

COURSE OUTLINE

1. GENERAL

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| SCHOOL | Engineering | | |
| ACADEMIC UNIT | Mechanical Engineering | | |
| LEVEL OF STUDIES | Undergraduate | | |
| COURSE CODE | FE0105 | SEMESTER | 5 th |
| COURSE TITLE | Numerical Methods | | |
| INDEPENDENT TEACHING ACTIVITIES <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> | WEEKLY TEACHING HOURS | CREDITS | |
| Lectures, Practical Exercises | 5 | 6 | |
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| <i>Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).</i> | | | |
| COURSE TYPE <i>general background, special background, specialized general knowledge, skills development</i> | Core, General Knowledge | | |
| PREREQUISITE COURSES: | | | |
| LANGUAGE OF INSTRUCTION and EXAMINATIONS: | Greek | | |
| IS THE COURSE OFFERED TO ERASMUS STUDENTS | No | | |
| ΗΛΕΚΤΡΟΝΙΚΗ ΣΕΛΙΔΑ ΜΑΘΗΜΑΤΟΣ (URL) | https://www.mie.uth.gr/?page_id=17885&lang=en | | |

2. LEARNING OUTCOMES

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| <p>Learning outcomes <i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i> <p>This course aims to provide to the students a theoretical and applied background in the numerical solution of mechanical engineering problems and to upgrade their skills in informatics including the implementation and development of engineering s/w. Following the successful completion of the course it is expected that the students are able to numerically solve linear and nonlinear algebraic systems, perform numerical interpolation and integration as well as to numerically solve ordinary and partial differential equations describing initial and boundary value problems.</p> <p>Upon successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • Implement successfully numerical methods in engineering • Apply and develop engineering software • Solve engineering problems via computational method • Investigate physical phenomena based on numerical solutions <p>General Competences <i>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?</i></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"><i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i></td> <td style="width: 50%; border: none;"><i>Project planning and management</i></td> </tr> <tr> <td style="border: none;"><i>Adapting to new situations</i></td> <td style="border: none;"><i>Respect for difference and multiculturalism</i></td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;"><i>Respect for the natural environment</i></td> </tr> </table> | <i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i> | <i>Project planning and management</i> | <i>Adapting to new situations</i> | <i>Respect for difference and multiculturalism</i> | | <i>Respect for the natural environment</i> |
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| <i>Adapting to new situations</i> | <i>Respect for difference and multiculturalism</i> | | | | | |
| | <i>Respect for the natural environment</i> | | | | | |

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|---|---|
| <i>Decision-making</i> <i>Working independently</i> <i>Team work</i> <i>Working in an international environment</i> <i>Working in an interdisciplinary environment</i> <i>Production of new research ideas</i> | <i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i> <i>Criticism and self-criticism</i> <i>Production of free, creative and inductive</i> <i>.....</i> <i>Others...</i> |
| <ul style="list-style-type: none"> • Retrieve, analyze and synthesize data and information, with the use of necessary technologies • Adjustment to new conditions/situations • Decision making • Autonomous work • Team work • Development of innovative and inductive thinking | |

3. SYLLABUS

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| <ul style="list-style-type: none"> • Introduction to scientific computing and numerical errors • Solution of linear and nonlinear algebraic systems using direct methods (Gauss and Gauss-Jordan elimination, Thomas algorithm, LU factorization) and iterative techniques (Jacobi, Gauss-Seidel, SOR, Newton) • Interpolation methods (polynomial, least squares, splines) • Numerical differentiation (Taylor series, finite differences) and integration (Newton-Cotes formulas and Gauss quadrature) • Solution of ordinary differential equations using Runge-Kutta methods • Solution of basic elliptic differential equations using finite difference methods |
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4. TEACHING and LEARNING METHODS - EVALUATION

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| DELIVERY <i>Face to face, Distance learning, etc.</i> | Face to face | |
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i> | Use of ICT | |
| TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>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> <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> | Activity | Semester workload |
| | Lectures | 60 hours |
| | Self-evaluating exercises | 30 hours |
| | Autonomous work | 60 hours |
| | Total | 150 hours |
| STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i> <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 Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i> | I. Midterm exam (40%) II. Final exam (60%) | |

5. ATTACHED BIBLIOGRAPHY

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- S. C. Chapra and R. P. Canade, Numerical Methods for Engineers, McGraw Hill International, 1998.
- Γ. Δ. Ακρίβης και Β. Α. Δουγαλής, Εισαγωγή στην Αριθμητική Ανάλυση, Πανεπιστημιακές Εκδόσεις Κρήτης, 1998.
- B. Carnahan, H. A. Luther and J. O. Wilkes, Applied Numerical Methods, John and Wiley, 1976.
- C. Pozrikidis, Αριθμητικές Υπολογιστικές Μέθοδοι στην Επιστήμη και τη Μηχανική, Εκδόσεις Τζιόλα, 2006.
- Contantinides, Applied Numerical Methods with Personal Computers, McGraw Hill International, 1988.
- G. V. Davis, Numerical Methods in Engineering & Science, Allen & Unwin, 1978.