COURSE OUTLINE

1. GENERAL INFORMATION

SCHOOL	MARITIME AND INDUSTRIAL STUDIES		
DEPARTMENT	INDUSTRIAL MANAGEMENT AND TECHNOLOGY		
LEVEL OF STUDY	UNDERGRADUATE		
COURSE UNIT CODE	TETEX12	**SEMESTER OF STUDY**	8th
COURSE TITLE	RELIABILITY AND MAINTENANCE OF TECHNOLOGICAL SYSTEMS (ELECTIVE COURSE)		

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	4	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 / English (in ERASMUS class)
THE COURSE IS OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.unipi.gr/courses/BDT320/

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 course covers the theoretical background of reliability and maintenance of industrial equipment, including fundamental reliability functions and distributions, as well as topics related to the maintenance process and maintenance and replacement policies. It also includes the use of relevant indicators for the techno-economic analysis of different maintenance policies.

Furthermore, the course examines reliability and maintenance from the perspective of green and digital industry, incorporating Life Cycle Assessment (LCA) techniques, Machine Learning algorithms for predictive maintenance, and approaches related to "digital disruption" in the adoption of relevant information systems within the framework of Industry 4.0.

Upon successful completion of the course, students will:

- Have acquired the theoretical background of reliability and maintenance of industrial equipment, including fundamental reliability functions and distributions, as well as topics related to the maintenance process and maintenance and replacement policies.

- Be able to study reliability and maintenance from the perspective of green and digital industry.
- Be capable of applying Life Cycle Assessment (LCA) techniques in the context of industrial maintenance.
- Be familiar with approaches related to "digital disruption" in the adoption of relevant information systems within the framework of Industry 4.0.
- Be able to select and apply appropriate Machine Learning algorithms to industrial maintenance problems using the Python programming language.

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 international environment (ERASMUS)
- Working in an interdisciplinary environment (ERASMUS)
- Project planning and management

2. COURSE CONTENT

The course covers the following topics:

- Introduction to Reliability and Maintenance of Technological Systems
- Fundamental Reliability Functions and Distributions
- Maintenance and Replacement Policies
- Maintenance and Reliability Assessment Indicators
- Life Cycle Assessment (LCA) in the Context of Industrial Maintenance
- Maintenance in the Framework of Industry 4.0
- "Digital Disruption" from Predictive Maintenance in Industry 4.0
- Total Productive Maintenance (TPM)
- Machine Learning
- The Python Programming Language
- Case Studies on Predictive Maintenance with Machine Learning Algorithms Implemented in Python

In addition, articles, audiovisual lecture material, web addresses, useful information and case studies are posted at 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, use of Python programming language
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>44</td></tr>
<tr><td>Laboratory case studies</td><td>8</td></tr>
<tr><td>Exercises</td><td>26</td></tr>
<tr><td>Self-study of lecture material and exercises</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>Course Total</td><td>137.5</td></tr>
</table>
</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 / English (in ERASMUS class)

Assessment Methods: The course syllabus is announced on eClass. The final grade is determined as follows:
• 50% from the written exam during the spring semester examination period, and in case of failure, during the retake examination period in September.
• 50% from the completion of a project involving a case study on predictive maintenance using Machine Learning in Python.

The written exam includes short-answer questions and exercises. 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. 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>
</table>

4. SUGGESTED BIBLIOGRAPHY

-Suggested Bibliography : Μπακούρος Ι. (2010). Αξιοπιστία και Συντήρηση Τεχνολογικών Συστημάτων. Εκδόσεις Σοφία.
-Scientific Journals: Reliability Engineering & System Safety, Journal of Quality in Maintenance Engineering, Computers in Industry, International Journal of Computer Integrated Manufacturing
-Lecture Notes