

Academic Year: ( 2020 / 2021 )

Review date: 08-07-2020

Department assigned to the subject:

Coordinating teacher: CARBO RUBIERA, JAVIER IGNACIO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

## OBJECTIVES

Competences:

Ability to mathematically model, compute and simulate in CS subjects.

Ability to apply acquired knowledge and to solve problems in uncertain environments, integrating new knowledge

Ability to express conclusions, knowledge and motivations in a clear and unambiguous way.

Ability to analyze information requirements of a given domain, and carry out the development of the corresponding information system.

Skills:

Resultados de aprendizaje:

Skill of implementing computer simulation models applied to engineering problems.

Skill of analyzing computer modeling and simulation methods.

Skill of developing open practicework with enough critical thinking.

Skill of converging acquired knowledge and its application to problems

Skill of integrating multidisciplinary knowledge.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
  - 11 Introduction
  - 12 Obtaining models
  - 13 Application domains
  - 14 Types of simulation models.
  - 15 Simulation steps.
  - 16 Pros and cons.
  - 17 Frequent mistakes in simulation.
2. Random Numbers
  - 21 Definition and types.
  - 22 Motivation.
  - 23 History
  - 24 Properties
  - 25 Types of generators.
  - 26 Conclusions.
3. Generation of random distributions
  - 31 General concepts.
  - 32 General methods.
  - 33 Specific methods.
  - 34 Conclusions.
4. Discrete event simulation.
  - 41 Introduction.
  - 42 Simulation of discrete events.
  - 43 Modeling tools
  - 44 Conclusions.
5. Distributed Simulation
  - 51 Introduction
  - 52 Parallel architectures
  - 53 Sincronization.
  - 54 Conclusions
6. Monte Carlo
  - 61 Introduction.
  - 62 Motivation.

63	History
64	Monte Carlo: Steps and examples.
65	Monte Carlo in Excel.
66	Conclusions.
7.	Analysis of simulation results.
71	Introduction.
72	Average and deviations.
73	Positioning measures.
74	Boxplot graphics.
75	Confidence intervals.
76	Contrasting Hypotheses.
TEMA 8. Modeling and simulating complex systems: Traffic simulation.	
81	Introduction
82	Generating the network.
83	Generating the traffic,
84	Simulations
85	Analysis of results.
Analysis with R	
91	Introduction to R.
92	Accessing data in xml files with R
93	Commonly used statistics.
94	Contrasting hypotheses.
95	Processing results.
96	Tests in R.

## LEARNING ACTIVITIES AND METHODOLOGY

- Theoretical lectures
- Practical works individually or in team
- Exercises of problem solving.
- Personal Homework

## ASSESSMENT SYSTEM

### Assessment Criteria

Assessment will be done through continuous assessment and final examination.

Continuous assessment: It will allow students to continue their learning process and get 60% of the final grade. To be provided through the assessment of different practical works related with the different theoretical concepts.

Final Exam: This exam is mandatory and will provide the remaining 40%. The exam consists of a series of theoretical and practical issues and / or exercise

The final grade is calculated by adding the scores for the continuous assessment and final examination. If the student has not conducted ongoing assessment, s/he may conduct an examination worth 60% of the final grade.

<b>% end-of-term-examination:</b>	40
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	60

## BASIC BIBLIOGRAPHY

- A.M. Law; W.D. Kelton SIMULATION MODELLING AND ANALYSIS, McGraw-Hill , 1991
- David, Nuno; Sichman, Jaime Simao Multi-Agent-Based Simulation IX, Springer, 2009
- J. Banks; J.S. Carson; B.L. Nelson. DISCRETE EVENT SYSTEM SIMULATION, Prentice Hall, 1996
- Jerry Banks Handbook of simulation : principles, methodology, advances, applications and practice, Jerry Banks.
- John A. Sokolowski, Catherine M. Banks Modeling and Simulation Fundamentals: Theoretical Underpinnings and Practical Domains, John Wiley & Sons, Inc, 2010
- Levent Yilmaz, Tuncer Ören Agent-Directed Simulation and Systems Engineering, Wiley, 2009
- Michael J. North, Charles M. Macal Managing Business Complexity, Oxford University Press, 2007
- Phan, Denis, and Amblard, Frédéric Agent-Based Modelling and Simulation, The Bardwell Press, 2007

- Uhrmacher, Adelinde. Multi-agent systems : simulation and applications, Taylor & Francis. 2009.

#### ADDITIONAL BIBLIOGRAPHY

- . Banks, J. S. Carson, B.L. Nelson, D.M. Nicol, Pearson, J. Discrete-Event Systems Simulation,, Prentice Hall.
- B. S. Bennet, Simulation Fundamental,, Prentice-Hall.
- Edited by Jerry Banks Handbook of simulation : principles, methodology, advances, applications and practice /, John Wiley & Sons,.
- F. Cellier, E. Kofman, Continuous systems simulation., Springer.
- R. L. Woods, K. L. Lawrence, Modeling and Simulation of Dynamic Systems,, Prentice-Hall.