UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course:	FUNDAMENTALS OF CLIMATIC CHANGE	**Code:**	37348
Type:	ELECTIVE	**ECTS credits:**	4.5
Degree:	340 - UNDERGRADUATE DEGREE PROGRAMME IN ENVIRONMENTAL SCIENCES	**Academic year:**	2023-24
Center:	501 - FACULTY OF ENVIRONMENTAL SCIENCES AND BIOCHEMISTRY	**Group(s):**	40
Year:	4	**Duration:**	First semester
Main language:	Spanish	**Second language:**	English
Use of additional languages:		**English Friendly:**	Y
Web site:		**Bilingual:**	N

Lecturer: **MIGUEL ANGEL GAERTNER RUIZ VALDEPEÑAS** - Group(s): **40**

Building/Office	Department	Phone number	Email	Office hours
Sabatini / 0.18	CIENCIAS AMBIENTALES	926051752	miguel.gaertner@uclm.es	Tuesday from 12 noon to 1 p.m., Thursday from 11 a.m. to 1 p.m. and from 3 p.m. to 6 p.m., by appointment by email.

2. Pre-Requisites

Not established

3. Justification in the curriculum, relation to other subjects and to the profession

Anthropogenic climate change is one of the main environmental threats for mankind. The main objective of this subject is to provide a good knowledge about the fundamentals of climate change science, giving illustrative examples of the main implications that climate change has and could have in the future. This forms the basis for mitigation strategies for consequences of future scenarios, as well as for adapting to such consequences. When a student studies this subject, it is intended firstly that he understands the complexity and magnitude of the problem, and then that he knows various mitigating actions offered by technology. For this reason, the learning process follows this sequence:

- Understanding the basic physical principles that determine global climate.

- Knowing the components of climate system and the complex interactions among them

- Studying climate variability at several timescales

- Analyzing the main causes of observed climate change

- Knowing the techniques of climated modelling and their uncertainties

- Knowing and interpreting current projections of anthropogenic climate change

- Studying the main impacts and consequences of anthropogenic climate change

- Knowing and analyzing strategies for mitigating anthropogenic climate change and adapting to its consequences

Despite the subject having a particularly strong relationship to the subject of Meteorology and Climatology, impacts of climate change occur (or they are expected to occur) in all types of areas, and because of this the subject has a strong multidisciplinary component and provides a knowledge with large practical importance for the development of the environmentalist profession.

4. Degree competences achieved in this course

Course competences

Code	Description
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
E01	Ability to understand and apply basic knowledge.
E03	Awareness of the temporal and spatial dimensions of environmental processes
E05	Capacity for qualitative data interpretation
E06	Capacity for quantitative data interpretation
E27	Know clean technologies and renewable energies.
E28	Energy management and optimization capacity
T01	To know a second foreign language.
T02	To know and apply the Information and Communication Technologies (ICT).
T03	To use a correct oral and written communication.
T04	To know the ethical commitment and professional deontology.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To know the projections of anthropogenic climate change, its causes, its main consequences, the techniques for its study and the strategies for its mitigation.

To understand the components of the climate system, the complex interactions between them and climate variability at different time scales.
Learn to relate environmental phenomena to the principles of physics that explain them. Especially those related to meteorological, climatological, air, noise and radiation pollution processes.

6. Units / Contents

Unit 1: Introduction: The climate system
Unit 2: Planetary balances of energy and water
Unit 3: The atmosphere
Unit 4: The oceans
Unit 5: Feedback mechanisms and sensitivity of climate system
Unit 6: The evolution of earth climate
Unit 7: Anthropogenic climate warming. Climate change
Unit 8: Climate models. Emissions scenarios and global climate change scenarios
Unit 9: Impacts of climate change
Unit 10: Mitigation of climate change

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CB05 E01 E03 E05	1.12	28	N	-	
Computer room practice [ON-SITE]	Combination of methods	CB01 CB05 E01 E03 E05 E06 T01 T02	0.48	12	Y	N	
Writing of reports or projects [OFF-SITE]	Combination of methods	CB01 CB05 E01 E03 E05 E06 E27 E28 T01 T02 T03 T04	1.2	30	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CB01 CB05 E01 E03 E05 E06 E27 E28 T01	1.5	37.5	N	-	
Final test [ON-SITE]	Assessment tests	CB01 CB05 E01 E03 E05 E06 E27 E28 T03	0.12	3	Y	Y	
Mid-term test [ON-SITE]	Assessment tests	CB01 CB05 E01 E03 E05 E06 T03	0.08	2	Y	N	
		Total:	**4.5**	**112.5**			
		Total credits of in-class work: 1.8					**Total class time hours: 45**
		Total credits of out of class work: 2.7					**Total hours of out of class work: 67.5**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Final test	35.00%	100.00%	Continuous assessment: Students that have passed the mid-term test (with a minimum grade of 4 over 10) only have to be assessed for the second part of the subject. Students that have not passed the mid-term test have to be assessed for the two parts of the subject. In this later case, the weight of the final exam in the final grade will be 70%. Non-continuous evaluation: the final grade of the subject will be the grade obtained in the final exam.
Practicum and practical activities reports assessment	30.00%	0.00%	
Mid-term tests	35.00%	0.00%	Mid-term exam for the first part of the topics. If passed, this part will not be included in the final exam. For passing this exam, a minimum grade of 4 over 10 is needed.
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The final grade will be obtained applying the indicated weights to the mid-term test, the practicum and the final exam. If the mid-term test has not been passed, the weight of the final exam will be 70%.

Non-continuous evaluation:

The grade of the final exam will be equal to 100% of the final grade. The modality assigned by default to the student will be the continuous evaluation. Any student may request the change to the non-continuous evaluation modality (before the end of the class period) by sending an email to the teacher, provided that he/she has not completed 50% of the assessable activities

Specifications for the resit/retake exam:

Continuous assessment: The assessment criteria for the midterm exam and the final exam will be the same indicated above: if the midterm test has been passed, it will have a 35% weight and the retake exam (for the second part of the topics) will have a 35% weight, but if the midterm test has not been passed, the weight of the retake exam (covering all the topics) will be 70%. The grade for the practicum will be the one obtained during the course, but in case of a fail grade the

practicum report may be optionally presented again.

Non-continuous evaluation: The grade of the final exam will be equal to 100% of the final grade.

Specifications for the second resit / retake exam:

The final grade in this case will coincide with the grade obtained in this second retake exam.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	**hours**

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)	IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change https://www.ipcc.ch/report/ar6/wg2/				2022	
Hartmann, Dennis L.	Global physical climatology	Academic Press		0-12-328530-5	1994	
Peixoto, J. P. & Oort A. H.	Physics of climate	American Institute of Physics		0-88318-712-4	1992	
Ruddiman, William F.	Earth's climate : past and future	W. H. Freeman and Company		0-7167-3741-8	2002	
Talley L.D., Pickard G.L., Emery W.J., Swift J.H.	Descriptive Physical Oceanography: An Introduction (Sixth Edition)	Elsevier	Boston	978-0-7506-4552-2	2011	
Ahrens, C. Donald	Meteorology today : an introduction to weather, climate and the environment	Brooks/Cole		0-534-37379-8	2000	
Archer D.	Global Warming: Understanding the forecast (2nd edition)	John Wiley & Sons Ltd		978-0-470-94341-0	2011	
Archer D. & Rahmstorf S.	The Climate Crisis: An Introductory Guide to Climate Change	Cambridge University Press		978-0-521-73255-0	2010	
Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)	IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change https://www.ipcc.ch/report/ar6/wg1/	Cambridge University Press			2021	
Paul Hawken (Ed.)	Drawdown : the most comprehensive plan ever proposed to reverse global warming	Penguin Books	New York	978-0-14-313044-4	2017	
P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)	IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change https://www.ipcc.ch/report/ar6/wg3/				2022	