



Teaching Guide

Teaching Guide				
Identifying Data				2017/18
Subject (*)	Mathematics III		Code	631G02260
Study programme	Grao en Tecnoloxías Mariñas			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Second	FB	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador	Rodriguez Aros, Angel Daniel	E-mail	angel.aros@udc.es	
Lecturers	Campo Cabana, Marco Antonio Cao Rial, María Teresa Rodriguez Aros, Angel Daniel	E-mail	marco.campo@udc.es teresa.cao@udc.es angel.aros@udc.es	
Web				
General description	This course is devoted to the study of basic concepts of Numerical Analysis and Statistics Methods. Even though theoretical results are given, the course is mainly of a practical nature. The students will implement the numerical methods in a computer (by using MatLab, Octave and Calc). This way the students will become confident in the use of tools which are of paramount importance for the current academic life and their future professional life.			

Study programme competences

Code	Study programme competences
A12	CE12 - Interpretar e representar correctamente o espazo tridimensional, coñecendo os obxectivos e o emprego dos sistemas de representación gráfica.
A14	CE14 - Avaliación cualitativa e cuantitativa de datos e resultados, así como a representación e interpretación matemáticas de resultados obtidos experimentalmente.
A17	CE17 - Modelizar situacións e resolver problemas con técnicas ou ferramentas físico-matemáticas.
A18	CE18 - Redacción e interpretación de documentación técnica.
B1	CT1 - Capacidad para gestionar los propios conocimientos y utilizar de forma eficiente técnicas de trabajo intelectual
B2	CT2 - Resolver problemas de forma efectiva.
B3	CT3 - Comunicarse de xeito efectivo nun ámbito de traballo.
B4	CT4 - Traballar de forma autónoma con iniciativa.
B5	CT5 - Traballar de forma colaboradora.
B6	CT6 - Comportarse con ética e responsabilidade social como cidadán e como profesional.
B7	CT7 - Capacidade para interpretar, seleccionar e valorar conceptos adquiridos noutras disciplinas do ámbito marítimo, mediante fundamentos físico-matemáticos.
B8	CT8 - Versatilidade.
B9	CT9 - Capacidade para a aprendizaxe de novos métodos e teorías, que lle doten dunha gran versatilidade para adaptarse a novas situacións.
B10	CT10 - Comunicar por escrito e oralmente os coñecementos procedentes da linguaxe científica.
B11	CT11 - Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos habilidades e destrezas.
C1	C1 - Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C2	C2 - Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C3	C3 - Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C4	C4 - Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C5	C5 - Entender a importancia da cultura emprendedora e coñecer os medios ao alcance das persoas emprendedoras.



C6	C6 - Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	C7 - Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
C8	C8 - Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.
C9	CB1 - Demostrar que posúen e comprenden coñecementos na área de estudo que parte da base da educación secundaria xeneral, e que inclúe coñecementos procedentes da vangardía do seu campo de estudo
C10	CB2 - Aplicar os coñecementos no seu traballo ou vocación dunha forma profesional e poseer competencias demostrables por medio da elaboración e defensa de argumentos e resolución de problemas dentro da área dos seus estudos
C11	CB3 - Ter a capacidade de reunir e interpretar datos relevantes para emitir xuícios que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
C12	CB4 - Poder transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado.
C13	CB5 - Ter desenvolvido aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores con un alto grao de autonomía.

Learning outcomes			
Learning outcomes		Study programme competences	
	A12		
	A14		
	A17		
	A18		
		B1	
		B2	
		B3	
		B4	
		B5	
		B6	
		B7	
		B8	
		B9	
		B10	
		B11	
			C1
			C2
			C3
			C4
			C5
			C6
			C7
			C8
			C9
			C10
			C11
			C12
			C13

Contents	
Topic	Sub-topic



Lesson 1.- Introduction to MATLAB and Octave	1.1.- Types of data. Basic operations. 1.2.- Vectors and matrices 1.3.- Functions 1.4.- Logical operators
Lesson 2.- Number, Algorithm and Errors	2.1.- Introduction 2.2.- Numbers: Representation and Storage 2.3.- Algorithms 2.4.- Errors: Classification and Propagation
Lesson 3.- Numerical Solution of Systems of Linear Equations	3.1.- General considerations 3.2.- Direct methods 3.2.1.- Systems with Immediate Solution 3.2.1.1.- Diagonal matrix 3.2.1.2.- Upper Triangular matrix 3.2.1.2.- Inferior Triangular matrix 3.2.2.- Methods of Elimination or Transformation 3.2.2.1.- Method of Gauss 3.2.2.1.- Method of Gauss-Jordan 3.2.3.- Methods of Decomposition: Factorisation LU 3.2.3.1.- Method of Doolittle 3.2.3.2.- Method of Crout 3.2.3.3.- Method of Cholesky 3.3.- Iterative methods 3.3.1.- Method of Jacobi 3.3.2.- Method of Gauss-Seidel
Lesson 4.- Numerical Interpolation	4.1.- Introduction 4.2.- Lagrange Interpolating Polynomial 4.3.- Hermite Interpolating Polynomial 4.4.- Divided Differences. Newton Formula
Lesson 5.- Numerical solution of nonlinear equations	5.1.- Introduction 5.2.- Method of the Bisection 5.3.- Method of Newton-Raphson 5.4.- Method of the Secante. It regulates Falsi. 5.5.- Method of the Fixed Point
Lesson 6.- Numerical Differentiation and Numerical Integration	6.1.- Finite differences. Derivación Numerical. 6.2.- Numerical integration. General concepts. 6.3.- Rectangular approximations 6.4.- Method of the Trapezes 6.5.- Rule of Simpson 6.6.- Formulas of Quadrature
Lesson 7.- Numerical Solution of Ordinary Differential Equations	7.1.- Introduction: General Definitions 7.2.- Methods of Taylor 7.3.- Method of Euler 7.4.- Method of Heun 7.5.- Methods of Runge-Kutta



Lesson 8.- Statistics Methods	8.1 Descriptive Statistics 8.1.1 Generalities 8.1.2 Treatment of the information and graphic representations 8.1.3 Measures of centralisation. Measures of dispersion 8.1.4 Binomial and Normal Distributions 8.2 Curve Adjustment 8.2.1 Linear Regression. 8.2.2 Least Squares Method 8.2.3 Measures of Accuracy 8.2.4 Nonlinear Measures of Accuracy
The development and overcoming of these contents, together with those corresponding to other subjects that include the acquisition of specific competencies of the degree, guarantees the knowledge, comprehension and sufficiency of the competencies contained in Table AIII / 2, of the STCW Convention, related to the level of management of First Engineer Officer of the Merchant Navy, on ships without power limitation of the main propulsion machinery and Chief Engineer officer of the Merchant Navy up to a maximum of 3000 kW.	Table A-III / 2 of the STCW Convention. Specification of the minimum standard of competence for Chief Engineer Officers and First Engineer Officers on ships powered by main propulsion machinery of 3000 kW or more.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Collaborative learning	A12 A14 A17 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	2	15	17
ICT practicals	A12 A14 A17 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	14	25	39
Problem solving	A12 A14 A17 A18 B1 B2 B3 B4 B5 B7 B8 B9 B10 B11 C1 C2 C3 C6 C7 C8 C10 C11 C12 C13	14	25	39
Guest lecture / keynote speech	A12 A14 A17 A18 B1 B3 B4 B6 B7 B9 B10 B11 C1 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	20	10	30



Objective test	A12 A14 A17 A18 B1 B2 B4 B6 B7 B10 B11 C1 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	4	0	4
Online discussion	A12 A14 A17 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C3 C4 C5 C6 C7 C8 C10 C11 C12	0	10	10
Document analysis	A12 A14 A17 A18 B1 B4 B5 B7 B9 C1 C2 C3 C4 C5 C6 C7 C8 C11	0	5	5
Personalized attention		6	0	6

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

Methodologies	
Methodologies	Description
Collaborative learning	Traballo en grupo
ICT practicals	Prácticas na Aula de Informática cos programas Matlab e Calc
Problem solving	Resolver problemas propostos
Guest lecture / keynote speech	Exposición inicial de cada tema
Objective test	Proba individual de coñecementos adquiridos
Online discussion	Participación nos foros abertos en Moodle
Document analysis	Valoración da información obtida en libros e internet

Personalized attention	
Methodologies	Description
Problem solving ICT practicals	The students are encouraged to attend in small groups or individually to the professors' office to solve questions that may arise, thus obtaining a more specific guidance, according to their specific difficulties.

Assessment			
Methodologies	Competencies	Description	Qualification
Problem solving	A12 A14 A17 A18 B1 B2 B3 B4 B5 B7 B8 B9 B10 B11 C1 C2 C3 C6 C7 C8 C10 C11 C12 C13	Plantexar os problemas que logo se resolverán coas TIC.	10
Guest lecture / keynote speech	A12 A14 A17 A18 B1 B3 B4 B6 B7 B9 B10 B11 C1 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	Asistencia e participación nas clases teóricas.	5



Collaborative learning	A12 A14 A17 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	Realización de traballos grupais	10
ICT practicals	A12 A14 A17 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	Realización das prácticas propostas na aula de Informática.	45
Objective test	A12 A14 A17 A18 B1 B2 B4 B6 B7 B10 B11 C1 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13	Resposta sobre os coñecementos adquiridos.	30
Online discussion	A12 A14 A17 A18 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 C1 C3 C4 C5 C6 C7 C8 C10 C11 C12	Participación nos debates abertos no Moodle.	0

Assessment comments

The students that do not participate in the EEES will be evaluated through an examination that will constitute 100% of the evaluation. The practical part of this exam can be scheduled in a different time, depending on the availability of the computer science room and to allow a break.

The course is divided in two parts: Part 1 (lessons 1-4) and part 2 (lessons 5-8). To pass it, it will be necessary to reach in each part a minimum of 3,5 points and afterwards obtain an average of, at least, 5 points.

In the unlikely case to reach an arithmetic average of 5 but not having, at least, 3,5 points in each one of the parts, the result of the evaluation will be of fail and the final qualification will be calculated with a suitable geometric average.

The criteria of evaluation contemplated in the framewor A-III/1 and A-III/2 of the Code STCW and his amendments related with this matter have been taken into account for the design of this qualification methodology.

Sources of information

Basic	- Huerta-Sarrate-Rodríguez Ferrán (1998). Métodos Numéricos. Edicions UPC - Michavila-Gavete (1992). Programación y Cálculo Numérico. Reverté - Curtis F. Gerald (1991). Análisis Numérico. Alfaomega - Burden-Faires (1998). Análisis Numérico. Thomson - García Merayo-Nevot Luna (1992). Análisis Numérico. Paraninfo - Spiegel (1991). Estadística. McGraw-Hill - Cordero-Hueso-Martínez-Torregrosa (2005). Métodos Numéricos con Matlab. Universidad Politécnica de Valencia - Mathews-Fink (1999). Métodos Numéricos con Matlab. Prentice Hall - J.M. Viaño (1995). Lecciones de Métodos Numéricos Vol 1: Introducción general y análisis de errores. Tórculo Edicións - J.M. Viaño (1997). Lecciones de Métodos Numéricos Vol 2: Resolución de ecuaciones numéricas. Tórculo Edicións - J.M. Viaño, M. Burgurea (1999). Lecciones de Métodos Numéricos Vol 3: Interpolación. Tórculo Edicións
Complementary	



Recommendations
Subjects that it is recommended to have taken before
Mathematics I/631G02151 Informatics/631G02154 Mathematics II/631G02156
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
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.