

## 584SM - NUMERICAL ANALYSIS

### Aims

#### KNOWLEDGE AND UNDERSTANDING

At the end of the course, the student should be able to prove to know the fundamental results of numerical analysis, and to know the basics of the python programming language.

#### CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING

At the end of the course, the student should be able to apply the acquired knowledge of numerical analysis to solve problems and exercises in applied mathematics, both at the theoretical level and through the use of a computer.

#### JUDGMENT AUTONOMY

At the end of the course the student should be able to) recognize and apply the most basic techniques of numerical analysis (interpolation, integration, numerical solution of ODEs, numerical solution of non-linear equations and non-linear systems, and numerical solution of PDEs and will also recognize the situations and problems in which these techniques can be advantageously used (simple models from physics and other disciplines).

#### COMMUNICATIVE SKILLS

At the end of the course, the student should be able to express themselves appropriately on the themes of numerical analysis, with clear language and exposure security.

#### LEARNING CAPACITY

At the end of the course, the student should be able to consult numerical analysis and computer programming manuals.

### Teaching Format

Frontal lectures and laboratories, with examples taken from Modern Mathematical Modeling. In particular, we will see the topics of basic numerical analysis in: Data assimilation in biomechanics, statistics, medicine, electric signals; Model order reduction of matrices; Linear models for hydraulics, networks, logistics; State equations (real gases), applied mechanics systems, grow population models, financial problems; Applications of ODEs examples in electric phenomena, signals and dynamics of populations (Lotke-Volterra); Models for prey-predator, population dynamics, automatic controls; Applications of PDEs, the Poisson problem  
- Elastic rope / Bar under traction / - Heat conductivity /- Maxwell equation  
Laboratories will be done in python, using numpy and scipy as the core libraries.

### Assessment

Oral examination + Python project