Modelling Workshop

Code: 42255
ECTS Credits: 6

2024/2025

Degree	Type	Year
4313136 Modelling for Science and Engineering	OT	0

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Students must have mathematical and computational skills at the level of a science degree.

Objectives and Contextualisation

The Mathematical Modelling Workshop is aimed at analyzing and solving real-world problems by means of mathematics. It has a very practical and interdisciplinary character.

Competences

- Analyse complex systems in different fields and determine the basic structures and parameters of their workings.
- Analyse, synthesise, organise and plan projects in the field of study.
- Apply logical/mathematical thinking: the analytic process that involves moving from general principles to particular cases, and the synthetic process that derives a general rule from different examples.
- Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialisation.
- Continue the learning process, to a large extent autonomously.
- Formulate, analyse and validate mathematical models of practical problems in different fields.
- Isolate the main difficulty in a complex problem from other, less important issues.

- Look for new areas to open up within the field.
- Present study results in English.
- Show responsibility in information and knowledge management and in group/ project leadership in multidisciplinary teams.
- Solve complex problems by applying the knowledge acquired to areas that are different to the original ones.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use appropriate numerical methods to solve specific problems.

Learning Outcomes

1. Analyse, synthesise, organise and plan projects in the field of study.
2. Apply logical/mathematical thinking: the analytic process that involves moving from general principles to particular cases, and the synthetic process that derives a general rule from different examples.
3. Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialisation.
4. Choose the best description of a system on the basis of its particular characteristics
5. Construct and resolve models to describe the behaviour of a real system.
6. Continue the learning process, to a large extent autonomously.
7. Implement the appropriate numerical methods to find a solution to the problem being studied.
8. Isolate the main difficulty in a complex problem from other, less important issues.
9. Look for new areas to open up within the field.
10. Present study results in English.
11. Provide a solution to a real problem with time restrictions.
12. Show responsibility in information and knowledge management and in group/ project leadership in multidisciplinary teams.
13. Solve complex problems by applying the knowledge acquired to areas that are different to the original ones.
14. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Content

Mathematical modelling, i.e. solving real-world problems by means of mathematics.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	38	1.52	2, 1, 3, 5, 12, 11, 8, 7, 9, 6, 13, 4, 14
Project	112	4.48	2, 1, 3, 10, 5, 12, 11, 8, 7, 9, 6, 13, 4, 14

The main activity of the workshop is the development of mathematical modeling projects by students organized in teams.

The course is organized in three fundamental parts, in addition to some preparation sessions for the presentation of the projects and their evaluation.

Each of the fundamental parts consists of five sessions of two hours each. The first two sessions of each part are dedicated to the presentation of a real life problem and to the introduction of the basic mathematical and computational tools necessary to address the solution of the proposed problem. In the following three sessions of each part of the course, students work in teams to provide a solution to the proposed problem. In these sessions the students are supervised and have the advice of the teaching staff of the subject to complete the projects.

At the end of the course the three projects will be presented in the form of an oral dissertation and a written report.

The projects that will be covered in this course are:

Scheduling Problems with Calendars

Inverse problems and imaging

Fitting data with dynamical models: lessons on mathematical field work.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
1. Team project. Written report	40	0	0	2, 1, 3, 10, 5, 12, 11, 8, 7, 9, 6, 13, 4, 14
2. Team project. Oral presentation	30	0	0	2, 1, 3, 10, 5, 12, 11, 8, 7, 9, 6, 13, 4, 14
3. Exam	30	0	0	2, 1, 3, 10, 5, 12, 11, 8, 7, 9, 6, 13, 4, 14

The mark of the evaluation items 1 will be the same for all members of each team, whereas those of items 2 and 3 have an individual character. In exceptional cases where a component of a team has collaborated clearly less than his/her teammates, his/her grades in item 1 will be multiplied by a factor less than 1.

Items 1 and 2 refer to the organization and expression of the discourse, both in writing (item 1) and in speech (item 2).

The exam (item 3) will deal with (a) the general concepts and illustrative examples addressed in the projects.

Bibliography

General: Ch. Rousseau + Y. Saint-Aubin, 2008. Mathematics and Technology. Springer.

The necessary bibliography and references are provided for each project.

Software

No specific software is required

Language list

Name	Group	Language	Semester	Turn
(TEm) Theory (master)	1	English	first semester	afternoon