ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

593000196 - Scientific methodology

DEGREE PROGRAMME

59AC - Master Univ. en Sistemas y Servicios para la Sociedad de la Informacion

ACADEMIC YEAR & SEMESTER

2017/18 - Semester 1

Index

Learning guide

1. Description

1.1. Subjet details

Name of the subject	593000196 - Scientific methodology
No of credits	5 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	59AC - Master Univ. en Sistemas y Servicios para la Sociedad de la Informacion
Centre	Escuela Tecnica Superior de Ingenieria y Sistemas de Telecomunicacion
Academic year	2017-18

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Manuel Vazquez Lopez	A4205	manuel.vazquez@upm.es	Sin horario. Stated in Moodle
Maria Pilar Ochoa Perez (Subject coordinator)	3112	pilar.ochoa@upm.es	Sin horario. Stated in Moodle
Marta Sanchez Agudo	3112	marta.sanchez@upm.es	Sin horario. Stated in Moodle

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.3. External faculty

Name and surname	Email	Institution
Mara Bernardo Sacristan	mara.bernardo@upm.es	Instituto de Cerámica y Vidrio (CSIC)

3. Skills and learning outcomes *

3.1. Skills to be learned

CEI.5 - Capacidad de modelado matemático de problemas de ingeniería relacionados con las TIC.

CEI.6 - Capacidad de aplicar métodos de predicción y simulación en el desarrollo de sistemas y servicios.

CEI.7 - Capacidad de análisis y procesamiento de datos.

CEI.8 - Capacidad de análisis y optimización de los procesos de medida.

CEP.7 - Capacidad de modelado matemático de problemas de ingeniería relacionados con las TIC.

3.2. Learning outcomes

RA138 - Analizar distintos procesos de medida y adquirirá los conocimientos necesarios para su optimización.

RA139 - Aplicar métodos y herramientas necesarios para un correcto procesamiento de datos

RA140 - Proponer mejoras en los dispositivos y sistemas bajo estudio.

RA137 - Adquirir destrezas para el uso de los métodos y herramientas de predicción y simulación.

RA141 - Realizar informes técnicos correctos a partir del análisis del sistema de medida y los resultados obtenidos.

RA136 - Analizar y representar matemáticamente un problema de ingeniería.

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

"Modeling and Analysis of Data in Engineering" is included within the subject "Scientific Methodology".

"Modeling and Analysis of Data in Engineering" aims to provide students with the necessary tools to correctly analyze measurement systems and results and subsequently elaborate technical reports or scientific papers. In addition, the studients will acquire skills on using prediction and simulation methods and then, propose improvements to devices and systems.

4.2. Syllabus

1. Mathematical modelling in engineering problems.
   1.1. Mathematical representation of engineering problems.
   1.2. Error theory.
   1.3. Concepts of numerical algebra: Regression.
   1.4. Integration, differentiation and interpolation of data. Tools.
2. Application to experimental techniques of data analysis.
   2.1. Algebraic and graphic representation of data: linear regression, data fitting; analysis of simulated results.
   2.2. Data analysis and fitting of statistical distributions. Application to experimental results of tests.
   2.3. Global analysis of reliability test. Determination of parameters from test data.
3. Finite Elements Method
   3.1. Background of the Finite Elements Method.
   3.2. Fundaments of the Finite Elements Method.
   3.3. Applications of the Finite Elements Method.

5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	**Lesson 1: Mathematical modelling in engineering problems.** Duration: 03:00 Lecture			
2	**Lesson 1: Mathematical modelling in engineering problems.** Duration: 03:00 Lecture			
3	**Lesson 1: Mathematical modelling in engineering problems.** Duration: 03:00 Lecture			
4	**Lesson 1: Mathematical modelling in engineering problems.** Duration: 03:00 Problem-solving class			**Self-directed study and independent work** Individual work Continuous assessment Duration: 02:00
5	**Lesson 2: Application to experimental techniques of data analysis** Duration: 03:00 Lecture			
6	**Lesson 2: Application to experimental techniques of data analysis** Duration: 03:00 Lecture			
7	**Lesson 2: Application to experimental techniques of data analysis** Duration: 03:00 Lecture			
8	**Lesson 2: Application to experimental techniques of data analysis** Duration: 03:00 Problem-solving class			
9	**Lesson 2: Application to experimental techniques of data analysis** Duration: 03:00 Problem-solving class			**Self-directed study and independent work** Individual work Continuous assessment Duration: 02:00
10	**Lesson 3: Finite Elements Method** Duration: 03:00 Lecture			

11	**Lesson 3: Finite Elements Method** Duration: 03:00 Lecture			
12	**Lesson 3: Finite Elements Method** Duration: 03:00 Lecture			
13	**Lesson 3: Finite Elements Method** Duration: 03:00 Problem-solving class			
14	**Lesson 3: Finite Elements Method** Duration: 01:00 Lecture			**Solving problems in the lecture room. Independent work.** Individual work Continuous assessment Duration: 02:00
15	**Tutorial support session** Duration: 03:00 Additional activities			
16	**Tutorial support session** Duration: 03:00 Additional activities			
17				**Final Exam (only for those students who do not opt for continuous assessment)** Written test Final examination Duration: 02:00

The independent study hours are training activities during which students should spend time on individual study or individual assignments.

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The subject schedule is based on a previous theorical planning of the subject plan and might go to through experience some unexpected changes along throughout the academic year.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
4	Self-directed study and independent work	Individual work	No Presential	02:00	33.4%	2 / 10	CEI.8 CEI.5 CEI.6 CEI.7 CEP.7
9	Self-directed study and independent work	Individual work	No Presential	02:00	33.3%	2 / 10	CEI.8 CEI.5 CEI.6 CEI.7 CEP.7
14	Solving problems in the lecture room. Independent work.	Individual work	Face-to-face	02:00	33.3%	2 / 10	CEI.8 CEI.5 CEI.6 CEI.7 CEP.7

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final Exam (only for those students who do not opt for continuous assessment)	Written test	Face-to-face	02:00	100%	5 / 10	CEI.8 CEI.5 CEI.6 CEI.7 CEP.7

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

Modality A: Continuous assessment:

To pass the subject will be necessary to perform the following individual tests, obtaining between the three of them an average of 5 points out of a total of 10 points:
- Topic 1: Deliver the work indicated by the teacher within the established period (33.4%)
- Topic 2: Deliver the work indicated by the teacher within the established period (33.3%)
- Topic 3: Solve practical exercises in the classroom. (33.3%)

Modality B: Final exam:
To pass the subject will be necessary to take the exam in the day scheduled by the Academic Year Planning, obtaining an average of 5 points out of a total of 10 points.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
W. H. Press, B. P. Flannery, S. A. Teukolsky, W. T. Vetterling. Numerical Recipes. Cambridge University Press	Bibliography	
R.H. Enns and G.C. McGuire, An introductory guide to the mathematical models of science, Springer, New York (2006)	Bibliography	
J.R. Taylor, Introducción al análisis de errores, REVERTÉ (2014)	Bibliography	
G.L. Squires, Practical Physics, Cambridge U.P. (2001)	Bibliography	

W: Bolton, Electrical and electronic measurement and testing, Longmann	Bibliography	
C.V. Girija y M. Zülfü, Finite Element Method for Engineers, Alpha Science (2011)	Bibliography	
Moodle	Web resource	

8. Other information

8.1. Other information about the subject

Notice: The information contained in this guide is orientative. Therefore it is susceptible of modification due to errata, omissions or unforeseen incidences occurred during the academic year. Also, changes can be made if it is advisable for the correct development of the subject.