

## COURSE OUTLINE

### GENERAL

|                                                                                                                                                                                                                                                                       |                                                                                                                                                                     |                              |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------|
| <b>SCHOOL</b>                                                                                                                                                                                                                                                         | School of Science                                                                                                                                                   |                              |                |
| <b>ACADEMIC UNIT</b>                                                                                                                                                                                                                                                  | Department of Mathematics                                                                                                                                           |                              |                |
| <b>LEVEL OF STUDIES</b>                                                                                                                                                                                                                                               | Undergraduate                                                                                                                                                       |                              |                |
| <b>COURSE CODE</b>                                                                                                                                                                                                                                                    | <b>MAE511</b>                                                                                                                                                       | <b>SEMESTER</b>              | <b>5</b>       |
| <b>COURSE TITLE</b>                                                                                                                                                                                                                                                   | Real Analysis                                                                                                                                                       |                              |                |
| <b>INDEPENDENT TEACHING ACTIVITIES</b><br><i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i> |                                                                                                                                                                     | <b>WEEKLY TEACHING HOURS</b> | <b>CREDITS</b> |
| Presentations, exercises, lectures                                                                                                                                                                                                                                    |                                                                                                                                                                     | 3                            | 3              |
| <i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>                                                                                                                                              |                                                                                                                                                                     |                              |                |
| <b>COURSE TYPE</b><br><i>general background, special background, specialised general knowledge, skills development</i>                                                                                                                                                | Special background                                                                                                                                                  |                              |                |
| <b>PREREQUISITE COURSES:</b>                                                                                                                                                                                                                                          | Calculus                                                                                                                                                            |                              |                |
| <b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>                                                                                                                                                                                                                      | Greek                                                                                                                                                               |                              |                |
| <b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>                                                                                                                                                                                                                      | Yes                                                                                                                                                                 |                              |                |
| <b>COURSE WEBSITE (URL)</b>                                                                                                                                                                                                                                           | <a href="http://www.math.uoi.gr/GR/studies/undergraduate/courses/perigr/MAE_511.pdf">http://www.math.uoi.gr/GR/studies/undergraduate/courses/perigr/MAE_511.pdf</a> |                              |                |

### LEARNING OUTCOMES

#### Learning outcomes

*The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.*

*Consult Appendix A*

- *Description of the level of learning outcomes for each qualifications cycle, according to*

*the Qualifications Framework of the European Higher Education Area*

- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

It is the most basic introductory course of Real Analysis of the  $n$ -dimensional real space. The student begins to understand the mean of the Lebesgue measure and its properties. He/she learns about the measurable functions and proceed to the Lebesgue integral with its several tools, as Lebesgue Dominated Convergence Theorem, Fatou Lemma, etc. Next the student learns about the difference of the Lebesgue integral with the Riemann integral and with the Generalized (improper) Riemann integral. Finally, he/she learns the absolute continuity, the functions of bounded variation and the Riemann-Stieljies integral.

**General Competences**

*Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?*

*Search for, analysis and synthesis of data and information, with the use of the necessary technology*

*Adapting to new situations*

*Decision-making*

*Working independently*

*Team work*

*Working in an international environment*

*Working in an interdisciplinary environment*

*Production of new research ideas*

*Project planning and management*

*Respect for difference and multiculturalism*

*Respect for the natural environment*

*Showing social, professional and ethical responsibility and sensitivity to gender issues*

*Criticism and self-criticism*

*Production of free, creative and inductive thinking*

*Others*

Working independently

Team work

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

**SYLLABUS**

$n$ -dimensional real space

Lebesgue Measure

Measurable functions

Lebesgue Integral

Comparison of Lebesgue with Riemann and Improper Riemann integrals

Absolute Continuity, Functions of Bounded Variation and Riemann-Stieljies integral

**TEACHING and LEARNING METHODS - EVALUATION**

**DELIVERY**

*Face-to-face, Distance learning, etc.*

Face-to-face

**USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**

*Use of ICT in teaching, laboratory education, communication with*

Use of ICT for the presentation and communication for submission of the exercises

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                 |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <i>students</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                 |                          |
| <b>TEACHING METHODS</b><br><i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i><br><br><i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i>                                       | <b>Activity</b>                                                                                                                                                                 | <b>Semester workload</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Lectures                                                                                                                                                                        | 39                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Home exercises                                                                                                                                                                  | 30                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Essay writing                                                                                                                                                                   | 30                       |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Course total                                                                                                                                                                    | <b>99</b>                |
| <b>STUDENT PERFORMANCE EVALUATION</b><br><i>Description of the evaluation procedure</i><br><br><i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i><br><br><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i> | Greek<br>Public Presentation of part of the course (30%)<br><br><i>Written work (40%) on the theory and solving problems.</i><br><br><i>Presentation of personal work (30%)</i> |                          |

#### ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

GEORGE L. KARAKOSTAS, REAL ANALYSIS, UNIVERSITY OF IOANNINA, 2004 (Greek)

WILLIAM DUNHAM, THE CALCULUS GALLERY, Masterpieces from Newton to Lebesgue, PRINCETON UNIVERSITY PRESS , PRINCETON AND OXFORD , 2005.