UNIVERSIDADE DA CORUÑA

Teaching Guide			
Identifying Data			2018/19
Subject (*)	Stochastic numerical methods	Code	614855226
Study programme	Mestrado Universitario en Matemática Industrial (2013)		

Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Optional	6

Language	Spanish		
Teaching method	Face-to-face		
Prerequisites			
Department	Matemáticas		
Coordinador	Vazquez Cendon, Carlos	E-mail	carlos.vazquez.cendon@udc.es
Lecturers	Calvo Garrido, María Del Carmen Vazquez Cendon, Carlos	E-mail	carmen.calvo.garrido@udc.es carlos.vazquez.cendon@udc.es
Web	www.m2i.es		
General description	Knowledge related to stochastic calculus and stochastic differential equations and the associated numerical techniques will be taught. Examples of problems in which these concepts and techniques arise will also be presented		

Study programme competences / results

Code	Study programme competences / results
A1	Alcanzar un conocimiento básico en un área de Ingeniería/Ciencias Aplicadas, como punto de partida para un adecuado modelado matemático, tanto en contextos bien establecidos como en entornos nuevos o poco conocidos dentro de contextos más amplios y multidisciplinares.
A2	Modelar ingredientes específicos y realizar las simplificaciones adecuadas en el modelo que faciliten su tratamiento numérico, manteniendo el grado de precisión, de acuerdo con requisitos previamente establecidos.
A3	Determinar si un modelo de un proceso está bien planteado matemáticamente y bien formulado desde el punto de vista físico.
A4	Ser capaz de seleccionar un conjunto de técnicas numéricas, lenguajes y herramientas informáticas, adecuadas para resolver un modelo matemático.
A5	Ser capaz de validar e interpretar los resultados obtenidos, comparando con visualizaciones, medidas experimentales y/o requisitos funcionales del correspondiente sistema físico/de ingeniería.
A7	Saber modelar elementos y sistemas complejos o en campos poco establecidos, que conduzcan a problemas bien planteados/formulados.
A8	Saber adaptar, modificar e implementar herramientas de software de simulación numérica.
B1	Saber aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios, incluyendo la capacidad de integrarse en equipos multidisciplinares de I+D+i en el entorno empresarial.
B2	Poseer conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación, sabiendo traducir necesidades industriales en términos de proyectos de I+D+i en el campo de la Matemática Industrial
B3	Ser capaz de integrar conocimientos para enfrentarse a la formulación de juicios a partir de información que, aun siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos.
B5	Poseer las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo, y poder emprender con éxito estudios de doctorado.

Learning outcomes

Learning outcomes	Study programme competences / results		
Knowing and applying different numerical methods for solving stochastic differential equations (Euler, Mistein, Taylor, etc.) and their computer implementation to solve examples of real problems	AC4 AC5 AC8	BC1 BC2 BR1	

Knowledge of Ito calculus and application to different examples of finance and other applied sciences	AC1 AC5 AC7	BJ1 BC1 BR1	
Understand concepts and results related stochastic differential equations and the fields of application of these to real problems	AC2 AC3 AC7	BJ1 BC2 BR1	
Concepts and results related to stochastic processes are introduced and fields of application thereof shall be indicated	AC1 AC7	BJ1	
Knowledge of Monte Carlo methods and its application to solve problems	AC2 AC4	BC2 BR1	

Contents	
Topic	Sub-topic
1. Introduction to stochastic processes	
2. Monte Carlo Methods	
3. Ito calculus	
4. Stochastic differential equations	
5. Numerical methods for stochastic differential equations	

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Problem solving		0	60	60
Problem solving		0	36	36
Objective test		4	0	4
Guest lecture / keynote speech		42	0	42
Personalized attention		8	0	8
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Problem solving	- The .pdf documents contain simple exercises for review and application of concepts - Further references are indicated where you can find exercises related to the exposed subjects
Problem solving	A set of problems are posed to be solved at home, some are shorter and others require greater dedication
Objective test	Problems staments are delivered to the student to be solved, for this purpose the student can use the slides that have been presented in class by the teacher
Guest lecture / keynote speech	- Previously to lecture sessions, a .pdf document with the contents of the lecture is delivered to students. - Table PC and videoconferencing systems will be used to allow the following of the lectures form the different campus. - Participation of students with questions and comments to be discussed during lectures will be encouraged. Also the questiones eill be solved and remarks will be illustrated by using Windows Journal computer application when necessary.

Personalized attention	
Methodologies	Description
Problem solving	Exercises of students will be reported and their results will be discussed

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**

Problem solving		Valoraranse os exercicios propostos en clases para a súa realización fóra de clases	50
Objective test		In afixed date a written practical exam of the knowledge of the subject in fixed date will held. In case of failing, also at a later date an additional recovery exam of the same type will take place.	50

Assessment comments

Sources of information	
Basic	- P. Glasserman (2004). Monte Carlo methods in financial engineering. Springer - P. Kloeden, E. Platen (1992). Numerical solution of stochastic differential equations. Springer - T. Mikosh (1998). Elementary stochastic calculus with finance in view. World Scientific - B. Oksendal (1998). Stochastic differential equations. An introduction with applications. Universitext, Springer
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Mathematical modeling in finance/614855211
Other comments