

[MMD002] BIOINFORMATICS AND DATA ANALYSIS

GENERAL INFORMATION

Studies	MASTER'S DEGREE IN BIOMEDICAL TECHNOLOGIES		Subject	Data analysis
Semester	2	Course	1	Mention / Field of specialisation
Character	COMPULSORY		Language	ENGLISH
Plan	2017	Modality	Adapted Face-to-face	Total hours
Credits	7,5	Hours/week	6.56	118.14 class hours + 69.36 non-class hours = 187.5 total hours

PROFESSORS

GARITANO GARITANO, IÑAKI
ALBERDI ARAMENDI, ANE

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
(No specific previous subjects required)	(No previous knowledge required)

SKILLS

VERIFICA SKILLS

SPECIFIC

MMCE09 - To interpret biological phenomena and model them using mathematical, statistical and computer knowledge

MMCE10 - To validate the use of statistical and computer models to extract new knowledge and solve problems in the field of Biomedical Engineering

GENERAL

MMCG03 - Being able to analyse complex situations and making decisions while estimating the social, economic or ethical responsibilities related

MMCG04 - Providing a practical and useful interprofessional framework relating to end user's safety for the product or service

CROSS

MMCTR1 - To select one measure or idea out of several and implement them in response to the needs or circumstances emerging in the work process

MMCTR2 - To work with people, getting them involved and guiding them towards the achievement of a common goal, with a global vision of work and its characteristics (quality, deadlines, etc.), taking individual interests into account

BASIC

M_CB10 - To have learning skills and the capacity for self-guided or independent subsequent learning.

M_CB7 - To know how to apply the acquired knowledge and competencies and the ability to solve problems in new or unfamiliar contexts within wider (or multidisciplinary) environments related to their field of study

M_CB8 - To be able to integrate different types of knowledge and make complex judgements based on information that, in spite of being partial or limited, includes ideas on the social and ethical responsibilities associated with the application of knowledge

M_CB9 - To share knowledge, conclusions and their rationale with specialised and lay audiences in a clear, unambiguous manner

LEARNING RESULTS

RMM159 To know and understand biological phenomena and their mathematical formulation.

LEARNING ACTIVITIES

	CH	NCH	TH
Presentation of the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	2 h.		2 h.
Individual and team exercises		2 h.	2 h.

EVALUATION SYSTEM

	W
Individual written and oral tests to assess technical skills of the subject	30%
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices	70%

MAKE-UP MECHANISMS

Individual written and oral tests to assess technical skills of the subject
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices

CH - Class hours: 2 h.

NCH - Non-class hours: 2 h.

TH - Total hours: 4 h.

RMM160 To propose solutions using statistical and information science tools to model biological phenomena

LEARNING ACTIVITIES

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Presentation of the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	3 h.		3 h.
Individual and team exercises	2 h.	3 h.	5 h.

EVALUATION SYSTEM

	<i>W</i>
Individual written and oral tests to assess technical skills of the subject	30%
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices	70%

MAKE-UP MECHANISMS

Individual written and oral tests to assess technical skills of the subject
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices

CH - Class hours: 5 h.
NCH - Non-class hours: 3 h.
TH - Total hours: 8 h.

RMM161 To design a scientific study and the accompanying data collection process

LEARNING ACTIVITIES

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Individual and/or team computer simulation practice	15,24 h.	22,86 h.	38,1 h.
Classroom presentations of relevant concepts and procedures in participatory environments	25,4 h.		25,4 h.

EVALUATION SYSTEM

	<i>W</i>
Individual written and oral tests to assess technical skills of the subject	40%
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices	60%

MAKE-UP MECHANISMS

Individual written and oral tests to assess technical skills of the subject
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices

CH - Class hours: 40,64 h.
NCH - Non-class hours: 22,86 h.
TH - Total hours: 63,5 h.

RMM162 To know, develop and apply suitable data analysis algorithms

LEARNING ACTIVITIES

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Presentation of the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.		20 h.
Individual and team exercises	15 h.	20,5 h.	35,5 h.

EVALUATION SYSTEM

	<i>W</i>
Individual written and oral tests to assess technical skills of the subject	30%
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices	70%

MAKE-UP MECHANISMS

Individual written and oral tests to assess technical skills of the subject
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices

CH - Class hours: 35 h.
NCH - Non-class hours: 20,5 h.
TH - Total hours: 55,5 h.

RMM163 To analyze the variables that are part of the solution to a problem, to plan actions in order to reach a stable solution assuming responsibilities in the work group, organizing and planning tasks.

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	14 h.	8,5 h.	22,5 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	
CH - Class hours: 14 h.			
NCH - Non-class hours: 8,5 h.			
TH - Total hours: 22,5 h.			

RMM164 To know and apply problem solving tools in the field of biomedical engineering with initiative, decision -making, creativity and critical thinking.

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	14 h.	8,5 h.	22,5 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	
CH - Class hours: 14 h.			
NCH - Non-class hours: 8,5 h.			
TH - Total hours: 22,5 h.			

RMM165 To define the problem, the development of the solution and the conclusions efficiently, arguing and justifying each one of them and using correct written and spoken language.

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	4 h.	2 h.	6 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	
CH - Class hours: 4 h.			
NCH - Non-class hours: 2 h.			
TH - Total hours: 6 h.			

RMM166 To define the objectives, perform the planning for its consecution and to coordinate with the rest of the members of the team.

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	3,5 h.	2 h.	5,5 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
CH - Class hours: 3,5 h. NCH - Non-class hours: 2 h. TH - Total hours: 5,5 h.		

CONTENTS

1. Introduction
2. Data generation
3. Data collection and ingestion
4. Data storage
5. Exploratory Data Analysis
6. Data preprocessing
 - 6.1 Data reduction
7. Data analysis
 - 7.1 Statistical Analysis
 - 7.2 Machine Learning
 - 7.3 Deep Learning
8. Data visualization

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Subject notes Topic related web quires	Machine learning with R : expert techniques for predictive modeling. Lantz, Brett. Packt, 2019. ISBN: 978-1-78829-586-4 Kafka [Libro] : the definitive guide: real-time data and stream processing at scale. ISBN: 978-1-4919-3613-9 (online) 978-1-4919-3616-0 (paper) O'Reilly Media, 2017. Neha Narkhede, Gwen Shapira, Todd Palino Designing data intensive applications : the big ideas behind reliable, scalable, and maintainable systems. Kleppmann, Martin. O'Reilly, 2017. ISBN: 978-1-491-90311-7 (online) 978-1-449-37332-0 (paper)