Course Unit	Operational Research II			Field of study	Quantitative Methods		
Bachelor in	Industrial Management and Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	3	Level	1-3	ECTS credits	6.0
Type	Semestral	Semester	1	Code	9104-754-3103-00-23		

Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Carla Alexandra Soares Geraldes

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Identify and select the appropriate operational research techniques to solve existing problems in organizations
2. Critically analyze complex problems
3. Develop simulations models, using a software package, to solve Industrial Management problems
4. Interpret simulation results and draw conclusions from the simulation projects

Prerequisites

Before the course unit the learner is expected to be able to:
The student should know the basic concepts of Operational Research.

Course contents

Formulation and solving techniques for Integer Programming problems. Markov processes. Queuing systems. Simulation.

Course contents (extended version)

1. Integer Linear Programming
   - The use of binary variables in Integer Programming.
   - Some formulation examples in Integer Programming.
   - General procedures used to solve Integer Programming problems.
   - The Branch-and-Bound algorithm.
   - The Cutting Planes algorithm.
2. Markov Processes
   - Definition and basic concepts
   - Transition matrix of a Markov chain
   - Analysis of both ergodic and absorbing chains
   - Generalizations
3. Queuing systems
   - Characterisation of queuing processes
   - The M/M/1 queuing system
   - Queuing systems with more than one server
   - Finite source models and systems with limited capacity
   - Priority queuing models
4. Simulation
   - Simulation in OR
   - Modelling of systems (manufacturing or services) using simulation
   - Fundamental concepts (entities, queues, etc.)
   - Development of models
   - SIMIO simulation software
   - Validity and credibility of the simulation model
   - Applications and analysis of simulation outputs

Recommended reading

1. Notas de apoio (fornecidas pelo docente)
2. Hillier, F. S. , Lieberman, G. J. , Introduction to Operations Research, 11th ed. McGraw-Hill, 2021 (ISBN: 9781259872990)
3. Mourão, M. C , Pato, M. V. , Pinto, L. S, Simões, O. A. , Valente, J. , Investigação Operacional - Exercícios e Aplicações, 2. ª ed. , Escolar Editora, 2019 (ISBN: 9789725925560)

Teaching and learning methods

The theorical contents should be presented in theoretical-practical lectures, accompanied by the exercises solving. In non-presencial hours the topics should be consolidated through the exercises solving supported by computer tools. Some individual or group tutorial lectures could be scheduled if it would be necessary.

Assessment methods

1. Distributed evaluation - (Regular, Student Worker) (Final)
   - Final Written Exam - 50% (Only for students attending the classes.)
   - Practical Work - 50% (Only for students attending the classes. To be partially held during classes.)
2. Final evaluation - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

Carla Alexandra Soares Geraldes	José Mário Escudeiro de Aguiar	António Jorge da Silva Trindade Duarte	José Carlos Rufino Amaro
05-10-2023	07-10-2023	09-10-2023	10-10-2023