Course guides
220104 - MNQG - Numerical and Quantitative Methods

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 732 - OE - Department of Management.
749 - MAT - Department of Mathematics.

Degree: BACHELOR’S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2021 ECTS Credits: 7.5 Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: Acho Zuppa, Leonardo
Marti Badia, M. Elena

Others: Pujol Vazquez, Gisela

PRIOR SKILLS

Topics on calculus, and modeling of linear equations.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. An adequate understanding of business concepts and the institutional and legal framework of companies. An understanding of business organisation and management
3. The ability to solve mathematical problems that may arise in an engineering context. The ability to apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation

Transversal:
1. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

The course is divided into three parts:
* Lecture sessions.
* Practical sessions (exercises and problems).
* Self-study and doing exercises and activities.

In the content of the sessions, teachers will introduce the theoretical foundations of the subject, concepts, methods and illustrate with examples appropriate to facilitate understanding.

In practical sessions in the classroom, teachers guide students in applying theoretical concepts to problem solving, based on critical thinking at all times. The exercises will be proposed that students solve exercises in the classroom and outside the classroom, to promote contact and use the basic tools needed to solve problems.

Students, autonomously, should work the material provided by the teacher and the result of the work sessions, to assimilate concepts. Teachers will provide a study plan and monitoring activities (ATENEA).

LEARNING OBJECTIVES OF THE SUBJECT

Provide to the students with the basic tools and methods of computation and mathematical programming to study how to implement other subjects for the degree.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>61,0</td>
<td>32.53</td>
</tr>
<tr>
<td>Self study</td>
<td>112,5</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>14,0</td>
<td>7.47</td>
</tr>
</tbody>
</table>

Total learning time: 187.5 h

CONTENTS

Module 1: Numerical Methods.

Description:
II. Nonlinear equations: Numerical solution to nonlinear equations by using the bisection, secant, Newton, and iteration of the fixed point algorithms. Bolzano and Rolle Theorems. Numerical errors.
IV. Approximation of functions. Polynomial function approximation by using the concept of minimal quadrats. Numerical errors.

Specific objectives:
Faculty to solve engineering mathematical problems by using numerical methods. Feasibility of applied numerical concepts to solve nonlinear equations, differential equations, statistics optimization, etc. Ability to program numerical methods in Python or similar.

Full-or-part-time: 150h
Theory classes: 46h
Laboratory classes: 14h
Self study: 90h

Module 2: Quantitative Methods.

Description:
I. Enterprise definition and its structure
II. Linear Programming
III. Dual Model and Sensibility
IV. Mix-Integer Linear Programming

Specific objectives:
To learn the concept of an enterprise and understand its institutional and juridic rules.
To use organization and management methods to enterprises.
To apply mix-integer linear programming to enterprises.

Full-or-part-time: 37h 30m
Theory classes: 15h
Self study: 22h 30m
ACTIVITIES

ACTIVITY 1: LARGE GROUP SESSIONS / THEORY

Full-or-part-time: 112h 15m
Theory classes: 56h
Self study: 56h 15m

ACTIVITY 2: SMALL GROUP SESSIONS / PRACTICES

Full-or-part-time: 36h 55m
Laboratory classes: 14h
Self study: 22h 55m

ACTIVITY 3: MIDTERM EXAM

Full-or-part-time: 2h
Theory classes: 2h

ACTIVITY 4: FINAL EXAM

Full-or-part-time: 3h
Theory classes: 3h

ACTIVITY 5: PRACTICES

Full-or-part-time: 33h 20m
Self study: 33h 20m

GRADING SYSTEM

- Partial exam module 1: 25%
- Final exam of module 1: 25%
- Final exam of module 2: 20%
- Tasks of the 1st evaluation of module 1: 15%
- Tasks of the 2nd evaluation of module 1: 15%

Remark: In this subject, there is no revaluation nor other.

BIBLIOGRAPHY

Basic:
RESOURCES

Other resources:
Python
Theoretical lectures
Set of exercises
Atenea open questions