Course guide
240733 - 240733 - Numerical Methods in Engineering

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGIES AND ECONOMIC ANALYSIS (Syllabus 2018). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: Antonio Susín Sánchez

Others:

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

The main goal of the course is to provide the numerical expertise for dealing with the problems one can face in the orbit of engineering and economics.
This course is mainly devoted to differential equations, which model the majority of the engineering processes. We will use the mathematical background introduced in the previous semesters to study both the analytical and numerical properties of the differential equations.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	30,0	20.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

Interpolation

Description:
1D and 2D interpolation. Shape functions. Applications of the interpolation.

Full-or-part-time: 20h
Theory classes: 4h
Practical classes: 4h
Self study : 12h

Iteration

Description:
Iteration concept. Convergence of an Iteration. Fixed Points. Iterations with complex variables. Fractal sets.

Full-or-part-time: 20h
Theory classes: 4h
Practical classes: 4h
Self study : 12h

Ordinary Differential Equations

Description:
Boundary and Initial value problems. Stability and Classification of constant coefficients linear systems.

Specific objectives:
Boundary and Initial value problems. Stability and Classification of constant coefficients linear systems. Stability of non-linear systems. Numerical methods for ODE: Euler, Runge-Kutta, etc.

Full-or-part-time: 40h
Theory classes: 8h
Practical classes: 8h
Self study : 24h

Partial Differential Equations

Description:
Wave, Thermal and Laplace/Poisson equations. Conservation laws. D'Alembert Formula. Variable separation. Numerical Methods for PDE: Finite Differences, Temporal evolution, Graphical representation.

Full-or-part-time: 40h
Theory classes: 8h
Practical classes: 8h
Self study : 24h

GRADING SYSTEM

The final mark will be computed by means of,

FM=0.1*MA+0.3*MT+0.6*FE

where MA is the resulting mark of the exams of Matblab, MT is the mark of the mid term exam and FE is the mark of the final exam.

The reevaluation will consist in an exam including all the contents and scheduled by the School. In case of reevaluation, the final mark will be computed by means of:

FM=0.1*MA+0.9*RM

BIBLIOGRAPHY

Basic:
- Quarteroni, Alfio; Saleri, Fausto; Sacco, Riccardo. Numerical mathematics [on line]. 2nd ed. New York ; Barcelona [etc.]: Springer, cop. 2007 [Consultation: 15/07/2019]. Available on: https://link.springer.com/book/10.1007/b98885. ISBN 9783540346586.
- Quarteroni, A.; Saleri, F.; Gervasio, P. Scientific computing with MATLAB and Octave [on line]. 4th ed. Heidelberg: Springer, 2014 [Consultation: 07/09/2022]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-3-642-12430-3. ISBN 9783642453663.

RESOURCES

Audiovisual material:
- Nom recurs. Resource