COURSE OUTLINE

(1) OVERVIEW

SCHOOL	MARITIME & INDUSTRY		
DEPARTMENT	INDUSTRIAL MANAGEMENT & TECHNOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΤΕΣΤΑ31	SEMESTER	6
COURSE TITLE	QUEUEING THEORY & SYSTEMS SIMULATION		

DISCRETE TEACHING ACTIVITIES *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*	WEEKLY TEACHING HOURS	ECTS
Lectures	4	5.5
Please add additional rows if needed. A detailed description of the teaching organization and instructional methods is provided in Section (4).		

COURSE TYPE *core (C), core elective (CE), elective (E) - background, specialization, skill development*	CE - 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

Learning Outcomes

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.

Please refer to Appendix A

- *Description of the Level of Learning Outcomes for each study cycle according to the Qualifications Framework of the European Higher Education Area.*
- *Descriptive Indicators of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B.*
- *Concise Guide for Writing Learning Outcomes*

The subject of the course is the introduction to Classical Queueing Theory and Simulation Methods. In Queuing Theory, the basic concepts are presented, with emphasis on the structural characteristics of the systems, the evaluation of their effectiveness and their practical applications. The course presents Poisson processes and systems with one or more service stations, infinite or finite population and infinite or finite waiting positions. For presenting the analytical relationships, emphasis is given on the way these arise from Markov's general equilibrium relations and Little's Law.

Simulation introduces the basic concepts, definitions and the central concept of discrete events simulation methods through many examples. The course presents the methods of generating random numbers and the "dimensions" of the simulation (based on a fixed time step, events, entities, etc.). The course includes the demonstration of software use, with the main aim of recognizing the basic concepts and definitions that have been discussed theoretically and in exemplary tables.

Within the course, through many examples and its successful completion, the student becomes familiar with the theory and the basic concepts, so that he/she can:

- Identify in practice the problems that can be addressed by either Queueing Theory methods or Simulation methods, analyze their structure and characteristics, and identify the requirements in data and parameters.
- Easily learn any Queueing and Simulation Analysis software, having understood the theoretical and conceptual framework.
- Proceed to deepening stochastic processes in industrial processes.

General Competences

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?

Searching, analyzing, and synthesizing data and information, using the *Project design and management*

necessary technologies	*Respect for diversity and multiculturalism*
Adaptation to new situations	*Respect for the natural environment*
Decision making	*Demonstration of social, professional, and ethical responsibility and sensitivity to gender issues*
Autonomous work	*Exercising critical and self-critical thinking*
Teamwork	*Promotion of free, creative, and inductive thinking*
Working in an international environment	*…*
Working in an interdisciplinary environment	*Other competences: …*
Generation of new research ideas	

- 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:

Week	Topics
1	Introduction to queueing systems - Applications, definitions, assumptions and symbols. Basic structure and system features, performance measures. Poisson processes: Poisson distribution and negative exponential distribution, their relationship and their use in modeling queuing systems.
2	Queueing Systems - Little's Law and mean times in system and queue. Markov's birth-death and equilibrium equations for M/M/1. In-depth system study, feature changes and their impact on performance measures, cost issues, etc.
3	M/M/1 system – In depth study of the simplest queueing system based on stability relations. Cost optimization issues.
4	Generalization of stability relations and M / M / S system - Comparison with M/M/1 system and cost optimization issues.
5	Systems with finite population - source of arrivals - M/M/1/∞/N and M/M/S/∞/N.
6	Systems with limited capacity - M/M/1/K και M/M/S/K.
7	Other systems: Examination of how our approach to queueing systems can be generalized to systems with other characteristics.
8	Introduction to Simulation - General concepts, objectives, advantages - disadvantages, applications, classification of simulation models.
9	Simulation of discrete systems - General logic, stochastic phenomena, pseudorandom numbers and their generation methods. Simulation based on entities, fixed time, event-based, and so on. Special computational techniques in simulation.
10	Simulation as a method of analyzing complex queuing systems - Simulation of business problems: order policies, stocks etc.
11	Modelling systems for Discrete Event Simulation – Entities, life cycle, flow charts, entity characteristics, events and activities, use of queues, Activity Cycle Diagram.
12	Simulation software - Using MS Excel to solve simple simulation problems, applications of complex business simulations using specialized software.
13	Review exercises

Selected case studies from the international literature are also presented. 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

<table>
<tr><td>TEACHING MODE
Face-to-face, in-class lecturing, distance teaching and distance learning etc.</td><td>• Face-to-face in a classroom
• Distance teaching & learning (if required)</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY
Use of ICT in Teaching, Laboratory Education, Communication with students</td><td>Teaching: Lectures using modern audiovisual equipment, learning support through the eClass electronic platform, synchronous distance teaching via MS Teams.
Communication with students: face-to-face during office hours, email, eClass platform, MS Teams tools</td></tr>
<tr><td>Organization of Teaching
A detailed description of the teaching methods and approach is provided.
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.

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</td><td><table><tr><th>Activity</th><th>Semester Workload</th></tr><tr><td>Lectures</td><td>52</td></tr><tr><td>Case studies / exercises</td><td>26</td></tr><tr><td>Self-study of lecture material and exercises</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></table></td></tr>
<tr><td>STUDENT ASSESSMENT
Description of the assessment process

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)

Explicitly state assessment criteria and information on whether and where these criteria are accessible to students are included.</td><td>Language of Assessment: Greek (English for ERASMUS students)
Assessment Mode: Face-to-face and/or distance learning (if required)
Assessment Methods: The final grade of the course is determined 100% by the written exams during the spring semester examination period and, in case of failure, during the September resit examination period.
The written exam includes problem-solving exercises and short-answer questions. It is conducted with closed books. However, the use of a two-page formula sheet is permitted, which students can create according to their own judgment.
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.
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.</td></tr>
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(5) SUGGESTED BIBLIOGRAPHY

- Books:

- Sfakianakis, M. (2020). Simulation and Applications, Broken Hill Publishers, ISBN: 9789925576593 [94643855] – in Greek
- Hamdy, T.A. (2024). Introduction to Operations Research, 11th Edition, Tziolas Publications, ISBN: 9786182210437 [122086451] – in Greek
- Ipsilantis, P. (2015). Operations Research, Propombos Publications, ISBN: 9786185036201 [50659326] – in Greek

- Journals:

- Other educational material:

- Lecture Notes and Supporting Material provided by the Instructor