Universitat Autònoma de Barcelona

2018/2019

Modelling Workshop

Code: 42255
ECTS Credits: 6

Degree	Type	Year	Semester
4313136 Modelling for Science and Engineering	OB	0	1

Contact

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Use of languages

Principal working language: english (eng)

Teachers

Angel Calsina Ballesta

Prerequisites

There are no specific prerequisites. Students must have mathematical and computational skills at a graduate level.

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.

Skills

- 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.

Methodology

Mathematical modelling is a problem-driven task. Its methodology is quite generic and revolves around the so-called mathematical modelling cycle: 1. Analysis, simplification, representation; 2. Mathematical treatment; 3. Interpretation; 4. Validation, error estimation, refinement.

The main activity of the workshop is a project to be developed by the students, organized in teams. Besides, the workshop will include also some talks about general ideas, techniques and illustrative examples.

The project simulates the situation of a team of mathematicians that has been hired by a company.

The subject of the project will be a real-world problem. The spirit of the project should not be "finding the correct solution", but rather "giving a reasonable answer". The project must end up in a final presentation of the results. This presentation will comprise both an oral dissertation and a written memoir. Both of them should be addressed to the (possibly hypothetical) company or organization that proposed the problem. As a general rule, technicalities will be relegated to special sections of the written memoir.

The professors of the course may enquire about the respective contribution of the different members of each team.

Activities

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

Evaluation

The marks of the evaluation items 1 and 2 will be the same for all members of each team, whereas those of items 3 and 4 have an individual character.

Item 1 will take into account the results of the project as well as the progress in new knowledge in connection with the project.

Items 2 and 3 refer to the organization and expression of the discourse, both and in writing (item 2) and in speech (item 3).

The exam (item 4) will be about (a) the general concepts and illustrative examples that will be presented in the course, and possibly (b) the team project.

All evaluation items require, as conditions *sine quibus non*, the originality of the work and the correctness of the mathematics.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
1. Team project. Contents	40	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
2. Team project. Written presentation	20	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
3. Team project. Oral presentation	10	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
4. Exam	30	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

Bibliography

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

P. Pevzner + R. Shamir, 2011. Bioinformatics for Biologists. Cambridge Univ. Press

Ph. Compeau + P. Pevzner, 2015. Bioinformatics Algorithms. Active Learning Publishers