COURSE OUTLINE

1. GENERAL INFORMATION

SCHOOL	MARITIME AND INDUSTRIAL STUDIES		
DEPARTMENT	INDUSTRIAL MANAGEMENT AND TECHNOLOGY		
LEVEL OF STUDY	UNDERGRADUATE		
COURSE UNIT CODE	ΤΕΟΔΕ13	**SEMESTER OF STUDY**	8th
COURSE TITLE	COMPUTATIONAL METHODS / TOOLS IN INDUSTRIAL MANAGEMENT		

INDEPENDENT TEACHING ACTIVITIES *in case in which credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and Project		5.5
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at section 4.		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Special background
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATION/ASSESSMENT:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

LEARNING OUTCOMES

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:

APPENDIX A

- *Description of the level of learning outcomes for each qualifications' cycle, according to the European Higher Education Area's Qualification Framework.*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and APPENDIX B*
- *Guidelines for writing Learning Outcomes*

The aim of the course is to familiarize students with the implementation and use of basic computational methods and tools for industrial management. The course focuses on descriptive, predictive, and prescriptive analytics methods with the use of machine learning algorithms and on their integration for solving modern industrial problems. Specific focus is given on the implementation of such methods with the use of the Python programming language. Python offers a plethora of libraries that can be used to build such computational tools for solving real-life scenarios. In the context of this course, students will become familiar with basic use of Python, as well as with libraries for data analytics that can be combined to solve complex problems. Upon successful completion of the course, the students will be able to:

- analyze an industrial case study and choose the appropriate computational tools and methods;
- design a computational method which combines various machine learning algorithms for data analytics;
- apply a computational method and use existing tools for descriptive, predictive, and prescriptive analytics;

- expand their ability to use Python and understand the basic programming principles along with Python's sophisticated functions.

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 aims

Search for, analysis and synthesis of data and information, by the use of technologies that are necessary according the case
Adapting to new situations
Decision-making
Independent work
Team work
Working in an international environment
Working in an interdisciplinary environment
Introduction of innovative research
Project planning and management
Respect for difference and multiculturalism
Environmental awareness
Social, professional and ethical responsibility and sensitivity to gender issues
Critical consciousness, criticism and self-criticism
Development of free, creative and inductive thinking

- Search for, analysis and synthesis of data and information, by the use of technologies that are necessary according the case
- Adapting to new situations
- Decision-making
- Independent work
- Working in an interdisciplinary environment
- Development of free, creative and inductive thinking

2. COURSE CONTENT

The course covers the following topics:

- Introductory lecture, lesson objective, Introduction to Data Analytics, Enterprise Architectures and Information Systems Development Methodologies for Industrial Management.
- Introduction to Machine Learning: Data Flow, Data Preprocessing, Classification, Regression.
- Machine Learning –Supervised Learning: Decision Tree classifier, Rule-based classifier, Naïve Bayes classifier, k-Nearest Neighbour
- Machine Learning –Unsupervised Machine Learning: Association Rules, k-means Clustering, Mixture Models
- Programming language categories, compiler / interpreter differences, familiarity with the Python environment and the programming tool (IDE). Code Flow Execution Mapping, Debugger - Input-Output Processing, Variable Types
- Libraries and the Python virtual environment - Basic data structures (tables, lists). Basic data structures (stack, queue), read / write from / to files - Special categories of Python data structures (data-frames, pandas)
- The scikit-learn library. Application examples.
- Industrial case studies with the use of Machine Learning in Python (e.g. Predictive Maintenance, Predictive Quality Control) on sensor data and enterprise systems data.
- Process Mining – Business Process Modelling, Industrial Process Discovery and Evaluation with analytics on event log data. The pm4py library.
- Industrial case studies with the use of Process Mining in Python (e.g. production planning) on event log data.

Students also participate in an individual project.

In addition, articles, audiovisual lecture materials, web addresses, useful information as well as exercises and / or software for the practice of students are posted in eclass.

3. TEACHING METHODS - ASSESSMENT

<table>
<tr><td>TEACHING MODE
Face-to-face, in-class lecturing, on distance teaching and distance learning etc.</td><td>In-class lecturing</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY
Use of ICT in Teaching, Laboratory Education, Communication with students</td><td>Teaching: Lectures with audiovisual media, support of the learning process through the eclass platform
Communication with students: face-to-face at office hours, email, eclass</td></tr>
<tr><td>COURSE DESIGN
Description of teaching techniques, practices and methods:
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, clinical practice, Art Workshop, Interactive teaching, Educational visits, project, Essay writing, Artistic creativity, etc.

The study hours for each learning activity as well as the hours of non- directed study are given according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity / Method</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Mini projects</td><td>26</td></tr>
<tr><td>Self-study of lecture material and case studies</td><td>57</td></tr>
<tr><td>Counselling</td><td>0.5</td></tr>
<tr><td>Exams (written)</td><td>2</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>137.5</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS
Detailed description of the evaluation procedures:
Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice questionnaires, short- answer questions, open-ended questions, problem solving, written work, Essay/report, oral exam, public presentation, laboratory work, art interpretation, other……etc

Evaluation criteria are specifically defined and given as well as if and where they are reported and accessible to students.</td><td>Language of exams: Greek

Assessment Methods: The exam material of the course is announced in eclass after the last course of the semester. The final grade of the course is as follows:
• 50% from the project.
• 50% of the written exams in the spring semester exam period and, in case of failure, in the September re-examination period.

The written examination includes exercises on data analytics algorithms. In addition, the selection of appropriate tools for the synthesis of a computational method and the analysis of its architecture using simple diagrams are required. It is conducted with closed books.

The evaluation of students with special learning difficulties in writing and reading (as certified and qualified by a competent institution) is performed according to the relevant procedure decided by the Department Assembly.

Notification of the Assessment Criteria: The evaluation criteria are made known during the first lecture and are clearly stated on the course website and e-class. The answers to the exam questions are posted at eclass after the exam date. Students have the opportunity to discuss their exam paper with the course instructor (at the posted office hours) after the announcement of the course grades.</td></tr>
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4. SUGGESTED BIBLIOGRAPHY

-Suggested Bibliography :

- Book: *Επιστήμη Δεδομένων: Βασικές Αρχές και Εφαρμογές με Python*, J. Grus, Εκδόσεις Παπασωτηρίου.
- Book: *Τεχνητή Νοημοσύνη*, Ι. Βλαχάβας, Π. Κεφαλάς, Ν. Βασιλειάδης, Φ. Κόκκορας, Η. Σακελλαρίου. Εκδόσεις Πανεπιστημίου Μακεδονίας.

- Selected chapters from the book: Μιαούλης, Γ., Μπουσδέκης, Α., & Θεοδωροπούλου, Γ. (2023). *Πληροφοριακά Συστήματα: Ανάλυση, Σχεδιασμός, Ανάπτυξη* [Προπτυχιακό εγχειρίδιο]. Κάλλιπος, Ανοικτές Ακαδημαϊκές Εκδόσεις. https://dx.doi.org/10.57713/kallipos-234

-Lecture Notes