UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2017/18
Subject (*)	Calculus		Code	730G03001
Study programme	Grao en enxeñaría en Tecnoloxías Industriais			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	First	FB	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador	Benitez Garcia, Marta	E-mail	marta.benitez@udc.es	
Lecturers	Benitez Garcia, Marta Brozos Vázquez, Miguel Calvo Garrido, María Del Carmen	E-mail	marta.benitez@udc.es miguel.brozos.vazquez@udc.es carmen.calvo.garrido@udc.es	
Web	campusvirtual.udc.es/moodle			
General description	This introductory calculus course covers differentiation and integration of functions of one and several variables. Topics include: the study of functions of one and several variables, their continuity and differenciability; Taylor polynomials and its application in optimization, finding local extrema and constrained optimization; the integration of functions in one variable, both by using Riemann sums and numerical integration and also using Barrow's rule, together with its applications to computing arc lengths, volumes of revolution and surface areas of revolution; and finally the integration of functions of several variables, together with its application to computing volume and mass of a solid body and its center of mass.			

Study programme competences / results	
Code	Study programme competences / results

Learning outcomes			
Learning outcomes	Study programme competences / results		
To think in a logic, critic and creative way.		B1 B2 B3 B5 B7	C4 C5
Ability of thinking in an abstract way, understanding and simplifying complex problems.	A1	B1 B2 B3 B5 B7	C1 C4 C5
To understand the main characteristics of the formulation of a mathematical problem using the tools of the inifinitesimal calculus.	A1 A5	B2 B3 B5 B7	C4
Get familiar with calculus language	A1	B1 B5	
To be able to evaluate the difficuylty of a problem and to choose the most suitable technique among the studied ones to carry on its solution. Have a good predisposition for problem solving		B3	C1 C4 C5

To be able to use the bibliography and the available IT tools to find the necessary information for solving a given problem	A1 A5	B5 B7	C1 C4 C5
To know the underlying geometrical meaning of the studied mathematical formalism. To be able to represent sets in the plane and in the three dimensional space using different coordinates systems	A1 A5	B1 B2	
To obtain a basic knowledge of functions of several variables: level sets, limits, continuity	A1 A5	B1 B2 B3	
To understand the importance of partial derivatives and their relation to instantaneous variation of a magnitude (phisical, chemical, economical) and to asses their utility for the correct mathematical formulation of problems in engineering	A1	B2 B5 B7	
To understand the meaning of integrals and their usage for the formulation of several problems in engineering. To know how to apply integral for the computation of areas of plane figures, areas of a surface of revolution and solid volumes.	A1	B2 B5 B7	

Contents	
Topic	**Sub-topic**
The following topics develop the contents established in the verification report	-Mean value theorems. -Introduction to vector calculus. -Taylor theorem and higher order derivatives. -Maximum and minimum. -Implicit function and inverse function. -Definite and indefinite integral. -Primitive Calculus. -Double and triple integrals. Applications to computing areas and volumes.
Complex numbers	The field of complex numbers. Operations: sum, produt. Module and argument. Polar form. Operating in polar form.
The space R^n	The vector space R^n. Scalar product: norms and distances. Classification of points and sets. Topology of R^n: bounded set, extrema. Coordinates systems: polar, cylindrical and spherical coordinates.
Functions of several variables	Scalar and vector functions. Level sets. Continuity. Continuity in compact sets.
Differenciation of funcions of several variables	Directional derivative. Partial derivatives: properties and practical computing. Differential map of a function. Gradient, relation with partial derivatives. Relation between the differential map and partial derivatives: jacobian matrix. Higher order partial derivatives. Introduction to vector calculus.

Applications of the differenciation of functions of several variables	Taylor polynomial for funcions of one and several variables. Critical points. Classification: Hessian matrix. Constrained optimization: dimensionality reduction, Lagrange multipliers method. Implicit function and inverse function theorems.
Integration of funcions of one variable	Riemann sums. Integrable functions. Integral Calculus Theorems: Mean Value Theorem, Fundamental Theorem and Barrow's rule. Primitive Calculus. Polinomial interpolation. Numerical integration. Compound Simpson's Rule. Application of integral calculus to computing arc lengths, volumes of revolution and surface areas of revolution.
Integration of functions of several variables	Double integrals. Triple integrals. Change of variable in double and triple integrals. Application of integral calculus to computing volume and mass of a solid body and its center of mass.
Appendix: The free software program, MAXIMA	Practical sessions with the free software program MAXIMA

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A5 B3 B5 B7 C4 C5	30	45	75
Problem solving	A1 A5 B1 B2 B3 B5 B7 C4 C5	20	25	45
Objective test	A1 A5 B1 B2 B3 B5 B7 C1 C4 C5	6	0	6
Workshop	A1 B1 B2 B3 C1 C4	10	10	20
Personalized attention		4	0	4
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	The course will be developed during the regular classes where the professor will explain the main concepts and results of the subject.
Problem solving	This classes are organiized in such a way that we practice how to solve the proposed problems.
Objective test	Three exams will be carried out during the course. The first one will be a partial exam where only some of the chapters will be considered. A final exam will be done at the end of the semester. Furthermore a computer exam will be carried out.
Workshop	Problems are solved assisted by the computer programm Maxima.

Personalized attention	
Methodologies	Description

Problem solving Workshop	The contents of the subject as well as the different methodologies used require that students also work by themselves. This can generate some personalized questions that they can solve by asking the teachers. In addition, the workshops will be guided by the teachers of the subject. The students with recognition of part-time dedication and academic exemption from attendance can use the tutorials as a reference in order to follow the course and the autonomous work.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Objective test	A1 A5 B1 B2 B3 B5 B7 C1 C4 C5	Written exams to assess the knowledge of the subject by the students. The subject will consists on 3 parts and the final qualification will be the addition of the qualification obtained at each of these parts. 1) The first one will be done in the teaching period through a partial exam and will probably involve the chapters 1, 2, 3 and 4. If the student passes this exam, the qualification is retained until the end of the present course. This part will be recoverable in the final exam (second chance). 2) The second (and final) exam will be carried out in the period of final exams. It will involve the second part of the subject and a second chance to pass the first part. The weight of both exams will be the 90% of the final qualification. In case of passing any of these two parts, either in the partial or in the final exam of january, the qualification is retained for the present course until the exam of second oportunity. 3) The third part will consist on the evaluation the competences using the program MAXIMA, where the students must show their capacity for problem solving using the MAXIMA program. The weight of this third part will be the 10% of the final qualification. This part WILL NOT be recoverable, but the obtanined qualification will be kept until second oportunity.	100

Assessment comments

Sources of information

Basic	- Salas, L., Hille, E., Etgen, G. (2003). Calculus. vol I-II. Madrid. Reverté - García, A. et al. (2007). Cálculo II. Teoría y Problemas de Análisis Matemático en Varias Variables. Madrid. Clagsa - García Castro, F., Gutiérrez Gómez, A. (1990-1992). Cálculo Infinitesimal. I-1,2. Pirámide. Madrid - Marsden, J., Tromba, A. (2010). Cálculo vectorial. ADDISON WESLEY - Varios (1990). Problemas de Cálculo Infinitesimal. Madrid. R.A.E.C. - Tébar Flores, E. (1977). Cálculo Infinitesimal. I-II. Madrid. Tébar Flores - Spiegel, M. R. (1991). Cálculo Superior. Madrid. McGraw-Hill - Soler, M., Bronte, R., Marchante, L. (1992). Cálculo infinitesimal e integral. Madrid - Burgos Román, Juan de (2007). Cálculo infinitesimal de una variable. Madrid. McGraw-Hill - Coquillat, F (1997). Cálculo Integral. Madrid. Tebar Flores - Larson, R., Hostetler, R., Edwards, B. (2013). Calculus. . Brooks Cole - García, A. et al. (2007). Cálculo I. Teoría y Problemas de Análisis Matemático en Una Variable. Madrid. Clagsa - De Diego, B. (1991). Ejercicios de Análisis: Cálculo diferencial e intergral (primer curso de escuelas técnicas superiores y facultades de ciencias). Madrid. Deimos
Complementary	As seguintes páxinas web poden resultar de interese para o estudio da materia: www.intmath.com www.ies.co.jp/math/java/ http://demonstrations.wolfram.com/http://dm.udc.es/elearning/ www.intmath.com www.ies.co.jp/math/java/ http://193.146.36.49/mat1

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Linear Algebra/730G03006 Statistics/730G03008 Diferential Equations/730G03011 Reliability Statistics and Numerical Methods/730G03046
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.