Quantitative models and methods in management II

Academic Year: (2023 / 2024) **Review date: 28-04-2023**

Department assigned to the subject: Mechanical Engineering Department

Coordinating teacher: GARCIA GUTIERREZ, ISABEL

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

No previous courses are required.

SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications
CG4. Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards in the field of Industrial Engineering.
CG5. Adequate knowledge of the concept of company, institutional and legal framework of the company. Organisation and management of companies.
CG6. Applied knowledge of company organisation.
CG8. Knowledge and ability to apply quality principles and methods.
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.
RA6. Transversal Skills: To have the necessary skills for the practice of engineering in today's society.

OBJECTIVES

- Knowledge and understanding of the fundamentals of quantitative algorithms and techniques for solving complex problems in industrial organization.
- Being able to identify the most appropriate quantitative technique according to the nature of the problem being treated.
- Being able to create an original simulation model in order to improve a real system, making modeling decisions in collaboration with other colleagues. Being able to apply the statistical techniques necessary to develop valid models and obtain results.
- Being able to identify non-polynomial problems that require the use of heuristic approximations for

their resolution.
- Knowing the fundamentals and dynamics of heuristic search algorithms and algorithms inspired by nature.
- Being able to present and defend the suitability of the decisions made in the context of applying quantitative techniques and algorithms to solve complex problems in industrial organization.

DESCRIPTION OF CONTENTS: PROGRAMME

-Productive and logistic system analysis by means of discrete event simulation.
-Design of simulation models of real systems. Definition of objectives and adoption of simplifying hypotheses.
-Implementation of simulation models. Programming in Witness (simulation software) for the development of a model of a real system.
-Application of the necessary statistical techniques in the different stages of development and exploitation of the model.
-Result analysis and configuration comparison in simulation.
-Introduction to NP problems. Review of the classical NP problems: the salesman problem, the knapsack problem, task programming with limited resources.
-Heuristic search algorithms.

LEARNING ACTIVITIES AND METHODOLOGY

The training activities include: Lectures, group and individual work by students under the supervision of the teacher, individual and group tutorials, compulsory laboratory practices, preparation of a group project. Carrying out partial and final evaluation tests.

ASSESSMENT SYSTEM

Midterm exam, group project, 18h of compulsory practices (most of them in the regular schedule of classes) and resolution of exercises.

Minimum mark in the simulation exam (mid term exam): 3.5
Minimum mark in the metaheristic algorithm exam: 3

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- Adenso Díaz Optimización heurística y redes neuronales, Paraninfo, 1996 (Capítulos 1 y 3)
- Goldberg Genetic algorithms in search, optimization, and machine learning, Addison-Wesley, 1989 (Capítulos 1 y 2)
- Haupt and Haupt Practical genetic algorithms, John Wiley & Sons, 1998
- Law and Kelton Simulation modeling and analysis , McGraw-Hill, 2007
- Law, A. Simulation modeling and analysis , McGraw-Hill, 2015
- Rich and Knight Inteligencia artificial, McGraw-Hill, 1994 (Capítulos 2 y 3)
- Taha, H. Investigación de operaciones, Pearson, 2004