

Academic Year/course: 2022/23

27030 - Numerical Treatment of Partial Differential Equations

Syllabus Information

Academic Year: 2022/23

Subject: 27030 - Numerical Treatment of Partial Differential Equations

Faculty / School: 100 - Facultad de Ciencias

Degree: 453 - Degree in Mathematics

ECTS: 6.0

Year: 4

Semester: Second semester

Subject Type: Optional

Module:

1. General information

1.1. Aims of the course

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the learning outcomes of the module provides training and competence to contribute to some extent to their achievement: (4) Quality education, (5) Gender equality, (8) Decent work and economic growth, (9) Industry, innovation and infrastructure, (10) Reducing inequality, (17) Partnerships for the goals.

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process designed for this course is based on the following:

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving sessions and tutorials.

4.2. Learning tasks

The program offered to the student to achieve the learning objectives comprises the following activities:

- Theory sessions with theoretical content and model problems.
- Problems proposed to the students for their autonomous work.
- Computer lab sessions in reduced groups.
- Voluntary office hours.
- Autonomous work of the student.

The teaching activities and assessment tasks will take place in a face-to-face mode, except in the case that, due to the health situation, the dispositions emitted by the competent authorities and by the University of Zaragoza compel to take them to a greater or lesser extent in a telematic form.

4.3. Syllabus

1. The finite difference method for one-dimensional boundary value problems.
2. The finite difference method for elliptic equations.
3. Solution of large systems of equations. The preconditioned conjugate gradient method and the multigrid method.
4. The finite difference method for parabolic problems.
5. The finite element method for one-dimensional boundary value problems.
6. The finite element method for elliptic equations.
7. Implementation of the methods and numerical simulation.

4.4. Course planning and calendar

See the calendar of the Universidad de Zaragoza and the timetable established by the Facultad de Ciencias.

4.5. Bibliography and recommended resources

- R.J. LeVeque: *Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time Dependent Problems*. SIAM 2007.
- C. Johnson: *Numerical Solution of Partial Differential Equations by the Finite Element Method*. Dover 2009.
- Y. Saad: *Iterative Methods for Sparse Linear Systems*. SIAM 2003.

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=27030>