## COURSE OUTLINE

## (1) GENERAL

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|---|---|---|---|
| **SCHOOL** | SCHOOL OF SCIENCES | | |
| **DEPARTMENT** | DEPARTMENT OF CHEMISTRY | | |
| **LEVEL OF STUDIES** | ISCED level 6 – Bachelor's or equivalent level | | |
| **COURSE CODE** | YN102 | **SEMESTER** | 1st Semester |
| **COURSE TITLE** | Mathematics I | | |

| **TEACHING ACTIVITIES** *If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.* | **TEACHING HOURS PER WEEK** | **ECTS CREDITS** |
|---|---|---|
| | 4 | 6 |
| | | |
| | | |
| *Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.* | | |

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|---|---|
| **COURSE TYPE** *Background, General Knowledge, Scientific Area, Skill Development* | General Background |
| **PREREQUISITES:** | |
| **TEACHING & EXAMINATION LANGUAGE:** | Greek |
| **COURSE OFFERED TO ERASMUS STUDENTS:** | NO |
| **COURSE URL:** | https://eclass2.emt.duth.gr/courses/CHEM-N1102/ |

## (2) LEARNING OUTCOMES

**Learning Outcomes**
*Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.*

The primary objective of this course is to introduce students to the fundamental concepts of Calculus, with an emphasis on Differential and Integral Calculus. The course aims to equip students with essential mathematical tools necessary for understanding and solving problems encountered in Chemistry and related scientific disciplines. Students will explore key topics including functions, limits, continuity, derivatives, integrals, and basic differential equations. Emphasis is placed on developing the ability to interpret and model real-world problems using mathematical principles. The knowledge acquired will provide a solid foundation for advanced studies in science and engineering courses.

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

- Understand and describe the fundamental concepts of functions, limits, and continuity.
- Compute and interpret derivatives and integrals of elementary functions.
- Apply differential calculus to analyze and model rates of change in scientific problems.
- Apply integral calculus to compute areas, volumes, and other quantities relevant to chemistry and physics.
- Formulate and solve simple differential equations arising in chemical and physical contexts.
- Develop problem-solving skills by applying calculus techniques to real-world scenarios in Chemistry.
- Recognize the role of mathematics as a key analytical tool in scientific reasoning and modeling.

**General Skills**

*Name the desirable general skills upon successful completion of the module*

| | |
|---|---|
| *Search, analysis and synthesis of data and information,* | *Project design and management* |
| *ICT Use* | *Equity and Inclusion* |
| *Adaptation to new situations* | *Respect for the natural environment* |
| *Decision making* | *Sustainability* |
| *Autonomous work* | *Demonstration of social, professional and moral responsibility and* |
| *Teamwork* | *sensitivity to gender issues* |
| *Working in an international environment* | *Critical thinking* |
| *Working in an interdisciplinary environment* | *Promoting free, creative and inductive reasoning* |
| *Production of new research ideas* | |

## (3) COURSE CONTENT

Week 1: Introduction (Set Theory Elements), Real Function of a Real Variable, Graph of a Function, Linear Function, Operations with Functions, Known Functions (Logarithmic, Exponential, Trigonometric, etc.), Composition of Functions, Linear Function and Characteristics of a Linear Function.

Week 2: Limit of a Function, Definition of Limits, Properties of Limits, One-Sided Limits, Limit to Infinity and Infinite Limit.

Week 3: Continuity of a Function, One-Sided Continuity, Types of Discontinuities, Continuous Extension of a Function, Properties of Continuous Functions, Propositions and Theorems for Continuous Functions.

Week 4: Derivative of a Function, Derivative as a Rate of Change, Differentiation Rules, Chain Rule, Derivative of a Composite Function, Propositions and Theorems of Continuous and Differentiable Functions, Higher-Order Derivative.

Week 5: Applications of Derivatives in Mathematics and Sciences, Geometrical Application of Derivatives

Week 6: Equation of a Tangent Line to a Function, L'Hopital's Rule, Newton-Raphson Method for Finding Approximate Roots of a Function.

Week 7: Optimization of a Real Function, First and Second Derivative Tests for Finding Extreme Points, Convexity, Concavity, and Inflection Points.

Week 8: Integral of a Real Function, Indefinite and Definite Integral, Integration Rules.

Week 9: Methods of Integration, Integration by Substitution, Integration by Parts.

Week 10: Integration of Rational Functions, Generalized Integrals, Applications of Integrals in the Sciences.

Week 11: Introduction to Differential Equations, First-Order Differential Equations, Initial Value Problem.

Week 12: Separable Differential Equations, Homogeneous Differential Equations.

Week 13: Second-Order Differential Equations.

## (4) LEARNING & TEACHING METHODS - EVALUATION

<table>
<tr><td>TEACHING METHOD<br>Face to face, Distance learning, etc.</td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT)<br>Use of ICT in Teaching, in Laboratory Education, in Communication with students</td><td>Use of ICT in Teaching<br>Use of ICT in Communication with students</td></tr>
<tr><td>TEACHING ORGANIZATION<br>The ways and methods of teaching are described in detail.<br>Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.<br><br>The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</td><td><table><tr><th>Activity</th><th>Workload/semester</th></tr><tr><td>Lectures</td><td>52</td></tr><tr><td>Bibliographic research & analysis</td><td>98</td></tr><tr><td>Total</td><td>150</td></tr></table></td></tr>
<tr><td>STUDENT EVALUATION<br>Description of the evaluation process<br><br>Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others<br><br>Please indicate all relevant information about the course assessment and how students are informed</td><td>Student evaluation languages<br>Greek<br>Method (Formative or Concluding)<br>Summative<br>Student evaluation methods<br>Written Exam with Problem Solving<br>Rate<br>100</td></tr>
</table>

## (5) SUGGESTED BIBLIOGRAPHY


- Διαφορικός και Ολοκληρωτικός Λογισμός, 2η έκδοση (2010). ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ. ISBN: 9789605243029.
- Γενικά Μαθηματικά - Απειροστικος Λογισμός τόμος Ι, Αθανασιάδης Χ.Ε., Γιαννακούλιας Ε., Γιωτόπουλος Σ.Χ. Σ.
- ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ι.Κ.Ε. ISBN: 9789602662489. Εισαγωγή στις Διαφορικές Εξισώσεις, Logan David. LIBERAL BOOKS ΜΟΝΟΠΡΟΣΩΠΗ ΕΠΕ. ISBN: 9786185012083.
- Μαθηματικά Ι β έκδοση, Ρασσιάς Θ.. ΕΚΔΟΣΕΙΣ ΤΣΟΤΡΑΣ ΑΘΑΝΑΣΙΟΣ Ε.Ε. ISBN: 9786185066765
- Μαθήματα ανώτερων μαθηματικών, Μπράτσος Αθανάσιος: https://repository.kallipos.gr/handle/11419/424
- Λογισμός συναρτήσεων μιας μεταβλητής, Τουμπής Σταύρος, Γκιτζένης Σάββας: https://repository.kallipos.gr/handle/11419/2177

**Eudoxus**

- Διαφορικός και Ολοκληρωτικός Λογισμός, 2η έκδοση (2010). ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ
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