Mathematical Modelling in the Environment

ECTS: 6 ECTS

COORDINATOR: Lino J. Alvarez Vazquez (lino@dma.uvigo.es)

UNIVERSITY WHERE THE COORDINATOR IS: UVigo

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

LECTURER 1: Miguel A. Fernández Varela (Miguel.Fernandez@inria.fr)

UNIVERSITY WHERE THE LECTURER 1 IS: UVigo

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

SUBJECT CONTENTS

Topic 1: Introduction.

1.1. The role of mathematical models in environmental sciences.

1.2. Analysis/control of environmental problems.

1.3. Choice of mathematical tools.

Topic 2: Getting started: Models of biological communities.

2.1. Communities of species.

2.2. Communities of two species (competition, symbiosis, commensalism, predator/prey, migration ...)

2.3. Age distribution in populations.

Topic 3: Propagation models for pollution.

3.1. Mathematical models concerning the air environment.

3.1.1. Basics.

3.1.2. Transport and diffusion models.

3.2. Mathematical models relating to the aquatic environment.

3.2.1. Model classification.

3.2.2. General models of adsorption and sedimentation.

3.2.3. Three-dimensional models.

3.2.4. Two-dimensional shallow water models.

3.2.5. One-dimensional models for rivers and canals.

3.2.6. Zero-dimensional models.

Topic 4: Control of environmental processes.

4.1. Formulations.

4.2. Realistic examples.

METHODOLOGY

The class is a combination of master session where the teacher will present the theoretical contents of the subject and problem and/or exercises solving (in these hours the teacher will solve problems of each of the items and will introduce new methods of resolution from a practical point of view). The student must also solve problems proposed by the teacher in order to apply the acquired knowledge.

LANGUAGE USED IN CLASS: Spanish

IS IT COMPULSORY TO ATTEND CLASS? Students can attend via conference system

---

BIBLIOGRAPHY

C.R. Hadlock, Mathematical modeling in the environment , Mathematical Association of America, 1998.

N. Hritonenko – Y. Yatsenko, Mathematical modeling in economics, ecology and the environment, Kluwer Academic Publishers, 1999.

J. Pedlosky, Geophysical fluid dynamics, Springer Verlag, 1987.

SKILLS

Basic:

CG1: To have knowledge that provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context, knowing how to translate industrial needs in terms of R & D in the field of mathematics Industrial.

CG2: To be able to apply the acquired knowledge and abilities to solve problems in new or unfamiliar environments within broader contexts, including the ability to integrate multidisciplinary R & D in the business environment.

CG4: To have the ability to communicate the findings to specialist and non-specialist audiences in a clear and unambiguous way.

CG5: To have the appropriate learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous, and also to be able to successfully undertake doctoral studies.

Specific:

CE1: To acquire a basic knowledge in an area of Engineering / Applied Science, as a starting point for an adequate mathematical modelling, using well-established contexts or in new or unfamiliar environments within broader and multidisciplinary contexts.

CE2: To model specific ingredients and make appropriate simplifications in the model to facilitate their numerical treatment, maintaining the degree of accuracy, according to previous requirements.

CE5: To be able to validate and interpret the results, comparing them with visualizations, experimental measurements and functional requirements of the physical engineering system.

Modelling specialization:

CM1: To be able to extract, using different analytical techniques, both qualitative and quantitative models.

WILL YOU BE USING A VIRTUAL PLATFORM? Yes. faitic.uvigo.es

WILL YOU BE USING ANY SPECIFIC SOFTWARE? No.

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

1. Resolution of problems and/or exercises: At this point two aspects will be assessed:

   a) attendance and active participation in class (25% of the final mark).

   b) Individual theoretical exercises: Exercises that the teacher will propose in the classroom (25% of the final mark).

2. Final exam (50% of the final mark).

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

The same as for the first assessment opportunity.
