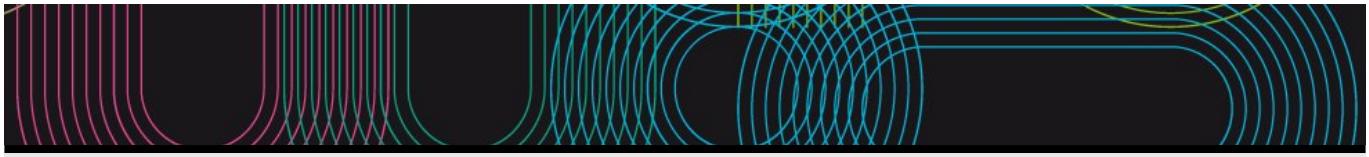

IDENTIFYING DATA				
Mathematics: Calculus 2 and differential equations				
Subject	Mathematics: Calculus 2 and differential equations			
Code	V12G363V01204			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Cachafeiro López, María Alicia			
Lecturers	Bazarra García, Noelia Busto Ulloa, Saray Cachafeiro López, María Alicia Calvo Ruibal, Natividad Castejón Lafuente, Alberto Elias Durany Castrillo, José Estévez Martínez, Emilio Fernández García, José Ramón Martínez Brey, Eduardo Meniño Cotón, Carlos			
E-mail	acachafe@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim of the matter is making the student know the basic techniques of integral calculus in several variables, vector calculus, differential ordinary equations and its applications.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering.
C1	CE1 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	CT1 Analysis and synthesis.
D2	CT2 Problem solving.
D3	CT3 Oral and written proficiency in the own language.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Application of knowledge.
D15	CT15 Objectification, identification and organization.
D16	CT16 Critical thinking.

Expected results from this subject	Training and Learning Results		
Understanding of the basic concepts of integral calculus in several variables.	B3	C1	D1

Knowledge of the main techniques of integration of functions of several variables.	B3 B4	C1	D1 D2 D9
Knowledge of the main results of vector calculation and applications.	B3 B4	C1	D1 D2 D9
Acquisition of the basic knowledge for solving equations and linear differential systems.	B3 B4	C1	D1 D2 D9
Understanding of the importance of integral calculus, vector calculus and differential equations for the study of the physical world.		C1	D9 D16
Application of the knowledge of integral calculus, vector calculus and differential equations.		C1	D2 D6 D9 D16
Acquisition of the necessary capacity to use this knowledge in the manual and computer resolution of issues, exercises and problems.		C1	D1 D2 D3 D6 D9 D15 D16

Contents

Topic	
Integral calculus in several variables.	The double integral on rectangles. Cavalieri's Principle. Reduction to iterate integrals. Double integral on elementary regions. Properties. Fubini's theorem. The change of variables' theorem. The particular case of polar coordinates. Triple integrals on a box and elementary regions. Fubini's theorem. The change of variables' theorem. Particular cases: cylindrical and spherical coordinates. Geometric and physical applications of multiple integration: computation of volumes, mass centers and inertia momentums.
Vector calculus.	Curves in the plane and in three-dimensional space. Arc length. Change of parameter. Line or trajectory integrals with respect to the arc length of scalar fields. Line integral or circulation of vector fields. Properties. Fundamental theorem of line integrals. Green's theorem on the plane. Regular surfaces. Tangent plane. Normal vector. Area of a Surface. Surface integral of scalar fields. Flux or surface integral of vector fields. Divergence and curl operators. Characterization of conservative fields. Stokes' theorem. Gauss' theorem.
Differential equations.	Ordinary differential equations. Concept of solution of an ordinary differential equation. Theorems of existence and uniqueness for problems with initial conditions. Methods of solution of first order differential equations: equations in separable variables, equations reducible to separable variables, homogeneuous equations, linear and linear reduced equations. Exact differential equations. Integrating factors. Differential equation of a uniparametric family of plane curves. Orthogonal trajectories. Linear differential equations of order two and greater. Initial condition problems. Fundamental sets. Method of variation of parameters . Method of undetermined coefficients. Order reduction. Euler's equation. Systems of linear differential equations.
Numerical methods for initial value problems.	Introduction to numerical methods. Euler's and improved Euler's method. Runge-Kutta's fourth order method.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	60	92
Problem solving	22	24	46
Laboratory practical	9	0	9
Essay questions exam	3	0	3

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

Methodologies

	Description

Lecturing	In theory clases the profesor will explain the basic contents of the matter. The students will have basic reference texts to follow the matter.
Problem solving	The professor will solve problems and exercises and the student will have to solve similar exercises to acquire the necesssary skills.
Laboratory practical	The professor will solve problems and exercises by hand or by use of informatic tools and the student will have to solve similar exercises to acquire the necessary skills.

Personalized assistance

Methodologies	Description
Problem solving	The profesor will personally help solving doubts and requirements from the students, especially in problem and laboratory clases and in office hours.
Laboratory practical	The profesor will personally help solving doubts and requirements from the students, especially in problem and laboratory clases and in office hours.

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	Written andor homework tests will be done.	60	B3 B4	C1	D1 D2 D3 D6 D9 D15 D16
Essay questions exam	A final test will be done on the contents of the whole matter.	40	B3 B4	C1	D1 D2 D3 D9 D15 D16

Other comments on the Evaluation

The continuous assessment will be done based on the former exposed criteria.

Those students rejecting the continuous assessment will be evaluated with a final test based on the contents of the matter, which will be the 100% of their grade.

In the second call, the assessment will consist of a test based on the contents of the matter, which will be the 100% of the grade.

Ethical commitment:

The student is expected to have an adequate ethical behaviour. In case of detection of a non ethic behaviour (for example cheating or use of non-authorized electronic devices), the student will be considered not to have reached the necessary skills to pass the matter. In this case the student will fail with numerical grade 0.

Sources of information

Basic Bibliography

Larson, R., Edwards, B.H., **Cálculo 2 de varias variables**, 9ª edición, McGraw-Hill, 2010

Marsden, E., Tromba, A.J., **Cálculo Vectorial**, 6ª edición, Pearson, 2018

Rogawski, J., **Cálculo: varias variables**, 2ª edición, Reverté, 2012

Thomas, G.B. Jr., **Cálculo: varias variables**, 12ª edición, Addison-Wesley-Pearson Education, 2010

García, A., López, A., Rodríguez, G., Romero, S., de la Villa, A., **Cálculo II. Teoría y problemas de funciones de varias variables**, 2ª edición, CLAGSA, 2002

Nagle, K., Saff, E.B., Snider, A.D., **Ecuaciones diferenciales y problemas con valores en la frontera**, 4ª edición, Pearson Educación, 2005

Zill, D.G., **Ecuaciones Diferenciales con aplicaciones de modelado**, 9ª edición, Cengage Learning, 2009

García, A., García, F., López, A., Rodríguez, G., de la Villa, A., **Ecuaciones Diferenciales Ordinarias**, CLAGSA, 2006

Kincaid, D., Cheney, W., **Métodos numéricos y computación**, 6ª edición, Cengage Learning, 2011

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Mathematics: Algebra and statistics/V12G320V01103
Mathematics: Calculus 1/V12G320V01104

Other comments

In case of discrepancies, the Spanish version of this guide will prevail