



## IDENTIFYING DATA

### Mathematics: Mathematical analysis

Subject	Mathematics: Mathematical analysis			
Code	O06G151V01102			
Study programme	Grado en Ingeniería Informática			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cid Araujo, Jose Angel Pájaro Diéguez, Manuel			
Lecturers	Cid Araujo, Jose Angel Pájaro Diéguez, Manuel			
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Web	<a href="http://moovi.uvigo.gal">http://moovi.uvigo.gal</a>			
General description	This subject is lectured in the first semester simultaneously with the subject Mathematics: Mathematical basics for IT and it serves as the basis for the preparation of the subject Mathematics: Statistics.			

English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

## Training and Learning Results

Code	
A1	Students will have shown they have sufficient knowledge and understanding of an area of study, starting after completion of general secondary education, and normally reaching a level of proficiency that, being mostly based on advanced textbooks, will also include familiarity with some cutting-edge developments within the relevant field of study.
A2	Students will be able to apply their knowledge and skills in their professional practice or vocation and they will show they have the required expertise through the construction and discussion of arguments and the resolution of problems within the relevant area of study.
A3	Students will be able to gather and interpret relevant data (normally within their field of study) that will allow them to have a reflection-based considered opinion on important issues of social, scientific and ethical nature.
B8	Knowledge of the essential subjects and technologies that will allow students to learn and develop new methods and technologies, as well as those that will endow them with versatility to adapt to new situations.
B9	Ability to solve problems by taking the initiative, making decisions and acting independently and creatively. Ability to communicate the knowledge contents, skills and abilities of the Computer Science Engineer profession.
C1	Ability to solve mathematical problems that might arise in engineering. Ability to apply knowledge of: linear algebra; integral and differential calculus; numerical methods; numerical algorithms; statistics and optimization.
C3	Ability to understand and master the essential concepts of discrete mathematics, mathematical logic, algorithmic mathematics and computational complexity, and their application to the resolution of engineering problems.
C4	Essential knowledge of use and programming of computers, operating systems, data bases and computer programs with application in engineering.
C12	Knowledge and application of basic algorithmic procedures of computer technologies to design solutions to problems, analyzing the appropriacy and complexity of the proposed algorithms.
D4	Analysis, synthesis and evaluation capacity
D5	Organizational and planning skills
D6	Ability to abstract: ability to create and use models that reflect real situations
D7	Ability to search, relate and structure information from various sources and to integrate ideas and knowledge.

D9 Ability to quickly integrate and work efficiently in unidisciplinary teams and to collaborate in a multidisciplinary environment

D11 Critical thinking

### Expected results from this subject

Expected results from this subject	Training and Learning Results			
LO1: Acquire concepts, procedures and strategies of Mathematical Analysis that have applications in computer science.	A1 A2	B8	C1 C3	D4 D5 D6 D7 D9 D11
LO2: Apply Mathematical Analysis to computer problems and problems that can be treated by computational means.	A1 A2 A3	B8	C1 C3	D4 D5 D6 D7 D9 D11
LO3: Understand mathematical reasoning to read, understand and construct mathematical arguments.	A2 A3	B8	C1 C3	D4 D5 D6 D7 D9 D11
LO4: Know how to use mathematical theories, procedures and tools appropriately in professional development.	A1 A2 A3	B8	C1	D4 D5 D6 D7 D9 D11
LO5: Know how to use and interpret mathematical software tools.			C4 C12	D4 D5 D6 D7 D9 D11
LO6: Develop capacities to determine the requirements that determine the possibility of finding solutions to specific problems.	A2		C1	D4 D5 D6 D7 D9 D11
LO7: Know how to find algorithmic solutions to the problems that have been raised and assess the suitability of the answers.			C3 C4 C12	D4 D5 D6 D7 D9 D11
LO8: Have initiative to propose alternatives to solutions already found.		B9		D4 D5 D6 D7 D9 D11
LO9: Arguing and logically justifying opinions and decisions	A1 A2	B8	C1	D4 D5 D6 D7 D9 D11
LO10: Be able to effectively communicate ideas and projects.	A3	B9	C1 C12	D4 D5 D6 D7 D9 D11

<b>Contents</b>	
Topic	
BLOCK I.- Real numbers, Sequences, Series.	Real numbers. Sequences. Series.
BLOCK II.- Functions, Derivation, Integration.	Continuity. Derivation. Integration.
BLOCK III.- Numerical analysis.	Numerical solution of equations. Interpolation. Numerical integration.
Laboratory practices.	Sequences and real series. Methods for solving equations. Interpolation. Numerical integration.

<b>Planning</b>			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	3	1	4
Lecturing	16.5	33	49.5
Problem solving	13	26	39
Mentored work	4	4	8
Seminars	2	10	12
Laboratory practical	6	6	12
Objective questions exam	3	10	13
Essay questions exam	2.5	10	12.5

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

<b>Methodologies</b>	
	Description
Introductory activities	Activities aimed at making contact and gathering information about the students, as well as presenting the subject.
Lecturing	Presentation of the contents of the subject by the teacher that are illustrated with numerous examples and applications.
Problem solving	Formulation, analysis, resolution and discussion of problems and exercises related to the subject.
Mentored work	Support, attention and resolution of students' doubts.
Seminars	Preparation of a group work on an application of Mathematical Analysis in computing.
Laboratory practical	In each laboratory practice several exercises will be carried out with the help of MAXIMA, a free software program for scientific and symbolic calculation.
In the Continuous Evaluation, attendance to Practices is mandatory in order to be evaluated on them. In any case, passing the Practices is not essential to pass the course.	

<b>Personalized assistance</b>	
Methodologies	Description
Lecturing	Attention and resolution of doubts to the students in relation to the different activities of the subject. The tutoring sessions may be carried out by telematic means (email, Campus Remoto,...) under the modality of prior agreement.
Problem solving	Attention and resolution of doubts to the students in relation to the different activities of the subject. The tutoring sessions may be carried out by telematic means (email, Campus Remoto,...) under the modality of prior agreement.
Mentored work	Attention and resolution of doubts to the students in relation to the different activities of the subject. The tutoring sessions may be carried out by telematic means (email, Campus Remoto,...) under the modality of prior agreement.
Laboratory practical	Attention and resolution of doubts to the students in relation to the different activities of the subject. The tutoring sessions may be carried out by telematic means (email, Campus Remoto,...) under the modality of prior agreement.
Tests	Description
Objective questions exam	Attention and resolution of doubts to the students in relation to the different activities of the subject. The tutoring sessions may be carried out by telematic means (email, Campus Remoto,...) under the modality of prior agreement.

Essay questions exam Attention and resolution of doubts to the students in relation to the different activities of the subject. The tutoring sessions may be carried out by telematic means (email, Campus Remoto,...) under the modality of prior agreement.

Assessment						
	Description	Qualification	Training and Learning Results			
Problem solving	Completion of a collection of basic problems for each lesson.	15	A1	B8	C1	D4
			A2	B9		D5
	Expected Results from this Subject: LO1, LO2, LO3, LO4, LO6, LO8, LO9, LO10.		A3			D6
						D7
						D9
						D11
Seminars	Carrying out a work on computer applications of Mathematical Analysis.	10	A1		C3	D4
			A2		C4	D5
			A3		C12	D6
	Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO7, LO10.					D7
						D9
						D11
Laboratory practical	Carrying out exercises with the help of the mathematical software MAXIMA.	10	A1		C3	D4
			A2		C4	D5
			A3		C12	D6
	Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO7, LO10.					D7
						D9
						D11
Objective questions exam	Carrying out a knowledge test at the end of each Block.	25	A1	B8	C1	D4
			A2	B9		D5
	Expected Results from this Subject: LO1, LO2, LO3, LO4, LO6, LO8, LO9, LO10.		A3			D6
						D7
						D9
						D11
Essay questions exam	Taking a test at the end of the semester about the contents corresponding to the subject.	40	A1	B8	C1	D4
			A2	B9		D5
			A3			D6
	Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO6, LO8, LO10.					D7
						D9
						D11

## Other comments on the Evaluation

### CONTINUOUS EVALUATION SYSTEM

#### TEST 1: Exercise Deliveries.

Description: Submission and presentation of exercises carried out in groups.

Applied Methodologies: Problem solving.

% Grade: 15%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, B8, B9, C1, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO6, LO8, LO9, LO10.

#### TEST 2: Maxima Practices.

Description: Completion of exercises in groups with the help of the mathematical software MAXIMA.

Applied Methodologies: Laboratory practical.

% Grade: 10%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, C3, C4, C12, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO7, LO10.

### **TEST 3: Partial Tests.**

Description: Completion of an individual knowledge test at the end of each Block. The partial tests do not release material for the Final Test.

Applied Methodologies: Objective questions exam.

% Grade: 25%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, B8, B9, C1, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO6, LO8, LO9, LO10.

### **TEST 4: Assignment.**

Description: Completion and presentation of a group project on applications of Mathematical Analysis to Informatics.

Applied Methodologies: Seminars.

% Grade: 10%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, C3, C4, C12, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO7, LO10.

### **TEST 5: Final Test.**

Description: Completion of an individual test at the end of the semester that will cover the contents taught during classroom lectures.

Applied Methodologies: Essay questions exam.

% Grade: 40%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, C3, C4, C12, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO6, LO8, LO10.

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Students who miss, without justification, any test of Continuous Evaluation will be graded with a 0 in that test.

## **GLOBAL EVALUATION SYSTEM**

**Procedure for choosing the Global Evaluation modality:** Once one month has passed since the beginning of the semester, a period of 10 working days will be enabled for enrolled students to formally state their intention to participate in the Global Evaluation system.

### **TEST 1: Theoretical-Practical Evaluation.**

Description: Completion of an individual test that will cover the contents taught during classroom lectures.

Applied Methodologies: Essay questions exam.

% Grade: 80%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, B8, B9, C1, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO6, LO8, LO9, LO10.

### **TEST 2: Maxima Practices.**

Description: Completion of an individual test in front of the computer in which exercises will be solved with the help of the

mathematical software MAXIMA.

Applied Methodologies: Laboratory practical.

% Grade: 10%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, C3, C4, C12, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO7, LO10.

### **TEST 3: Assignment.**

Description: Completion and presentation of a project on applications of Mathematical Analysis to Informatics.

Applied Methodologies: Seminars.

% Grade: 10%

% Minimum: There is no minimum.

Evaluated Training and Learning Results: A1, A2, A3, C3, C4, C12, D4, D5, D6, D7, D9, D11.

Evaluated Expected Results from this Subject: LO1, LO2, LO3, LO4, LO5, LO7, LO10.

### **EVALUATION CRITERIA FOR EXTRAORDINARY CALL AND END OF DEGREE.**

In both calls, the Global Evaluation system explained above will be used.

Students who pass the Maxima Practices and/or the Project in the Ordinary Call can keep the corresponding grade for the Extraordinary Call (July).

### **GRADE CALCULATION PROCESS**

The final grade will be the weighted sum, according to the corresponding percentages, of the grades obtained in each section of the evaluation, provided that not attending an evaluation test implies obtaining a 0 in that test.

### **EVALUATION DATES**

The dates of the Partial Tests corresponding to the Continuous Evaluation system will be published in the activity calendar, available on the ESEI website

<https://esei.uvigo.es/docencia/horarios/>

The official exam dates for the different calls, officially approved by the Xunta de Centro of the ESEI, are published on the ESEI website

<https://esei.uvigo.es/docencia/horarios/>

### **USE OF MOBILE DEVICES**

All students are reminded of the prohibition of using mobile devices in exercises and practices, in compliance with article 13.2.d) of the University Student Statute, which establishes the duty to "Abstain from using or cooperating in fraudulent procedures in evaluation tests, in the work carried out or in official documents of the university."

### **TUTORIAL CONSULTATION/REQUEST**

Tutorials can be consulted through the subject site on Moovi, accessible at

<https://moovi.uvigo.gal/>

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## Sources of information

### Basic Bibliography

Larson, R.; Edwards, B.H., **Cálculo 1 y Cálculo 2**, 9786075220154-9786075220178, 10ª, Cengage Learning, 2016

Stewart, J., **Cálculo, conceptos y contexto**, 970-686-543-8, 3ª, International Thomson Ed., 2006

Burden, R.L.; Faires, J.D.; Burden, A. M., **Análisis Numérico**, 978-607-526-404-2, 10ª, Cengage Learning, 2017

### Complementary Bibliography

Apostol, T.M., **Calculus, vol. 1**, 84-291-5001-3, 2ª, Reverté, 1965

De Burgos, J., **Cálculo infinitesimal de una variable**, 978-84-481-5634-3, 2ª, Mc. Graw-Hill, 2007

Quarteroni, A.; Saleri, F., **Cálculo científico con Matlab y Octave**, 978-88-470-0503-7, Springer, 2006

Isaacson, E.; Keller, H.B., **Analysis of numerical methods**, 0-471-42865-5, John Wiley and Sons, 1966

Rodríguez Riotorto, M. (Traductor), **Manual de Maxima**,

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## Recommendations

### Subjects that continue the syllabus

Mathematics: Statistics/O06G151V01201

### Subjects that are recommended to be taken simultaneously

Mathematics: Mathematical basics for IT/O06G151V01101