Universitat de Lleida

DEGREE CURRICULUM

QUANTITATIVE METHODS

Coordination: RIUS TORRENTÓ, JOSEP MARIA

Academic year 2021-22

QUANTITATIVE METHODS 2021-22

Subject's general information

Subject name	QUANTITATIVE METHODS
Code	102401
Semester	1st Q(SEMESTER) CONTINUED EVALUATION

Typology	Degree	Course	Character	Modality
	Bachelor's degree in Industrial Organization and Logistics Engineering	3	COMPULSORY	Attendance-based

Course number of credits (ECTS)	6

Type of activity, credits, and groups	Activity type	PRAULA	TEORIA
	Number of credits	3	3
	Number of groups	1	1

Coordination	RIUS TORRENTÓ, JOSEP MARIA
Department	BUSINESS ADMINISTRATION
Teaching load distribution between lectures and independent student work	60 classroom hours and 90 hours of independent work.
Important information on data processing	Consult this link for more information.
Language	Catalan and Spanish
Distribution of credits	3 theoretical credits and 3 practical credits.

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
RIUS TORRENTÓ, JOSEP MARIA	josep.riustorrento@udl.cat	6	

Subject's extra information

This course requires continuous work throughout the semester in order to achieve the objectives set. It requires critical thinking and capacity for abstraction.

It is recommended to visit the Virtual Campus space associated with the course frequently, since all the corresponding information is announced there and the material with which the subject will be developed will be published before the beginning of each topic.

Learning objectives

- Learn the methodology and scope of the Operations Research.
- Work with linear programming and design models based on this technique.
- Use computer programs to solve linear programming and discuss the results.
- Analyze the sensitivity of the results obtained to variations of some parameters of the model.
- Know particular cases of linear programming.
- Introduce the problem of linear programming with integer and binary variables, in order to expand the possibilities of modeling situations.
- Analyze complex real cases of linear programming.
- Introduce the non-linear programming and learn basic tools that help make decisions in these cases.

Competences

Competencias básicas

- **B02**. That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.
- **B03**. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.
- **B04**. That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

Competencias generales

- **CG3**. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.
- **CG4**. To Solve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Chemical Engineering/Industrial Organization Engineering.
- **CG9**. To organize and plan in the field of the company, and other institutions and organizations.
- **CG10**. To work in a multilingual and multidisciplinary environment.

Competencias específicas

- **CE28**. To acquire capacity to design and optimize industrial plants and productive processes.
- **CE31**. To acquire capacity for production planning and control, maintenance program implementation and perform statistical process control.

Competencias transversales

- **CT1**. To develop a proper understanding and oral and written expression of Catalan and Spanish.
- **CT3**. To implement new technologies and technologies of information and communication.
- **CT5**. To apply essential notions of scientific thinking.

Subject contents

Lesson 1. Introduction to operations research

- Definition of linear programming

- Characteristics of linear programs

- Intuitive approach to the resolution method of linear programs

Lesson 2. Interpretation of results

- Feasible regions. Definition and types

- Increment of the independent term of a restriction

- Special situations: no limit solution, multiple solution and no solution

Topic 3. Sensitivity analysis in linear programming

- Modification of a coefficient of the objective function

- Modification of the independent term of a restriction

- Modification of the technical coefficients of the restrictions

Lesson 4. The simplex algorithm

- The simplex algorithm

- Matrix expression of the simplex algorithm

- The simplex dual algorithm

Lesson 5. The dual model.

- The symmetric primal linear program and its dual

- Fundamental theorems

- Dual of non-symmetrical approaches

Lesson 6. Integer and mixed linear programming

- Introduction to the integer programming and the application domains

- Introduction to binary programming

- Modeling of linear, binary and mixed linear programming problems

- Problem solving and results analysis

Lesson 7. Non-linear programming

- Introduction to non-linear programming

- Convexity applied to the objective function and restrictions

- Introduction to separable programming

- Modeling the linear function by sections

- Modeling with binary variables

Methodology

Each week the student will attend to four hours of virtual and classroom lectures. Two of them will be held in the classroom, where the theoretical contents of the subject will be presented, combined by practical examples and methods for problem solving. As support material for the lectures, we will use slides provided to the students through the virtual campus.

In the other two hours the concepts presented on the theory lectures will be applied to practical cases. Computer software will be used to solve the problems and practical examples.

Development plan

Week	Activities	Personal Study
1	*Introduction*	

2-4	*Lectures*	4 h/week. Personal study and problems resolution
5-8	*Practical Cases*	4 h/week. Personal study and problems resolution
9	*Test*	8 hours. Test preparation
10-12	*Lectures*	4 h/week. Personal study and problems resolution
13-14	*Practical Cases*	4 h/week. Personal study and problems resolution
15	*CPLEX Test*	8 hours. Test preparation
16-17	*Final Exam*	8 hours. Examen preparation
18	*Tutorship*	
19	*Recovery*	

Evaluation

Acr.	Evaluation Activities	Weigh	Minimum rate	Groupal	Mandatori	Recoverable
T1	*Test*	25%	NO	NO	YES	NO
PRA	*Practical cases*	15%	NO	NO	YES	NO
E1	*Final Exam*	50%	3	NO	YES	YES*
T2	*CPLEX Test*	10%	NO	NO	YES	NO

FinalScore = 0,25*T1 + 0,15*PRA + 0,50*E1 + 0,10*T2
*Max subject score: 5

Bibliography

Hillier F. S., Lieberman G.J. (2010) Introducción a la Investigación de Operaciones, 9ª ed. McGraw-Hill

Ríos Insua, S. (1996) *Investigación operativa. Programación lineal i aplicaciones*. Ed. CERA.

Arreola , J.S. i Arreola, A. (2003) *Programación lineal. Una introducción a latoma de decisiones cuantitativa*. Ed. Thomson.

Winston, W.L. (2005) *Investigación de operaciones. Aplicaciones y algoritmos*. Ed.Thomson.