Course guide
240EO012 - 240EO012 - Quantitative Methods for Business

Last modified: 16/05/2023

Unit in charge:	Barcelona School of Industrial Engineering
Teaching unit:	732 - OE - Department of Management.

Degree: MASTER'S DEGREE IN MANAGEMENT ENGINEERING (Syllabus 2012). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 7.5 **Languages:** Spanish

LECTURER

Coordinating lecturer: García Villoria, Alberto

Others: García Villoria, Alberto

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEO3. Acquire concepts and techniques related to quantitative and experimental methods for analysis and decision making.
CEO4. Apply quantitative and experimental methods for decision-making in situations where intangibles appear.

Generical:
CGO4. Learn and master the analytical tools necessary for decision making in the organizational context more efficient.

Transversal:
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

Basic:
CB7. (ENG) Que els estudiants sàpiguen aplicar els coneixements adquirits i la seva capacitat de resolució de problemes en entorns nous o poc coneguts dintre de contextos més amplis (o multidisciplinars) relacionats amb la seva àrea d'estudi.

TEACHING METHODOLOGY

The teaching methodology is divided in three parts:

- Face-to-face sessions of master classes
- Face-to-face sessions of practical work (exercises and problems)
- Autonomous study work

In the exposition sessions of the contents, the Professor will introduce the theory basis of the material, concepts, methods and results illustrating them with convenient examples to help its understanding.

In the class sessions of practical work, the Professor will guide the students in the application of the theory concepts to solve the problems, developing at all times the critical thinking. Exercises will be proposed to the student, and he or she will have to solve it in class and, if they are not finished, they will have to be carried out out of class, in order to favour the use of the basic tools for the resolution of problems.

The student, in an autonomous way, must work the contents of the coursse exposed by the Professor and the result of the practical work sessions to assimilate and fix the concepts

LEARNING OBJECTIVES OF THE SUBJECT

The course Quantitative Methods for Business introduces the student to the modelling concepts, principles and basis by the linear and integer programming, the resolution of the linear and integer programming, the graph theory, the simulation and the queuing theory, for the analysis and decision making in all types of contexts

STUDY LOAD

Type	Hours	Percentage
Hours large group	22,5	13.64
Self study	120,0	72.73
Hours small group	22,5	13.64

Total learning time: 165 h

CONTENTS

Module 1: Graph Theory

Description:
Concept. Terminology. Representation of graphs. Optimization exercises in graphs: minimum partial tree, extreme paths, optimal flows

Specific objectives:
Introduce the student to the concepts, principles and basis of the graph theory

Related activities:
Activity 1 (sessions of big groups/Theory), activity 2 (sessions of medium groups/exercises), activity 3 (partial exam) and activity 4 (final exam)

Full-or-part-time: 34h
Theory classes: 5h
Practical classes: 9h
Self study : 20h

Module 2: Modelling by linear and integer programming

Description:
Concept of the mathematical program and linear program. Linear programs and mixed-integer linear programs. Modelling techniques.

Specific objectives:
Introduce the students to the concepts, principles and basis of the modelling by the linear and integer programming

Related activities:
Activity 1 (sessions of big groups/theory), activity 2 (sessions of medium groups/exercises), activity 3 (partial exam) and activity 4 (final exam)

Full-or-part-time: 52h
Theory classes: 8h
Practical classes: 9h
Self study : 35h

Module 3: Resolution of the linear and integer programming

Description:
Resolution of linear programs: Simplex algorithm. Duality. Simplex-dual algorithm. Sensitivity analysis. Application of the simplex algorithm: numerical problems and software packages. Introduction to the resolution algorithms of linear mixed-integer programs. Software

Specific objectives:
Introduce the student to the concepts, principles and basis of the resolution of the linear and integer programming

Related activities:
Activity 1 (sessions of big groups/theory), activity 2 (sessions of medium groups/exercises) and activity 4 (final exam)

Full-or-part-time: 31h
Theory classes: 7h
Practical classes: 9h
Self study : 15h

Module 4: Queuing Theory

Description:
Causes and cost of waiting. Classification of the systems with waits. Management of queues. Queuing theory: birth and death processes. Introduction to the queues network

Specific objectives:
Introduce the student to the concepts, principles and basis of the queuing theory

Related activities:
Activity 1 (sessions of big groups), activity 2 (sessions of medium groups/exercises) and activity 4 (final exam)

Full-or-part-time: 31h 30m
Theory classes: 5h
Practical classes: 9h
Self study : 17h 30m

Module 5: Simulation

Description:
Concept, classification and applications. Management of the clock in the discrete simulation. Random simulation. Obtention of samples of random variables. Analysis of the results. Reduction of the variance. Introduction to simulation languages

Specific objectives:
Introduce the students to the simulation concepts, principles and basis

Related activities:
Activity 1 (sessions of big groups/theory), activity 2 (sessions of medium groups/exercises) and activity 4 (final exam)

Full-or-part-time: 31h 30m
Theory classes: 5h
Practical classes: 9h
Self study : 17h 30m

ACTIVITIES

SESSION OF BIG GROUPS/THEORY

Description:
Previous and later preparation of the theory sessions and attendance to this sessions

Specific objectives:
Transfer the necessary knowledge for a correct interpertation of the contents developed in the sessions of big groups, resolution of the doubts regarding to the units of the course and development of the generic competences

Material:
Slides and bibliography of the course

Delivery:
During the sessions some face-to-face exercises will be carried out in class, individually and/or in small groups

Full-or-part-time: 75h
Theory classes: 30h
Self study: 45h

SESSIONS OF MEDIUM GROUPS/EXERCISES

Description:
Previous and later preparation of the practical sessions and attendance to this sessions

Specific objectives:
Acquire the necessary skills for a correct interpretation of the exercises of the course, as well as a satisfactory resolution.

Material:
Slides, bibliography and statements of the practices of the course

Delivery:
During these sessions, the student will develop practical exercises individually or in small groups

Full-or-part-time: 90h
Practical classes: 45h
Self study: 45h

PARTIAL EXAM

Description:
Individual written examination about the contents of the modules 1 and 2

Specific objectives:
The examination must demonstrate that the student has acquired and assimilated the concepts, principles and basis related to the modules 1 and 2.

Material:
Statement of the partial examination

Delivery:
The delivery will be the resolution of the examination

FINAL EXAM

Description:
Individual written examination about the contents of modules 1, 2, 3, 4 and 5

Specific objectives:
The examination must demonstrate that the student has acquired and assimilated the concepts, principles and basis related to the modules 1, 2, 3, 4 and 5

Material:
Statement of the final examination

Delivery:
The delivery will be the resolution of the examination

Full-or-part-time: 13h 30m
Theory classes: 3h
Self study: 10h 30m

GRADING SYSTEM

The qualification of the student will be the following:

Final mark = max(0,7*Nef + 0,2*Npp; 0,9*Nef) + 0,1*Nep

Where:

Nef: Mark of the final exam
Npp: Mark of the partial exam
Nep: Mark of practical learning

Reevaluation exam.
A written exam is performed on the date determined by the School. Only students who have suspended the subject can be presented (in any case a student that has passed can do the reevaluation exam). The test is similar to the final exam and replaces its marks.The student can carry all the material that he/she considers suitable, except computers and mobile phones.

EXAMINATION RULES.

In order to carry out the partial evaluation of the theoretical teaching (Npp) a short written examination is carried out.
In order to carry out the final evaluation of the theoretical teaching (Nef) a written examination is carried out on the day determined by the School.For the evaluation of the practical lessons (Nep) is performed and given a short writing exercise during the sessions of practical lessons. In all cases the student can bring all the material they considers appropriate, except computer, tablet and mobile phone.