240EO012 - Quantitative Methods for Business

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 732 - OE - Department of Management
Academic year: 2017
Degree: MASTER'S DEGREE IN MANAGEMENT ENGINEERING (Syllabus 2012). (Teaching unit Compulsory)
ECTS credits: 7,5  Teaching languages: Spanish

Teaching staff
Coordinator: García Villoria, Alberto
Others: García Villoria, Alberto
Calleja Sanz, Gema

Degree competences to which the subject contributes

Specific:
1. Acquire concepts and techniques related to quantitative and experimental methods for analysis and decision making.

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 course 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

<table>
<thead>
<tr>
<th>Total learning time: 187h 30m</th>
<th>Hours medium group:</th>
<th>27h</th>
<th>14.40%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>40h 30m</td>
<td>21.60%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>120h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
# Content

## Module 1: Graph Theory

**Learning time:** 34h  
- Theory classes: 5h  
- Practical classes: 9h  
- Self study: 20h

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

**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)

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

## Module 2: Modelling by linear and integer programming

**Learning time:** 52h  
- Theory classes: 8h  
- Practical classes: 9h  
- Self study: 35h

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

**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)

**Specific objectives:**  
Introduce the students to the concepts, principles and basis of the modelling by the linear and integer programming
### Module 3: Resolution of the linear and integer programming

**Learning time:** 31h  
- Theory classes: 7h  
- Practical classes: 9h  
- Self study: 15h

**Description:**  

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

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

### Module 4: Queuing Theory

**Learning time:** 31h 30m  
- Theory classes: 5h  
- Practical classes: 9h  
- Self study: 17h 30m

**Description:**  

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

**Specific objectives:**  
Introduce the student to the concepts, principles and basis of the queuing theory
## Module 5: Simulation

### Learning time:
- Theory classes: 5h
- Practical classes: 9h
- Self study: 17h 30m

### Description:
- Obtention of samples of random variables. Analysis of the results. Reduction of the variance. Introduction to simulation languages

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

### Specific objectives:
- Introduce the students to the simulation concepts, principles and basis
### Planning of activities

<table>
<thead>
<tr>
<th>SESSION OF BIG GROUPS/ THEORY</th>
<th>Hours: 75h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 30h</td>
</tr>
<tr>
<td></td>
<td>Self study: 45h</td>
</tr>
</tbody>
</table>

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

**Support materials:**
Slides and bibliography of the course

**Descriptions of the assignments due and their relation to the assessment:**
During the sessions some face-to-face exercises will be carried out in class, individually and/or in small groups

**Specific objectives:**
Transfer the necessary knowledge for a correct interpretation 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

<table>
<thead>
<tr>
<th>SESSIONS OF MEDIUM GROUPS/ EXERCISES</th>
<th>Hours: 90h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 45h</td>
</tr>
<tr>
<td></td>
<td>Self study: 45h</td>
</tr>
</tbody>
</table>

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

**Support materials:**
Slides, bibliography and statements of the practices of the course

**Descriptions of the assignments due and their relation to the assessment:**
During these sessions, the student will develop practical exercises individually or in small groups

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

### PARTIAL EXAM

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

**Support materials:**
Statement of the partial examination

**Descriptions of the assignments due and their relation to the assessment:**
The delivery will be the resolution of the examination

**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.
Final Exam

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 will re-evaluate the theoretical lessons and the note of said examination will only replace the note of the re-evaluated parts: the final and partial exam mark. In all cases the student can carry all the material that he/she considers suitable, except computers and mobile phones.

Thus, the mark of the student will be the following:

Final mark = 0,8*Nre + 0,2*Nep

Where:
Nre: Mark of the reevaluation exam
Nep: Mark of practical learning
Regulations for carrying out activities

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 consider appropriate, except computer, tablet and mobile phone.

Bibliography