# [GFA004] Mathematical Methods Applied to Engineering

## GENERAL INFORMATION

| | | | | | |
|---|---|---|---|---|---|
| **Studies** | DEGREE IN ENGINEERING PHYSICS APPLIED TO INDUSTRY | | | **Subject** | Mathematics |
| **Semester** | 1 | **Course** | 2 | **Mention / Field of specialisation** | |
| **Character** | COMPULSORY | | | | |
| **Plan** | 2022 | **Modality** | Face-to-face | **Language** | EUSKARA/ENGLISH |
| **Credits** | 6 | **Hours/week** | 0 | **Total hours** | 90 class hours + 60 non-class hours = **150 total hours** |

## 2030 AGENDA GOALS

## PROFESSORS

AGUIRRE ALONSO, MIKEL
TELLERIA ALLIKA, XABIER

## REQUIRED PREVIOUS KNOWLEDGE

| Subjects | Knowledge |
|---|---|
| CALCULUS I | *(No previous knowledge required)* |
| LINEAR ALGEBRA | |
| CALCULUS II | |

## LEARNING RESULTS

| LEARNING RESULTS | KC | SK | AB | ECTS |
|---|---|---|---|---|
| **GFR102** - Solving any mathematical problems that may arise in engineering. Aptitude in applying knowledge of: differential equations, Laplace and Fourier transforms and complex variables | | x | | 5,4 |
| **G-RTR1** - To develop interdisciplinary projects specific to their specialty and of gradual complexity, - becoming aware of respect for human rights and fundamental rights, and analyzing and assessing the impact of the proposed solutions on the SDGs - to acquire and/or apply basic, advanced and/or avant-garde, demonstrating the ability to work in multidisciplinary teams and/or undertake further studies with a high degree of autonomy | | x | | 0,24 |
| **G-RTR2** - To express information, ideas and the arguments that support them in an orderly, clear and coherent manner, orally and in writing, based on quality information, self-made or obtained from different sources, using inclusive and non-discriminatory language | | x | | 0,36 |
| | | | **Total:** | 6 |

*KC: Knowledge or Content / SK: Skills / AB: Abilities*

## SECONDARY LEARNING RESULTS

**1RGF292** **(1 sem)**

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams | 1 h. | 2 h. | 3 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 100% |

**MAKE-UP MECHANISMS**

*(No mechanisms)*

**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 1 h.
**NCH - Non-class hours:** 2 h.
**TH - Total hours:** 3 h.

**1RGF294** **[!]** ***(1 sem)Realiza una presentación oral del proyecto con argumentos elaborados por sí mismos y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.***

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams | | 3 h. | 3 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems | 100% |

**MAKE-UP MECHANISMS**

*(No mechanisms)*

**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 0 h.
**NCH - Non-class hours:** 3 h.
**TH - Total hours:** 3 h.

**RGF206** **[!]** ***Conoce las propiedades fundamentales del plano complejo y las funciones definidas en él, así como las diferentes técnicas para la resolución de problemas.***

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints | | 5 h. | 5 h. |
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams | | 4 h. | 4 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 25 h. | | 25 h. |
| Carrying out exercises and solving problems individually and/or in teams | 11 h. | 10 h. | 21 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 30% |
| Individual written and/or oral tests or individual coding/programming tests | 70% |

**Comments:** The grades for the practical assignments are subject to the exam/retake grade as follows: If the exam grade is <3, the assignment grade will be grade × 0.5. If the exam grade is 3 ≤ grade < 5, the assignment grade will be grade × 0.75. If the exam grade is 5 ≤ grade < 8, the assignment grade will be grade × 1. If the exam grade is ≥8, the assignment grade will be grade × 1.1.

**MAKE-UP MECHANISMS**

Individual written and/or oral tests or individual coding/programming tests

**Comments:** The 25%(E)–75%(R) mechanism will be applied to calculate the exam grade if we obtained a grade <5 in the checkpoint or if we take the exam to improve our grade.

**CH - Class hours:** 36 h.
**NCH - Non-class hours:** 19 h.
**TH - Total hours:** 55 h.

**1RGF291** **(1 sem)**

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams | | 3 h. | 3 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Self-assessment | 25% |
| Co-assessment | 25% |
| Observation (technical capacity, attitude and participation) | 50% |

**MAKE-UP MECHANISMS**

*(No mechanisms)*

**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 0 h.
**NCH - Non-class hours:** 3 h.
**TH - Total hours:** 3 h.

**RGF205** **[!]** ***Identifica y modeliza diferentes tipos de ecuaciones diferenciales y sistemas de ecuaciones diferenciales para la resolución de problemas físicos e ingenieriles mediante diversas técnicas y sabe utilizar las transformadas de Laplace y Fourier.***

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints | | 5 h. | 5 h. |
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams | | 8 h. | 8 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 40 h. | | 40 h. |
| Carrying out exercises and solving problems individually and/or in teams | 12 h. | 15 h. | 27 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 37,5% |
| Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems | 22,5% |
| Individual written and/or oral tests or individual coding/programming tests | 40% |

**Comments:** The grades for the practical assignments are subject to the exam/retake grade as follows: If the exam grade is <3, the assignment grade will be grade × 0.5. If the exam grade is 3 ≤ grade < 5, the assignment grade will be grade × 0.75. If the exam grade is 5 ≤ grade < 8, the assignment grade will be grade × 1. If the exam grade is ≥8, the assignment grade will be grade × 1.1.

**MAKE-UP MECHANISMS**

Individual written and/or oral tests or individual coding/programming tests

**Comments:** The 25%(E)–75%(R) mechanism will be applied to calculate the exam grade if we obtained a grade <5 in the checkpoint or if we take the exam to improve our grade.

**CH - Class hours:** 52 h.
**NCH - Non-class hours:** 28 h.
**TH - Total hours:** 80 h.

**1RGF293** **(1 sem)**

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams | | 3 h. | 3 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems | 100% |

**MAKE-UP MECHANISMS**

*(No mechanisms)*

**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 0 h.
**NCH - Non-class hours:** 3 h.
**TH - Total hours:** 3 h.

**1RGF290** **(1 sem)**

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in | 1 h. | 2 h. | 3 h. |

interdisciplinary contexts, real and/or simulated, individually and/or in teams

| EVALUATION SYSTEM | W | MAKE-UP MECHANISMS |
|---|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 85% | *(No mechanisms)* |
| Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems | 15% | |

**CH - Class hours:** 1 h.
**NCH - Non-class hours:** 2 h.
**TH - Total hours:** 3 h.

## CONTENTS

1. Complex Analysis- Complex Functions. Differentiation and Cauchy-Riemann Equations.- Complex Integration.- Cauchy's Integral Formulas.- Meromorphic Functions and the Residue Theorem.- Laurent Series.2. Ordinary Differential Equations (ODEs)- Higher-Order ODEs.- Systems of ODEs.- Laplace and Fourier Transforms.- Sturm-Liouville Problems.- Power Series Solutions.- Introduction to Numerical Methods.

## LEARNING RESOURCES AND BIBLIOGRAPHY

| Learning resources | Bibliography |
|---|---|
| [!] *Apuntes de la asignatura* | https://labur.eus/Cq5w9 |
| [!] *Plataforma Moodle* | |