

COURSE OUTLINE

(1) OVERVIEW

SCHOOL	MARITIME & INDUSTRY		
DEPARTMENT	INDUSTRIAL MANAGEMENT & TECHNOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	TEOΔE13	SEMESTER	8
COURSE TITLE	COMPUTATIONAL METHODS / TOOLS IN INDUSTRIAL MANAGEMENT		
DISCRETE TEACHING ACTIVITIES		WEEKLY TEACHING HOURS	ECTS
<i>In cases where ECTS credits are awarded to distinct components of the course (e.g., Lectures, Laboratory Exercises, etc.), please indicate them separately. If the credits are awarded as a whole for the entire course, please state the weekly teaching hours and the total number of credits</i>			
Lectures & Project		4	5.5
<i>Please add additional rows if needed. A detailed description of the teaching organization and instructional methods is provided in Section (4).</i>			
COURSE TYPE <i>core (C), core elective (CE), elective (E) - background, specialization, skill development</i>	E - Specialization		
PREREQUISITE COURSES:	None.		
LANGUAGE OF TEACHING AND EXAMINATIONS:	Greek (English for ERASMUS students)		
THIS COURSE IS AVAILABLE TO ERASMUS STUDENTS	Yes		
COURSE WEBPAGE (URL)			

(2) LEARNING OUTCOMES

<p>Learning Outcomes</p> <p><i>The learning outcomes of the course are described, specifying the particular knowledge, skills, and competencies at the appropriate level that students will acquire upon successful completion of the course.</i></p> <p><i>Please refer to Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the Level of Learning Outcomes for each study cycle according to the Qualifications Framework of the European Higher Education Area.</i> • <i>Descriptive Indicators of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B.</i> • <i>Concise Guide for Writing Learning Outcomes</i> 			
<p>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.</p> <p>Upon successful completion of the course, the students will be able to:</p> <ul style="list-style-type: none"> • 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. 			
<p>General Competences</p> <p><i>Taking into account the general competences that a graduate should have acquired (as listed in the Diploma Supplement and outlined below), which of these competences does the course aim to develop?</i></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <i>Searching, analyzing, and synthesizing data and information, using the necessary technologies</i> <i>Adaptation to new situations</i> <i>Decision making</i> <i>Autonomous work</i> <i>Teamwork</i> </td> <td style="width: 50%; border: none;"> <i>Project design and management</i> <i>Respect for diversity and multiculturalism</i> <i>Respect for the natural environment</i> <i>Demonstration of social, professional, and ethical responsibility and sensitivity to gender issues</i> <i>Exercising critical and self-critical thinking</i> </td> </tr> </table>		<i>Searching, analyzing, and synthesizing data and information, using the necessary technologies</i> <i>Adaptation to new situations</i> <i>Decision making</i> <i>Autonomous work</i> <i>Teamwork</i>	<i>Project design and management</i> <i>Respect for diversity and multiculturalism</i> <i>Respect for the natural environment</i> <i>Demonstration of social, professional, and ethical responsibility and sensitivity to gender issues</i> <i>Exercising critical and self-critical thinking</i>
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<i>Working in an international environment</i>	<i>Promotion of free, creative, and inductive thinking</i>
<i>Working in an interdisciplinary environment</i>	<i>...</i>
<i>Generation of new research ideas</i>	<i>Other competences: ...</i>

- Searching, analyzing, and synthesizing data and information, using the necessary technologies
- Adaptation to new situations
- Decision making
- Autonomous work
- Demonstration of social, professional, and ethical responsibility and sensitivity to gender issues
- Exercising critical and self-critical thinking
- Promotion of free, creative, and inductive thinking

(3) 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.

Furthermore, articles, audiovisual lecture material, web links to useful resources, exercises, and software are uploaded in electronic format on the eClass platform.

(4) TEACHING and LEARNING METHODS - ASSESSMENT

TEACHING MODE <i>Face-to-face, in-class lecturing, distance teaching and distance learning etc.</i>	<ul style="list-style-type: none"> • Face-to-face in a classroom or the Lab • Distance teaching & learning (if required) 														
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY <i>Use of ICT in Teaching, Laboratory Education, Communication with students</i>	<p>Teaching: Lectures using modern audiovisual equipment, learning support through the eClass electronic platform, synchronous distance teaching via MS Teams.</p> <p>Communication with students: face-to-face during office hours, email, eClass platform, MS Teams tools</p>														
<p>Organization of Teaching</p> <p><i>A detailed description of the teaching methods and approach is provided.</i></p> <p><i>Lectures, seminars, laboratory exercises, fieldwork, study and analysis of literature, tutorials, internships (placements), clinical practice, artistic workshops, interactive teaching, educational visits, project work, writing assignments, artistic creation, etc.</i></p> <p><i>The student's study hours for each learning activity, as well as the hours of independent study, are specified in accordance with the principles of ECTS</i></p>	<table border="1"> <thead> <tr> <th>Activity</th> <th>Semester Workload</th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td>52</td> </tr> <tr> <td>Project</td> <td>26</td> </tr> <tr> <td>Self-study of lecture material and case studies</td> <td>57</td> </tr> <tr> <td>Consultation Support</td> <td>0.5</td> </tr> <tr> <td>Exams (written)</td> <td>2</td> </tr> <tr> <td>Course Total</td> <td>137.5</td> </tr> </tbody> </table>	Activity	Semester Workload	Lectures	52	Project	26	Self-study of lecture material and case studies	57	Consultation Support	0.5	Exams (written)	2	Course Total	137.5
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STUDENT ASSESSMENT	Language of Assessment: Greek (English for ERASMUS students)														

<p><i>Description of the assessment process</i></p> <p><i>Language of assessment, assessment methods, formative or summative evaluation, multiple-choice tests, short-answer questions, essay questions, problem-solving, written assignments, reports, oral examinations, public presentations, laboratory work, clinical patient examination, artistic interpretation, other(s)</i></p> <p><i>Explicitly state assessment criteria and information on whether and where these criteria are accessible to students are included.</i></p>	<p>Assessment Mode: Face-to-face and/or distance learning (if required)</p> <p>Assessment Methods: The final course grade is formed as follows:</p> <ul style="list-style-type: none"> • 50% by the project • 50% by the written exams taken in the examination period of the spring semester and, in case of failure, in the September resits <p>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.</p> <p>Students with Learning Difficulties: Students with certified learning difficulties in reading and writing (as recognized by the competent authority) are assessed according to the procedures established by the Department.</p> <p>Disclosure of Assessment Criteria: The assessment criteria are communicated during the first class and are clearly stated on the course website and the eClass platform. The exam syllabus is announced on eClass following the final lecture of the semester. The exam answers are posted on eClass after the examinations take place. Students have the right to review their graded exams and receive explanations regarding their grades. In cases of further requests, the procedures outlined in the current Study Regulations apply.</p>
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(5) SUGGESTED BIBLIOGRAPHY

<p>- Books:</p> <p>- Journals:</p> <p>- Other educational material:</p> <ul style="list-style-type: none"> • Lecture Notes and Supporting Material provided by the Instructor • Miaoulis, G., Bousdekis, A., Theodoropoulou, G. (2023). Information Systems: Analysis, Design, Development, Kallipos, open-source, https://dx.doi.org/10.57713/kallipos234
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