SUBJECT TEACHING GUIDE

G80 - Advanced Computation

Double Degree in Physics and Mathematics
Degree in Physics

Academic year 2020-2021

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Physics			Type and Year	Optional. Year 4 Optional. Year 4
Faculty	Faculty of Sciences				
Discipline	Subject Area: Advanced Computing Transversal Module: Specialisation Research / Applied Physics				
Course unit title and code	G80 - Advanced Computation				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	http://www.istr.unican.es/asignaturas/g80/				
Language of instruction	English		Mode of delivery	Face-to-face	

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3.1 LEARNING OUTCOMES
- Capability to use computers and informatics systems to represent and solve scientific problems.
- To know the basic phases of a software development process and the associated models.
- To know how to specify analyze and design complex software applications by using software modeling tools.
- To know how to evaluate algorithmic complexity and use practical tools for debugging software
- To know modeling resources to structure related data and the principles of data bases design.
- To have resources to program and/or manipulate applications with human machine interactions, user interfaces, input data mechanisms and the graphical representation of data.

4. OBJECTIVES

To know how to:

- Use computers and informatics systems for modeling and solving scientific problems

- Choose the appropriate kind of development process for informatics applications and know the labor that each phase encompasses.

- Model software with high level modeling tools.

- Calculate the computational complexity of an algorithm and evaluate its implications

- Identify ways to manage different volumes of information and organize them by means of simple models and data structures .

- Appraise and use input/output techniques for humane/machine interaction in data processing information systems.

6. COURSE ORGANIZATION

CONTENTS	
1	Part 0 - Introduction to the subject and quick review of programing languages
2	Part 1 - Simulation application: This part of the subject presents a practical simulation case. In it, mathematical computation models will be used to solve a physical problem. The computational requirements as well as the data organization needed are described. The input/output data to use are also described.
3	Part 2 - Software engineering principles: Models and techniques for the specification, analysis, design, and tests of software applications.
4	Part 3 - Algorithms and Complexity measurements: Metrics to evaluate the computational and cyclomatic complexity are presented in order to evaluate the feasibility of an algorithm in terms of the computation time required.
5	Part 4 - Data structures and input/output strategies: Modeling and data organization, Java containers, input arguments, permanent storage and recall.
6	Part 5 - Usage of simulation based computational tools: Effective exploitation of simulation tools and the graphical representation of data in the computer using external tools.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Simulation Algorithm (written document)	Others	No	Yes	17,00
Evaluation of theoretical contents	Others	No	Yes	33,00
Final recovery exam for theoretical contents (in September)	Others	Yes	No	0,00
Simulation application (made and showed in the computer) and a spoken presentation	Activity evaluation with Virtual Media	No	Yes	17,00
Analysis and Design models (edited in a modeling tool) plus practical training programming exercises	Activity evaluation with Virtual Media	No	Yes	33,00
Final Laboratory recovery exam	Laboratory evaluation	Yes	No	0,00
TOTAL				100,00

Observations

The evaluation will be made along the teaching period of the subject.

Final grade will be calculated in the following way:

- 17% (T) Written assignment with the requirements for a simulation algorithm.
- 33% (P) Analysis and design models of a software application. These are presented in a software modeling tool in the lab (plus the solutions of practical programing exercises)
- 33% (T) Theory evaluation
- 17% (P) Implementation and oral presentation of the simulation software application.

The practical (P) sections of the subject evaluation have a combined weight of 50%. In order to be able to pass the subject a student needs to get a score of 4.00 or more. This is also necessary to be entitled to take the recovery exam for the other theory (T) 50% in September.

The practical sections may be recovered in a consolidated practical exam programmed for the September call.

Observations for part-time students

Not attending class is heavily discouraged. It is particularly advisable to attend at least the practical experiences. Even though there are recovery examinations for both, the theoretical and the practical parts of the subject, it is advisable to warn those who are already experts in the subject and may not like to go to class, that the exams require proficiency in the usage of the tools used in the laboratory, and hence, it may be significantly difficult to pass the subject by just taking those exams.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

M. P. Allen and D. J. Tildesley, "Computer Simulation of Liquids", Oxford University Press, 2001.

Eric J. Braude, "Software Engineering: An Object-Oriented Perspective". John Wiley & Sons, Inc. New York, USA, 2000 ISBN:0471322083

Michael Sipser. "Introduction to the Theory of Computation". Thomson Course Technology, 2006 ISBN 0534950973