Course guide
200172 - MMT - Mathematical Models in Technology

Last modified: 11/04/2024

Unit in charge: School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 9.0 **Languages:** English

LECTURER

Coordinating lecturer: JAIME FRANCH BULLICH

Others: Primer quadrimestre:
JAIME FRANCH BULLICH - M-A

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
5. CE-1. Propose, analyze, validate and interpret simple models of real situations, using the mathematical tools most appropriate to the goals to be achieved.
6. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
7. CE-3. Have the knowledge of specific programming languages and software.
8. CE-4. Have the ability to use computational tools as an aid to mathematical processes.

Generical:
1. CB-1. Demonstrate knowledge and understanding in Mathematics that is founded upon and extends that typically associated with Bachelor's level, and that provides a basis for originality in developing and applying ideas, often within a research context.
2. CB-2. Know how to apply their mathematical knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader or multidisciplinary contexts related to Mathematics.
3. CB-3. Have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements.
4. CB-4. Have the ability to communicate their conclusions, and the knowledge and rationale underpinning these to specialist and non-specialist audiences clearly and unambiguously.
9. CG-1. Show knowledge and proficiency in the use of mathematical language.
10. CG-2. Construct rigorous proofs of some classical theorems in a variety of fields of Mathematics.
11. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
12. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
13. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

Transversal:
14. ENTREPRENEURSHIP AND INNOVATION: Knowing about and understanding how businesses are run and the sciences that govern their activity. Having the ability to understand labor laws and how planning, industrial and marketing strategies, quality and profits relate to each other.
15. SUSTAINABILITY AND SOCIAL COMMITMENT. Being aware of and understanding the complexity of social and economic phenomena that characterize the welfare society. Having the ability to relate welfare to globalization and sustainability. Being able to make a balanced use of techniques, technology, the economy and sustainability.
16. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
17. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
18. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
19. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

TEACHING METHODOLOGY

(Section not available)

LEARNING OBJECTIVES OF THE SUBJECT

(Section not available)

STUDY LOAD

Type	Hours	Percentage
Hours large group	34,5	15.33
Hours small group	28,5	12.67
Self study	162,0	72.00

Total learning time: 225 h

CONTENTS

Modelling Laboratory

Description:
In the laboratory sessions, the students divide into groups od 3-4 people and study a different problem each group. The problems are realistic technological problems. About each problem partial presentations along the semester and a final presentation, together with a final report, have to be done.

Full-or-part-time: 130h
Laboratory classes: 31h 30m
Self study : 98h 30m

Seminar

Description:
In the seminar sessions the students have to make individual presentations about texts related to mathematical modelling. Some seminar sessions are also devoted to invite external visitors, focussing on professional and entrepreneurship experiences in the technological area.

Full-or-part-time: 95h
Theory classes: 31h 30m
Self study : 63h 30m

GRADING SYSTEM

A 70% of the total mark comes from attending and participating in the seminar, and from the project made at the lab. The other 30% will come from the activities performed at the seminar.

Completion of the corresponding unit of the subject "Ús solvent de la informació" will be required for the assesment of the course.

BIBLIOGRAPHY

Basic:
- Howison, Sam. Practical applied mathematics : modelling, analysis, approximation. New York: Cambridge University Press, 2005. ISBN 0521603692.
- Fowler, A.C. Mathematical models in the applied sciences. New York: Cambridge University Press, 1997. ISBN 0521467039.
- Cumberbatch, E.; Fitt, A. Mathematical modeling: case studies from industry [on line]. New York: Cambridge University Press, 2001 [Consultation: 21/06/2023]. Available on: https://www-cambridge-org.recursos.biblioteca.upc.edu/core/books/mathematical-modeling/E196EE609B5320352722DC023BD878B2. ISBN 9780521011730.
- Tayler, A. B. Mathematical models in applied mechanics. Oxford: The Clarendon Press, 2001. ISBN 0198515596.
- Witelsky, T.; Bowen, M. Methods of mathematical modelling. Cham (Switzerland): Springer, 2015. ISBN 9783319230412.

Complementary:
- Friedman, A.; Litman, W. Industrial mathematics : a course in solving real-world problems. Philadelphia: SIAM, 1994. ISBN 0898713242.
- Holmes, Mark H. Introduction to the foundations of applied mathematics [on line]. New York: Springer New York, 2009 [Consultation: 21/06/2023]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-0-387-87765-5. ISBN 9780387877655.
- Logan, J.D. Applied mathematics. Hoboken: Wiley-Interscience, 2013. ISBN 9781118475805.