

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	ENVIRONMENTAL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE – SELECTIVE IN THE “ATMOSPHERE -ENERGY – CLIMATE CHANGE” SPECIALIZATION		
COURSE CODE	15HY5N - K1	SEMESTER	9 TH
COURSE TITLE	CLIMATE CHANGE: THE SCIENTIFIC BASIS / MEASURES TO REDUCE CLIMATE EXTREME IMPACTS		
TEACHING ACTIVITIES <i>If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.</i>	TEACHING HOURS PER WEEK	ECTS CREDITS	
	3	5	
<i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i>			
COURSE TYPE <i>Background, General Knowledge, Scientific Area, Skill Development</i>	Scientific area, skill development		
PREREQUISITES:	Climatology, Physics of the atmosphere, Mathematics, Statistics		
TEACHING & EXAMINATION LANGUAGE:	Greek English for Erasmus+ students		
COURSE OFFERED TO ERASMUS STUDENTS:	Yes		
COURSE URL:	https://eclass.duth.gr/courses/424489/		

2. LEARNING OUTCOMES

Learning Outcomes <i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i>																		
<p>Understanding the meaning of natural and human induced climate changes and their impacts on natural and human systems and ecosystems.</p> <p>Development of the skills to determine risk factors that are related to exposure and vulnerability to climate changes.</p> <p>Development of skills to determine land use changes and their impact on carbon cycle.</p> <p>Development of skills to design mitigation measures at minimum cost.</p>																		
General Skills <i>Name the desirable general skills upon successful completion of the module</i>																		
<table border="0"> <tr> <td><i>Search, analysis and synthesis of data and information,</i></td> <td><i>Project design and management</i></td> </tr> <tr> <td><i>ICT Use</i></td> <td><i>Equity and Inclusion</i></td> </tr> <tr> <td><i>Adaptation to new situations</i></td> <td><i>Respect for the natural environment</i></td> </tr> <tr> <td><i>Decision making</i></td> <td><i>Sustainability</i></td> </tr> <tr> <td><i>Autonomous work</i></td> <td><i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i></td> </tr> <tr> <td><i>Teamwork</i></td> <td><i>Critical thinking</i></td> </tr> <tr> <td><i>Working in an international environment</i></td> <td><i>Promoting free, creative and inductive reasoning</i></td> </tr> <tr> <td><i>Working in an interdisciplinary environment</i></td> <td></td> </tr> <tr> <td><i>Production of new research ideas</i></td> <td></td> </tr> </table>	<i>Search, analysis and synthesis of data and information,</i>	<i>Project design and management</i>	<i>ICT Use</i>	<i>Equity and Inclusion</i>	<i>Adaptation to new situations</i>	<i>Respect for the natural environment</i>	<i>Decision making</i>	<i>Sustainability</i>	<i>Autonomous work</i>	<i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i>	<i>Teamwork</i>	<i>Critical thinking</i>	<i>Working in an international environment</i>	<i>Promoting free, creative and inductive reasoning</i>	<i>Working in an interdisciplinary environment</i>		<i>Production of new research ideas</i>	
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Teamwork
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

3. COURSE CONTENT

1. Introduction to Greenhouse phenomenon – Global temperature rise
2. Atmospheric components – Climate changes in the past
3. Sources of Green House Gasses, Carbon Footprint, CFCs and ozone protection
4. CO₂ measurements, sea level rise, ocean acidification, decrease of ice cap areas, extreme weather events, climate extremes
5. IPCC Assessment Reports: The Sixth Assessment Report (AR6), IPCC climate scenarios, Shared Socioeconomic Pathways (SSPs)
6. Climate change mitigation technologies: Carbon capturing, carbon sequestration, geological capturing, policies for GHGs minimization
7. Computation of vegetation carbon stock changes
8. International Policies: The Kyoto Protocol, The Paris Agreement, United Nations Framework for Climate Change
9. Legal Framework: National and European legislation – Carbon trading system
10. Climate negotiations and climate diplomacy, emissions monitoring, national and individual reporting and verification procedures (MRV)
11. Climate change adaptation, National Adaptation Strategy and Regional Mitigation measures, Civil Protection aspects
12. Climate change impacts, vulnerability and resilience to climate change, assessment of climate risk
13. Examples of national policies for carbon capturing and land management

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD <i>Face to face, Distance learning, etc.</i>	Face-to-face teaching with Power Point presentations. All presentations available with additional study material and assignments via e.class platform	
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i>	ICT is used throughout the course activities in teaching, laboratory exercises and communication. The course is strongly oriented to the use and application of open-source software and open data analysis.	
TEACHING ORGANIZATION <i>The ways and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc. The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</i>	Activity	Workload/semester
	Lectures – face to face	13
	Exercises - supervised	26
	Bibliographic research - unsupervised	26
	Problem solving - unsupervised	26
	Project development - supervised	40
	Presentation preparation - unsupervised	13
	Lectures – face to face	13

	Total	144
<p align="center">STUDENT EVALUATION</p> <p><i>Description of the evaluation process</i></p> <p><i>Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others</i></p> <p><i>Please indicate all relevant information about the course assessment and how students are informed</i></p>	<p>Assessment is based on individual assignment (30%), written exams. Students are expected to submit their assignments to e.class platform and participate in written exams.</p>	

5. SUGGESTED BIBLIOGRAPHY

Greek literature:

1. Κλιματολογία και Κλιματική Αλλαγή

Κωδικός Βιβλίου στον Εύδοξο: 112691796, Έκδοση: 1η/2022

Συγγραφείς: Barry Roger, Hall-McKim Eileen A., Νάστος Παναγιώτης (Επιστ. Επιμέλεια) ISBN: 9789604189724

Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

2. Κλιματική Αλλαγή

Κωδικός Βιβλίου στον Εύδοξο: 94691991

Έκδοση: 1η/2021

Συγγραφείς: Πασχαλίδου Αναστασία

ISBN: 978-960-418-812-3

Τύπος: Σύγγραμμα

Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

3. ΚΛΙΜΑΤΙΚΗ ΑΛΛΑΓΗ

Κωδικός Βιβλίου στον Εύδοξο: 68390777

Έκδοση: 1η/2017

Συγγραφείς: Εμμανουέλα Δούση

ISBN: 9789605696269

Τύπος: Σύγγραμμα

Διαθέτης (Εκδότης): Εκδόσεις Κυριάκος Παπαδόπουλος Α.Ε

4. Κλιματική Αλλαγή - Βιώσιμη Ανάπτυξη & Ανανεώσιμες Πηγές Ενέργειας

Κωδικός Βιβλίου στον Εύδοξο: 22825981

Έκδοση: 1η έκδ./2009

Συγγραφείς: Ανανιάδου - Τζημοπούλου Μαίρη [Συντονιστής έκδοσης], Τσιούρης Σωτήρης [Συντονιστής έκδοσης]

ISBN: 9789604561797

Τύπος: Σύγγραμμα

Διαθέτης (Εκδότης): Ζήτη Πελαγία & Σια Ι.Κ.Ε.

5. ΔΙΕΘΝΕΣ ΔΙΚΑΙΟ ΚΑΙ ΔΙΠΛΩΜΑΤΙΑ ΤΗΣ ΚΛΙΜΑΤΙΚΗΣ ΑΛΛΑΓΗΣ

Κωδικός Βιβλίου στον Εύδοξο: 94643576

Έκδοση: 1η/2020

Συγγραφείς: ΔΟΥΣΗ ΕΜΜΑΝΟΥΕΛΑ

ISBN: 9789606541124

Τύπος: Σύγγραμμα

Διαθέτης (Εκδότης): ΝΟΜΙΚΗ ΒΙΒΛΙΟΘΗΚΗ ΑΕΤΕ

6. ΥΠΕΝ, Δνση Κλιματικής Αλλαγής. 2016. Εθνική Στρατηγική Για Την Προσαρμογή Στην Κλιματική Αλλαγή.

7.ΥΠΕΝ. 2022. “Νόμος 4936/2022. Εθνικός Κλιματικός Νόμος - Μετάβαση Στην Κλιματική Ουδετερότητα Και Προσαρμογή Στην Κλιματική Αλλαγή, Επείγουσες Διατάξεις Για Την Αντιμετώπιση Της Ενεργειακής Κρίσης Και Την Προστασία Του Περιβάλλοντος.” ΥΠΕΝ. <https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders>.

8.ΦΕΚ Β΄4893. 2019. “Κύρωση Του Εθνικού Σχεδίου Για Την Ενέργεια Και Το Κλίμα (Εσεκ).” <http://www.elinyae.gr/ethniki-nomothesia/ya-42019-fek-4893b-31122019>.

ΦΕΚ Β΄4893. 2022. “Τροποποίηση Και Κωδικοποίηση Της Υπό Στοι- Χεία ΔΙΠΑ/Οικ.37674/27-7-2016 Υπουργικής Απόφασης «Τροποποίηση Και Κωδικοποίηση Της Υπουργικής Απόφασης 1958/2012 - Κατάταξη Δη- Μοσίων Και Ιδιωτικών Έργων Και Δραστηριοτήτων Σε Κατηγορίες Και Υποκατηγορίες Σύμφωνα.” Vol. 841.

Suggested International Literature

Banti, Maria A, Kyriakos Kiachidis, and Alexandra Gemitzi. 2019. “Estimation of Spatio-Temporal Vegetation Trends in Different Land Use Environments across Greece.” *Journal of Land Use Science*, 1–16. <https://doi.org/10.1080/1747423X.2019.1614687>.

Böhm, F., A. Haase-Schramm, A. Eisenhauer, W.-C. Dullo, M. M. Joachimski, H. Lehnert, and J. Reitner. 2002. “Evidence for Preindustrial Variations in the Marine Surface Water Carbonate System from Coralline Sponges.” *Geochemistry, Geophysics, Geosystems* 3 (3): 1–13. <https://doi.org/10.1029/2001gc000264>.

Cawley, Gavin C. 2011. “On the Atmospheric Residence Time of Anthropogenically Sourced Carbon Dioxide.” *Energy & Fuels* 25 (11): 5503–13. <https://doi.org/10.1021/ef200914u>.

Chen, Chi, Taejin Park, Xuhui Wang, Shilong Piao, Baodong Xu, Rajiv K Chaturvedi, Richard Fuchs, et al. 2019. “China and India Lead in Greening of the World through Land-Use Management.” *Nature Sustainability* 2 (2): 122–29. <https://doi.org/10.1038/s41893-019-0220-7>.

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European Comssion. 2021. “Report from the Commission to the European Parliament and the Council on the Functioning of the European Carbon Market in 2020 Pursuant to Articles 10(5) and 21(2) of Directive 2003/87/EC (as Amended by Directive 2009/29/EC and Directive (EU) 2018/410)” 10.

“European Court of Auditors Carbon Footprint Report 2014.” 2016.

Gemitzi, Alexandra, Reyadh Albarakat, Foteini Kratouna, and Venkat Lakshmi. 2021. “Land Cover and Vegetation Carbon Stock Changes in Greece : A 29-Year Assessment Based on CORINE and Landsat Land Cover Data.” *Science of the Total Environment* 786: 147408. <https://doi.org/10.1016/j.scitotenv.2021.147408>.

Gemitzi, Alexandra, Maria A Banti, and Venkat Lakshmi. 2019. "Vegetation Greening Trends in Different Land Use Types : Natural Variability versus Human-Induced Impacts in Greece." *Environmental Earth Sciences* 78 (5): 1–10. <https://doi.org/10.1007/s12665-019-8180-9>.

Giorgi, F. 2006. "Climate Change Hot-Spots." *Geophysical Research Letters* 33 (8): L08707. <https://doi.org/10.1029/2006GL025734>.

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Huang, Jianping, Blanca Mendoza, John S Daniel, Claus J Nielsen, Leon Rotstayn, and Oliver Wild. 2013. "Anthropogenic and Natural Radiative Forcing." *Climate Change 2013 the Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* 9781107057999: 659–740. <https://doi.org/10.1017/CBO9781107415324.018>.

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Neukom, Raphael, Luis A Barboza, Michael P Erb, Feng Shi, Julien Emile-Geay, Michael N Evans, Jörg Franke, et al. 2019. "Consistent Multidecadal Variability in Global Temperature Reconstructions and Simulations over the Common Era." *Nature Geoscience* 12 (8): 643–49. <https://doi.org/10.1038/s41561-019-0400-0>.

Peters, Glen P, and Zeke Hausfather. 2020. "Emissions - the 'business as Usual' Story Is Misleading." *Nature* 577 (January): 618–20.

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Ritchie, Hannah. 2020. "www.OurWorldinData.Org." 2020. 2020.

Sahney, Sarda, Michael J Benton, and Howard J Falcon-Lang. 2010. "Rainforest Collapse Triggered Carboniferous Tetrapod Diversification in Euramerica." *Geology* 38 (12): 1079–82. <https://doi.org/10.1130/G31182.1>.

Shepherd, A, and et al. 2020. "Mass Balance of the Greenland Ice Sheet from 1992 to 2018." *Nature* 579 (August 2019): 233–54. <https://doi.org/10.1038/s41586-019-1855-2>.

Stanley, Steven M., and John A. Luczaj. 2015. Earth System History. Fourth Edition. Freeman/Macmillan Higher Education, New York, NY, 2015.

“Summary for Policymakers. [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (Eds.)]. In: Climate Change 2022: Impacts, Adaptation and Vulnerability.” 2022. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [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, . <https://doi.org/10.1017/9781009325844.001>.

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Zhu, Zaichun, Shilong Piao, Ranga B Myneni, Mengtian Huang, Zhenzhong Zeng, Josep G Canadell, Philippe Ciais, et al. 2016. “Greening of the Earth and Its Drivers.” Nature Climate Change 6 (8): 791–95. <https://doi.org/10.1038/nclimate3004>.

URLs:

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- “<http://Playingwithgeologicaltime.Weebly.Com/>.” 2022. 2022.
- “<https://www.greatgreenwall.org/>.” 2022. 2022.
- “<https://www.kathimerini.gr/economy/561944860/Eyropaiko-Koinovoylio-Prasines-Oi-Ependyseis-Se-Pyriniki-Energieia-Kai-Fysiko-Aerio/>.” 2022. 2022.
- “<https://www.nature.org/en-us/>.” 2022. 2022.
- “<https://www.ungm.org/shared/knowledgecenter/pages/unfccc>.” 2022. 2022.
- <https://unfoundation.org/>

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

Teacher (full name):	Alexandra Gemitzi
Contact details:	agkemitz@env.duth.gr
Supervisors: (1)	YES
Evaluation methods: (2)	Oral examination with distance learning methods, provided that the integrity and reliability of the examination are ensured
Implementation Instructions: (3)	The oral examinations are conducted through presentation in Teams platform of the assignment conducted by each student. Five questions are set to the student and the grade is extracted by the assessment of the quality and clarity of presentation and the correctness of answers provided to the questions. Students should be equipped with a microphone, camera, internet connection and should be connected to the Teams platform. The inviolability of the exam is guaranteed by the identification of the student and the presence of a second examiner throughout the exams process.

(1) Please write YES or NO

(2) Note down the evaluation methods used by the teacher, e.g.

- *written assignment* or/and exercises
- written or oral examination with distance learning methods, provided that the integrity and reliability of the examination are ensured.

(3) In the **Implementation Instructions** section, the teacher notes down clear instructions to the students:

a) in case of **written assignment and / or exercises**: the deadline (e.g. the last week of the semester), the means of submission, the grading system, the grade percentage of the assignment in the final grade and **any other necessary information**.

b) in case of **oral examination with distance learning methods**: the instructions for conducting the examination (e.g. in groups of X people), the way of administration of the questions to be answered, the distance learning platforms to be used, the technical means for the implementation of the examination (microphone, camera, word processor, internet connection, communication platform), the hyperlinks for the examination, the duration of the exam, the grading system, the percentage of the oral exam in the final grade, the ways in which the inviolability and reliability of the exam are ensured and any other necessary information.

c) in case of **written examination with distance learning methods**: the way of administration of the questions to be answered, the way of submitting the answers, the duration of the exam, the grading system, the percentage of the written exam of the exam in the final grade, the ways in which the integrity and reliability of the exam are ensured and any other necessary information.

There should be an attached list with the Student Registration Numbers only of students eligible to participate in the examination.