Universidade de Vigo

IDENTIFYING DATA
Mathematics: Calculus 1

Subject	Mathematics: Calculus 1
Code	P52G382V01103
Study programme	Grado en Ingeniería Mecánica

Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st

Teaching language	Spanish
Department	
Coordinator	Cores Carrera, Débora
Lecturers	Cores Carrera, Débora
E-mail	cores@cud.uvigo.es
Web	http://moovi.uvigo.gal
General description	The general aim of this subject is that the students acquire knowledge of the basic techniques of the differential and integral calculus of one variable and differential calculus of several variables, that are required in other subjects that follow in the degree.

Training and Learning Results

Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of Industrial Engineering in Mechanical specialty.
C1	Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.
D1	Analysis and synthesis
D2	Problems resolution.
D6	Application of computer science in the field of study.
D9	Apply knowledge.
D14	Creativity.
D16	Critical thinking.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
Comprehension of basic knowledge of integral calculus of functions of one variable.	B3	C1	D1
Comprehension of the basic knowledge of differential calculus of one and several variables	B3	C1	D1
A good command of differential calculus techniques for the location of extremes, the local approximation of functions and the numerical resolution of systems of equations.	B3 B4	C1	D2 D9 D14 D16
Use of computer tools to solve problems of differential calculus and integral calculus.	B3 B4	C1	D2 D9 D14 D16
A good command of integral calculus techniques for computing of areas, volumes and surfaces.	B3 B4	C1	D2 D6 D9 D16

Contents

Topic	
Lesson 1. Limits and continuity in R.	Bolzano's theorem. Bisection's method.
Lesson 2. Differential calculus in R.	Optimization. Rolle's theorem. Mean value theorem. Taylor's polynomial. Newton-Raphson's method.
Lesson 3. Integral calculus of one variable.	Properties of the indefinite integral. Fundamental integration techniques. The definite integral. Applications of the definite integral.
Lesson 4. Sequences and Series.	The real numbers. Definition and basic concepts of sequences. Convergence of sequences. Convergence criteria and limits calculation techniques. Definition and basic concepts of series. Convergence of series. Convergence criteria for series.
Lesson 5. Limits and continuity of real functions of several variables.	The euclidean space Rn. Concept of a function of several variables. Limit of a function of several variables. Continuity of functions of several variables. Properties of the continuous functions.
Lesson 6. Differential calculus of real functions of several variables.	Directional derivatives. Partial derivatives. Gradient vector and Jacobian matrix. Differentiability of a real function of several variables. Conditions for the differentiability. Higher order differentiability. Hessian matrix. Local behaviour of differentiable functions.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	26	54
Problem solving	14	12	26
Mentored work	6	1	7
Seminars	15	10	25
Problem and/or exercise solving	4	4	8
Laboratory practice	1	1	2
Essay	0	4	4
Essay questions exam	9	15	24

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

Methodologies

	Description
Lecturing	The lecturer will expose the contents of the course in the theoretical lessons. The students will be able to consult bibliographic references as well as the notes of the course.
Problem solving	During the lessons of problems, the lecturer will solve model problems. The students will have a copy of the solutions of all the exercises that are made or proposed during these lessons. In the computer sessions, the students will use the Matlab/Octave computer tool, in order to apply the concepts presented in the theory lessons to practical cases. The students will have notes and scripts of the practices.
Mentored work	The students will have to solve exercises and problems that will be graded by the lecturer. Those exercises will be approached in groups and will be discussed on during seminar hours. Additionally, some of the mentored lessons (seminars) will be used for clarifying doubts related to Matlab practices.
Seminars	Intensive course of 15 hours for those students that have failed the course in their first call, previous to the exam in second call. Mentored lessons in groups with the lecturer.

Personalized assistance

Methodologies	Description

Lecturing	During the lecture lessons, the lecturer will clarity student doubts regarding the theoretical concepts exposed at that time.			
Problem solving	During the exercise and problem sessions, the lecturer will answer in a personalized way the student doubts.			
Seminars	During the mentored lessons, the lecturer will perform a personalized assistence to the students, proposing complementary exercises or any other kind of activities that will result in the best use of the lessons for the students. The lecturers of the course will answer the doubts and queries of the students, both personally, according to the schedule that will be published on the web page of the centre, as well as online (email, videoconference, Moovi forums, etc.) by previous appointment.			

Assessment

	Description	Qualification	Training and Learning Results		
Problem and/or exercise solving	Threre will be two partial exams, the first one will evaluate Lessons 1, 2 and 3 and the second one Lesson 4. Each one of the exams is 15% of the mark of continuous evaluation.	30	B3 B4	C1	D2 D9 D16
Laboratory practice	There will be a scored practice related to the contents given during the computer lessons. The weight in the continuous evaluation will be 15%.	15	B3 B4	C1	D2 D6 D9
Essay	There will be proposed a delivery of certain exercises along the whole course. The weight in the continuous evaluation will be 15%.	15	B3 B4	C1	D2 D6 D9
Essay questions exam	There will be a final exam with all the contents of the course. The weight in the continuous evaluation will be 40%.	40	B3 B4	C1	D1 D2 D14 D16

Other comments on the Evaluation

The students will have to take the regular exam with all the contents of the course, that will count as the 100% of the mark, in the case that the final note of continuous evaluation if lower than 5 (NEC lower than 5). Additionally, the students will have to take the regular exams if any of the following items occurs:

- No performing or delivery of any of the scored items above.

- Obtaining a lower mark than 4 points out of 10 in the final exam of continuous evaluation.

In the previous cases, the final mark of continuous evaluation will be: min{NEC, 4}.

In any case, the students that have passed the continuous evaluation, will have the possibility to take the regular exam in order to improve their mark.

The evaluations of the students in second and successive calls will be an exam with all the contents of the course that will count as the 100% of the mark.

ACADEMIC INTEGRITY: Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo , as well as point 6 of the fifth rule of Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces, **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity**, regardless of the percentage of importance that the test in question had in the overall continuous assessment and independently of other disciplinary actions that may be applied.

Sources of information
Basic Bibliography

J. Burgos, **Cálculo Infinitesimal de una variable**, McGraw Hill, 1994
J. Burgos, **Cálculo Infinitesimal de varias variables**, McGraw Hill, 1995
J.L. Bradley, K.J. Smith, **Cálculo (Volúmenes 1 y 2)**, Prentice Hall Iberia, 1998
R. Larson, R.P. Hostetler, B.H. Edwards, **Cálculo I y II**, McGrawHill, 2010

Complementary Bibliography

Recommendations

Other comments

The students of Calculus I are recommended to review the contents of trigonometry and differential and integral calculus corresponding to Bachillerato (equivalent to high school or A levels).