>Posting assignments on the internet and feedback on the students' effort by posting solutions on the internet and personal comments to each student (accessible only to the same)</p> <p>Posting supplementary material on the internet (OSS slides, old exam topics, etc.)</p> <p>Additionally, the students use office automation tools, web browsers and e-reader for digital books.</p>						
<p style="text-align: center;">MODULE DESIGN</p> <p><i>Description of teaching techniques, practices and methods: Lectures, seminars, laboratory practice, fieldwork,</i></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #e0e0e0; text-align: center;"><i>Activity</i></th> <th style="background-color: #e0e0e0; text-align: center;"><i>Annual Workload</i></th> </tr> </thead> <tbody> <tr> <td>5 OSS (* 4 hours)</td> <td style="text-align: center;">20</td> </tr> <tr> <td>Preparation of</td> <td style="text-align: center;">210</td> </tr> </tbody> </table>	<i>Activity</i>	<i>Annual Workload</i>	5 OSS (* 4 hours)	20	Preparation of	210
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<i>study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc</i>	Assignments (6 assignments * 35 hours)	
	Examination	3
	Individual study	327
	Total module workload (hours)	560
<p><i>The study hours for each learning activity as well as the hours of selfdirected study are given following the principles of the ECTS.</i></p>		
<p>STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS</p> <p><i>Detailed description of the evaluation procedures.</i></p> <p><i>Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other.....etc.</i></p> <p><i>Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students</i></p>	<p>Elaboration of written assignments during the academic year, the average of the grades of which participates in the formation of the final grade of module by 33%, if there is a passable in the final or repetitive examinations. In the final written exams the grade of the written assignments participates in the formation of the final grade of module by 67%.</p> <p>Exams language: Greek</p> <p>All the criteria are posted, both in each written assignment (in the LMS study.eap.gr), as well as in the general regulation of HOU at: https://www.eap.gr/education/study-regulations/</p>	

(6) SUGGESTED BIBLIOGRAPHY

<p><i>- Suggested bibliography:</i></p> <p>---Howard Eves, Foundations and Fundamental Concepts of Mathematics (Dover Books on Mathematics) 3rd Revised Boston:PWS-Kent, 1990</p> <p>---Davis D, The Nature and Power of Mathematics. ED Univ Creta ,2001 (in greek)</p> <p>---St. Shapiro, Thinking about Mathematics. The philosophy of Mathematics., Oxford University Press, New York, 2000, ISBN 978-0-19-289306-2</p> <p>---D. Tall, Mathematical growth: from Child to Mathematician. Journeys through Three Worlds of Mathematics, http://www.davidtall.com/mathematical-growth/</p> <p>Additional digital (and multimedia) material is available within the “study” platform</p> <p><i>-Related scientific papers:</i></p> <p>Rafael Núñez and George Lakoff, The Cognitive Foundations of Mathematics: The Role of</p>
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Conceptual Metaphor, Handbook of Mathematical Cognition.

Rafael E. Núñez, Conceptual Metaphor and the Cognitive Foundations of Mathematics: Actual Infinity and Human Imagination.

Rafael E. Núñez, Embodied Cognition and The Nature of Mathematics.

Christophe Heintz, Psychologism and the cognitive foundations of mathematics.

Reviews and criticisms about the book, "Where Mathematics Comes From: How the Embodied Mind Brings Mathematics Into Being", by George Lakoff and Rafael E. Núñez.

-Related scientific material from internet resources:

Mathematics Education Forum <http://mathforum.org/mathed/>

- Mathematics Education Resources:

- <http://newton.physics.wvu.edu:8082/jstewart/scied/math.html>

- <http://www.mste.uiuc.edu/mathed/mathedlinks.html>

- <http://archives.math.utk.edu/topics/mathEducation.html>

- Paul Ernest's page <http://www.ex.ac.uk/~PErnest/>

- D. Tall: <http://www.warwick.ac.uk/staff/David.Tall/drafts.html>

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