UAB
Universitat Autònoma de Barcelona

Applied Modelling & Simulation

Code: 43480
ECTS Credits: 6

2025/2026

Degree	Type	Year
Modelización para la Ciencia y la Ingeniería / Modelling for Science and Engineering	OP	1

Contact

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Teachers

Carlos Carrillo Jordan

Abraham De la Rosa Ibarra

Teaching groups languages

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

Prerequisites

User knowledge of computer systems and (recommended) some knowledge of a programming language but not essential.

Objectives and Contextualisation

The present course aims to:

- Introduce students to the modelling and simulation techniques used in multidisciplinary areas.
- Apply the appropriate methodology for developing models in multidisciplinary areas.
- Evaluate modelling and simulation tools available for different areas.
- Model and simulate structures of different types.

Learning Outcomes

1. CA21 (Competence) Apply computational tools to solve unprecedented problems in the field of engineering.
2. CA22 (Competence) Communicate the results obtained from engineering modelling projects to an expert audience.
3. CA23 (Competence) Incorporate sustainability criteria in the modelling applied to Engineering.

4. CA23 (Competence) Incorporate sustainability criteria in the modelling applied to Engineering.
5. KA17 (Knowledge) Identify the appropriate programming environments in engineering modelling.
6. KA18 (Knowledge) Identify the most common computing and resource management architectures to solve models and to simulate structures in the field of engineering.
7. SA21 (Skill) Use specific software to solve modelling problems for engineering.
8. SA22 (Skill) Apply specific mathematical models to analyse complex physical problems.
9. SA23 (Skill) Interpret the results and predictions obtained from applying a mathematical model to problem-solving in the field of engineering.

Content

Module 1: Modelling in engineering

- Tools for structural modelling
- Structures design
- Structural Simulation
- 3D Printed

Module 2: Applications of Complex Physical Models

- Forest fire spread models: basic and Rothermel model, global models
- Input uncertainty: Data Driven Systems (Genetic Algorithms, Statistic Systems)
- Multi-model prediction system (Numerical Weather Prediction, Wind Field model, Fuels models..)
- Numerical weather forecast models: Numerical Weather Prediction (NWP)
- Basic concepts of Atmospheric Modelization. NWP models and computational power

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theoretical Lectures	12	0.48	
Type: Supervised			
Practical sessions	26	1.04	
Type: Autonomous			
Collaborative work	40	1.6	
Individual (personal work)	20	0.8	
Technical documentation study and preparation	45	1.8	

The course will be developed in theoretical classes, practical excercises and seminars.

It is recommended that students attend all classes of the subject with a laptop and (minimum) Windows 10.

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
Environmental modelling and simulation: Case study	60%	4	0.16	CA21, CA22, CA23, KA17, KA18, SA21, SA22, SA23
Structural simulation	40%	3	0.12	CA21, CA22, CA23, KA17, KA18, SA21, SA22, SA23

The evaluation will be made by developing and presenting the proposed case studies using the tools presented in the lecture sessions. Group work and interaction will also be assessed.

In the case that the student has an evaluation of less than 5 points in some sections of the assessment (except the Lab), the student will have to do an additional (in person) test on the particular section.

Academic Integrity
If the student use someone else's work (code, figures, research publications, etc.) to produce any work for this course, the student must:

1. Indicate how this work was used,
2. Acknowledge this work in a bibliography section.

Violation of these policies will be considered a breach of academic integrity, and the student will be subject to penalties outlined by the MsC studies coordination at the Faculty of Sciences.The student is subject to the rights and responsibilities that includes an academic (grade) penalty administered by the professor and/or disciplinary action through the UAB judicial process by plagiarism responsabilitities.

Bibliography

- Solidedge user's guide: https://solidedge.siemens.com/es/solutions/users/students/
- WRF user's guide: https://www2.mmm.ucar.edu/wrf/users/docs/user_guide_v4/contents.html
- WRF-Chem user's guide: https://ruc.noaa.gov/wrf/wrf-chem/
- FARSITE user's guide: https://www.firelab.org/project/flammap
- WindNinja user's guide: https://www.firelab.org/project/windninja
- M. P. Groover. Fundamentals of Modern Manufacturing, Materials, Processes, and Systems. Prentice Hall. 1996
- Karl T. Ulrich and Steven D. Eppinger. Product Design and Development. Third Edition, McGraw-Hill, 2004
- Bernard P. Zeigler. Theory of Modeling and Simulation. Academic Press. 2000
- Sheldon Ros. Simulation. Academic Press. 2012.
- Angela B. Shiflet, George W. Shiflet (Author). Introduction to Computational Science: Modeling and Simulation for the Sciences. Princeton University Press.2014.

Software

SolidEdge

WRF

FARSITE

WindNinja

VirtualBox

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

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