

Academic Year: ( 2022 / 2023 )

Review date: 16-05-2022

Department assigned to the subject: Mathematics Department

Coordinating teacher: GONZALEZ RODRIGUEZ, PEDRO

Type: Basic Core ECTS Credits : 6.0

Year : 2 Semester : 2

Branch of knowledge: Engineering and Architecture

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Calculus I  
 Calculus II  
 Linear Algebra  
 Differential equations

**OBJECTIVES**

CB1. Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study

CB2. Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study

CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues

CB5. Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy

CG1: Ability to solve problems, showing initiative, creativity, con iniciativa, toma de decisiones, creatividad, critical thinking, and being able to communicate and transmit knowledge and abilities in the field of Industrial engineering.

CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.

CG4. Solve mathematical, physical, chemical, biological and technological problems that may arise within the framework of the applications of quantum technologies, nanotechnology, biology, micro- and nano-electronics and photonics in various fields of engineering.

CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.

CG6: Knowledge applied to company organization.

CG8: Knowledge and ability to apply the principles and methods of quality.

CG9: Knowledge and ability to apply computational and experimental tools to the analysis and qualification of Industrial Engineering problems .

RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them.

RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking.

RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study.

RA4. Research and innovation: Ability to use the right methods to do research and implement innovative solutions in the field of Industrial Engineering.

RA5. Engineering applications: Being able to apply their knowledge and understanding to solve problems and design devices or processes in the field of Industrial engineering applying quality, cost,

safety, efficiency and respect to the environment criteria.

RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be able to plan and organize their own training with a high degree of independence.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Fundamentals (floating point, errors, stability, algorithms...).
2. Numerical solution of equations and systems of nonlinear equations.
3. Interpolation and approximation of functions.
4. Numerical differentiation and integration.
5. Fast Fourier Transform.
6. Methods for ordinary differential equations
7. Methods for partial differential equations
8. Numerical linear algebra.

## LEARNING ACTIVITIES AND METHODOLOGY

AF1. THEORETICAL-PRACTICAL CLASSES. Knowledge and concepts students must acquire. Receive course notes and will have basic reference texts. Students partake in exercises to resolve practical problems

AF2. TUTORING SESSIONS. Individualized attendance (individual tutoring) or in-group (group tutoring) for students with a teacher. Subjects with 6 credits have 4 hours of tutoring/ 100% on-site attendance.

AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK. Subjects with 6 credits have 98 hours/0% on-site.

AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.

AF9. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. It entails 4 hours/100% on-site

AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.

MD1. THEORY CLASS. Classroom presentations by the teacher with IT and audiovisual support in which the subject's main concepts are developed, while providing material and bibliography to complement student learning

MD2. PRACTICAL CLASS. Resolution of practical cases and problem, posed by the teacher, and carried out individually or in a group

MD3. TUTORING SESSIONS. Individualized attendance (individual tutoring sessions) or in-group (group tutoring sessions) for students with teacher as tutor. Subjects with 6 credits have 4 hours of tutoring/100% on-site.

MD6. LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories under the tutor's supervision.

## ASSESSMENT SYSTEM

SE1. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. The percentage of the evaluation will be 40%.

SE2. CONTINUOUS EVALUATION. Assesses partial exams and projects throughout the course. The percentage of the evaluation will be 60% of the final grade.

**% end-of-term-examination:** 30

**% of continuous assessment (assignments, laboratory, practicals...):** 70

## BASIC BIBLIOGRAPHY

- Kendall E. Atkinson An introduction to numerical analysis, John Wiley and Sons, 1989
- Qingkai Kong, Timmy Siau, Alexandre Bayen Python Programming and Numerical Methods\_ A Guide for Engineers and Scientist, Academic Press, 2020
- Ward Cheney y David Kincaid Numerical mathematics and computing, Thomson Brooks/Cole, 2008

## ADDITIONAL BIBLIOGRAPHY

- J. C. Butcher NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS, Wiley, 2016