**COURSE OUTLINE**

1. **GENERAL**

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| **SCHOOL** | FINANCE AND STATISTICS | | | | |
| **ACADEMIC UNIT** | STATISTICS AND INSURANCE SCIENCE | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | **SAE134** | **SEMESTER** | | **FALL** | |
| **COURSE TITLE** | NUMERICAL ANALYSIS | | | | |
| **INDEPENDENT TEACHING ACTIVITIES** *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* | | | **WEEKLY TEACHING HOURS** | | **CREDITS** |
|  | | | 4 | | 6 |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | | |  | |  |
| **COURSE TYPE**  *general background,  special background, specialised general knowledge, skills development* | General background | | | | |
| **PREREQUISITE COURSES:** |  | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Yes | | | | |
| **COURSE WEBSITE (URL)** | <https://eclass.unipi.gr/courses/SAE134/> | | | | |

1. **LEARNING OUTCOMES**

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| **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* | |
| The aim is to teach numerical methods for solving mathematical problems with the aid of a computer. In addition to its theoretical part, the course familiarizes the student with the computer programming of the methods and application examples.  Main contents: Computer arithmetic. Errors and their propagation. Direct and iterative methods for systems of linear equations. Computation of eigenvalues and eigenvectors. Interpolation and approximation. Solving non-linear equations. Numerical differentiation and integration.  The student learns   1. computer arithmetic, the types of numerical errors and their effects 2. to apply the appropriate numerical method to the problem at hand 3. to correctly interpret the results 4. both the functioning of the methods and their practical application 5. to program numerical methods on the computer. | |
| **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…*  *…….* |
| Search for, analysis and synthesis of data and information, with the use of the necessary technology  Work independently  Production of free, creative and inductive thinking | |

1. **SYLLABUS**

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| * + 1. Computer arithmetic. Loss of significant digits and its avoidance. Error analysis and propagation     2. Direct and iterative methods for solving systems of linear equations     3. Approximation of matrix eigenvalues and eigenvectors. Application in PCA     4. Approximation of functions. Polynomial interpolation. Method of least squares     5. Methods of solving non-linear equations and systems of non-linear equations. Application in maximum likelihood parameter estimation     6. Numerical differentiation and integration     7. Applications using C and R programming |

1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **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 students* | Slides (in teaching)  Laboratory practice  e-class platform (in communication with students) |
| **TEACHING METHODS**  *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.*  *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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 46 | | Laboratory practice | 6 | | Independent study | 98 | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | | Course total | ***150*** | |
| **STUDENT PERFORMANCE EVALUATION**  *Description of the evaluation procedure*  *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.* | Language of evaluation: Greek  Methods of evaluation:  Written exam, including:  - Short-answer questions  - Problem solving  Evaluation criteria are explained to students and are accessible via e-class. |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:*  (in Greek)  1. Βραχάτης, Μ. (2011) Αριθμητική Ανάλυση - Εισαγωγή. Εκδόσεις Κλειδάριθμος.  2. Παπαγεωργίου, Γ. Σ., Τσίτουρας, Χ. Γ. (2015) Αριθμητική Ανάλυση (με εφαρμογές σε Matlab και Mathematica), έκδοση 3η, Τσότρας Αθ.  3. Chapra, S. C., Canale, R. P. (2016) Αριθμητικές Μέθοδοι για Μηχανικούς, έκδοση 7η, Εκδόσεις Τζιόλα.  4. Παπαϊωάννου Στ., Βοζίκης Χρ. (2016) Αριθμητική Ανάλυση, έκδοση 1η, Ακαδημαϊκά Ηλεκτρονικά Συγγράμματα και Βοηθήματα - Αποθετήριο "Κάλλιπος".  *- Related academic journals:* |