

## [GFA004] Mathematical Methods Applied to Engineering

### GENERAL INFORMATION

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

### PROFESSORS

AGUIRRE ALONSO, MIKEL  
TELLERIA ALLIKA, XABIER

### REQUIRED PREVIOUS KNOWLEDGE

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

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>GFR102</b> - 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
<b>G-RTR1</b> - 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		0,32
<b>G-RTR2</b> - 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		0,28

Total: 6

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

### SECONDARY LEARNING RESULTS

**RGF290** [!] *Muestra las habilidades para trabajar en grupo y resuelve los problemas planteados utilizando las herramientas adecuadas en cada caso.*

#### LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH 2 h. NCH 2 h. TH 4 h.

#### EVALUATION SYSTEM

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

#### MAKE-UP MECHANISMS

(No mechanisms)

CH - Class hours: 2 h.  
NCH - Non-class hours: 2 h.  
TH - Total hours: 4 h.

**RGF291** [!] *Utiliza la metodología adecuada para encontrar las soluciones a los problemas y para desarrollar los proyectos: Examina bien los problemas, y busca información significativa para hacerle frente y propone las soluciones.*

#### LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH NCH 4 h. TH 4 h.

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	100%	(No mechanisms)
<b>CH - Class hours:</b> 0 h. <b>NCH - Non-class hours:</b> 4 h. <b>TH - Total hours:</b> 4 h.		

**RGF292** [!] *Comunica, busca y estructura correctamente la información de manera escrita: Redacta una memoria de proyecto clara y concisa siguiendo los criterios establecidos en la guía para la redacción de la memoria de proyectos y utilizando herramienta informá*

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		4 h.	4 h.
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	100%	(No mechanisms)	
CH - Class hours: 0 h.			
NCH - Non-class hours: 4 h.			
TH - Total hours: 4 h.			

**RGF293** [!] *Comunica, busca y estructura correctamente la información de manera oral: Realiza una presentación oral y defensa del proyecto clara y concisa, utilizando adecuadamente los aspectos recogidos en la guía de comunicación oral y las herramientas informá*

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	MAKE-UP 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	100%	(No mechanisms)	
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

#### MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

20%

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

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

20%

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

60%

CH - Class hours: 52 h.

NCH - Non-class hours: 28 h.

TH - Total hours: 80 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

#### MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

10%

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

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

20%

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

70%

CH - Class hours: 36 h.

NCH - Non-class hours: 19 h.

TH - Total hours: 55 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

- Higher order ODE's.

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- ODE systems.
  - Laplace and Fourier Transforms.
  - Sturm-Liouville problems.
  - Series solutions.

## LEARNING RESOURCES AND BIBLIOGRAPHY

### Learning resources

Subject notes  
Moodle Platform

### Bibliography

<https://labur.eus/Cq5w9>