Course Syllabus
Climate Change

August – December 2021

Elective

Lecturer

Menary, Wayne

I. General course details

Course Name:	Climate Change		
Requirements:	100 credits	**Code:**	12279
Precedent:	None	**Semester:**	2021-2
Credits:	3	**Cycle:**	IX
Hours a week:	3 hours	**Course Mode:**	Remote distance learning
Major(s):	**Elective course:** Ing. Gestión Ambiental	**Course coordinator:**	Arauco Livia Mayra marauco@esan.edu.pe

II. Summary

The changes to global climate being brought about by human activity present one of the greatest challenges to confront humanity and are likely to have a profound effect over the working lives of today's students. Understanding them requires a comprehensive approach spanning multiple disciplines. The aim of this course is to equip students to begin to do this, by providing a grounding in the central scientific, economic and political issues surrounding climate change.

III. Course Objectives

To provide students from a wide range of backgrounds with an up-to-date view of the scientific, social, cultural, economic, technological and political challenges that climate change poses.

IV. Learning Outcomes

By the end of this course students should be able to:

a) Understand the major issues that climate change raises across a range of disciplines (science, economics, politics, engineering etc).
b) Explain the approaches to these challenges that are currently at play, or proposed, and the problems they create.
c) Appreciate the role of uncertainty in climate change, how this may be folded into actions, and how it is implemented across different fields (where it often has slightly different meanings).
d) Critically examine material relating to climate and climate change and assess its reliability.
e) Be able to meaningfully discuss the nature of climate change with individuals from a wide range of backgrounds.
f) Identify, formulate, seek information on, and analyse complex engineering problems to reach reasoned conclusions using basic principles of mathematics, natural science, and engineering science.
g) Communicate effectively, by understanding and writing reports and design documentation, making presentations, and transmitting and receiving clear instructions.
h) Understand and evaluate the impact of solutions to complex engineering problems in a global, economic, environmental and social context.

i) Create, select and use modern engineering and information technology techniques, skills, resources and tools, including prediction and modelling, with an understanding of their limitations.
j) demonstrate knowledge and understanding of the principles of engineering management and economic decision-making, and their respective application.

V. Methodology

The course methodology emphasizes active student participation with the Lecturer assuming the role of learning facilitator. **Students are expected to come to class having completed the readings in advance in order to actively participate in the weekly lectures, seminars, debates and related activities**.

Homework assignments and readings are designed to reinforce the specific course topic and/or to introduce new and additional issues.

Contact and communication between the student and lecturer will be via the virtual campus platform, where all the course resources will also be available.

VI. Evaluation

The integrated evaluation system is continuous. The grade of the subject is obtained by averaging the continuous evaluation (50%), the partial exam (20%) and the final exam (30%).

The average grade for the continuous assessment results from the average of assessed research reports, integrative activities and creation and presentation of an individual map. The weighting within the continuous evaluation is described in the following table:

PROMEDIO DE EVALUACIÓN PERMANENTE 50%		
Type of evaluation	**Description**	**Weighting %**
Role Play and Report	Climate Change **Solutions** Simulator (Role Play and follow-up report)	20
ESG Report	Report on Climate Change **Risk Management.**	20
Debate	Climate Change debate (active participation and follow-up report)	20
Business Case	Final project on a selected business climate change stress-testing / future-proofing scenario (Oral presentation and report)	40

The final average grade (FA) is obtained as follows:

$$\mathbf{FA} = (0{,}20 \times MTE) + (0{,}50 \times CEA) + (0{,}30 \times FE)$$

Where:
FA = Final Average
MTE = Mid-Term Exam
CEA = Continuous Evaluation Average
FE = Final Exam

VII. Programme Content

WEEK	*CONTENTS*	*ACTIVITIES / EVALUATION*
UNIT OF LEARNING I: The Science of Climate Change. • To understand, evaluate and critically review the underlying physical processes that govern global climate, the evidence for human-induced warming, predictions for the future, and assessment of mitigation strategy.		
1° 23rd to 28th August	**Why study this elective course on Climate Change?** **Introduction to the climate problem.** 1.1 What is climate? 1.2 What is climate change? 1.3 Geographical Coordinate Systems 1.4 Climate Change debate – who to believe? 1.5 Summary	Presentación del silabo en todos contenidos. Presentación de la metodología del curso. Revisión de guía (pautas) para el desarrollo de los trabajos encargados (Incluye explicación del instrumento de evaluación). Revisión de la Guía para presentación de trabajos escritos en la Universidad ESAN (normas APA) Lecture Class Seminar
	Video Activity: Ted Talk: Why should you believe scientists? http://www.ted.com/talks/naomi_oreskes_why_we_should_believe_in_science Climate of Doubt https://www.pbs.org/wgbh/frontline/film/climate-of-doubt/ **Read**: Chapter 1, Dessler (2015). Introduction to Modern Climate Change. Why Bother https://michaelpollan.com/articles-archive/why-bother/ IPCC 2021 Summary for Policymakers conflict: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf	
2° 30th August to 4th September	**Evidence for climate change** 2.1 Recent climate change 2.2 Historical climate record 2.3 Summary	Lecture & Class Seminar Debate I: Is emphasising consensus in climate science helpful for policymaking?
	Video Activity: Short-term variability http://www.youtube.com/watch?v=e0vj-0imOLw **Read**: Chapter 2, Dessler (2015). Introduction to Modern Climate Change.	
3° 6th to 11th September	**Basic physics of electromagnetic radiation & climate modelling** 1.1 Temperature and energy 1.2 Electromagnetic radiation 1.3 Energy balance 1.4 The Source of energy for our climate system	Lecture & Class Seminar Quiz 1

	1.5 Energy loss to space 1.6 The greenhouse effect 1.7 Summary	
	Video Activity: Infrared radiation causing flashover https://www.youtube.com/watch?v=ZH0k-NthgTY#t=45 **Read:** Chapters 3 & 4 Dessler (2015). Introduction to Modern Climate Change.	
4° 13th to 18th September	**The Carbon Cycle** 4.1 Greenhouse gases and our atmosphere's composition 4.2 Atmosphere-land biosphere-ocean carbon exchange 4.3 Atmosphere-rock exchange 4.4 Anthropogenic impacts on the carbon cycle 4.5 Long-term fate of carbon dioxide 4.6 Methane 4.7 Summary	Lecture & Class Seminar Quiz 2
	Video Activity: https://youtu.be/hgFpvDNfXOk **Read:** Chapter 5, Dessler (2015). Introduction to Modern Climate Change.	
5° 20th to 25th September	**Forcing, feedbacks, and climate sensitivity:** 5.1 Time lags in the climate system 5.2 Radiative forcing 5.3 Feedbacks 5.4 Climate sensitivity 5.5 Summary	Lecture & Class Seminar Quiz 3
	Read: Chapter 6, Dessler (2015). Introduction to Modern Climate Change.	
6° 27th September to 2nd October	**Why is the climate changing?** 6.1 Continental drift 6.2 The sun 6.3 The Earth's orbit 6.4 Internal variability 6.5 Greenhouse gases 6.6 Summary	Lecture & Class Seminar Quiz 4
	Video Activity: The Milankovitch Cycles https://youtu.be/iA788usYNWA **Read:** Chapter 7 Dessler (2015). Introduction to Modern Climate Change.	

<table>
<tr><td></td><td>Climate Change Evidence & Causes Update 2020
https://royalsociety.org/~/media/Royal_Society_Content/policy/projects/climate-evidence-causes/climate-change-evidence-causes.pdf</td><td></td></tr>
<tr><td>7°
4th to 9th
October</td><td colspan="2">MID-EXAMS (ELECTIVES)</td></tr>
<tr><td>8°
11th to 16th
October</td><td colspan="2">MID-TERM EXAMS</td></tr>
<tr><td colspan="3">UNIT OF LEARNING II:
• To analyse and assess the ecological, economic and social consequences of climate change.
• To examine and critically review the difficulties in the way of reaching a political consensus for action to mitigate climate change; political strategies and technological mechanisms to overcome them, and to adapt to future changes.</td></tr>
<tr><td>9°
18th to 23rd
October</td><td>Predictions of further climate change
9.1 The factors that control emissions
9.2 Emissions scenarios
9.3 Predictions of future radiative forcing
9.4 Predictions of future climate
9.5 Is the climate predictable?
9.6 Summary

Video Activity:
Engineering the Software for Understanding Climate Change
https://youtu.be/vIiW6ugLHL4

Read:
Chapter 8 Dessler (2015). Introduction to Modern Climate Change.</td><td>Lecture & Class Seminar

Debate II: Is the concept of ‘tipping point’ helpful for describing and communicating possible climate futures?

Evaluation: ESG Report</td></tr>
<tr><td>10°
25th to 30th
October</td><td>Impacts of climate change & Exponential Growth
10.1 Why should you care about climate change
10.2 Physical impacts
10.3 Abrupt climate changes
10.4 Exponential growth and the rule of 72
10.5 Limits to exponential growth
10.6 Discounting and the social cost of carbon
10.7 Summary

Video Activity:
http://www.vulture.com/2016/11/crown-recap-season-1-episode-4.html

Read:
Chapters 9 & 10 Dessler (2015). Introduction to Modern Climate Change.</td><td>Lecture & Class Seminar

Debate III: Can the social cost of carbon be calculated?</td></tr>
<tr><td>11°
2nd to 6th
November</td><td>Fundamentals of climate change policy & response
11.1 Adaptation
11.2 Mitigation
11.3 Geoengineering
11.4 Summary</td><td>Lecture & Class Seminar

Debate IV: Is it necessary to research solar climate engineering as a possible backstop technology?</td></tr>
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	Video Activity: http://www.cc.com/video-clips/lv0hd2/the-colbert-report-david-keith **Read**: Chapter 11 Dessler (2015). Introduction to Modern Climate Change.	Evaluation: ENROADS Simulation Role Play
12° 8th to 13th November	**Mitigation Scenarios** 12.1 Conventional regulations 12.2 Market-based regulations 12.3 Information and voluntary methods 12.4 Summary **Video Activity**: http://youtu.be/ZYi78LaY8u4 **Read**: Chapter 12 Dessler (2015). Introduction to Modern Climate Change. Case for a carbon Tax http://www.nytimes.com/2015/06/07/opinion/the-case-for-a-carbon-tax.html	Lecture & Class Seminar Debate V: Does successful emissions reduction lie in the hands of non-state rather than state actors?
13° 15th to 20th November	**The Politics of Climate Change** 13.1 The beginnings of climate science 13.2 The emergence of environmentalism 13.3 A long-term policy to address climate change 13.4 Summary **Read**: Chapter 13 Dessler (2015). Introduction to Modern Climate Change.	Lecture & Class Seminar Debate VI: Are social media making constructive climate policymaking harder?
14° 22nd to 27th November	**Course Summary: A Long-Term Policy to Address Climate Change** **Readings**: Chapter 14 Dessler (2015). Introduction to Modern Climate Change.	Lecture & Class Seminar **Evaluation** Final project presentations (Business stress-testing / future-proofing)
15° 29th November to 4th December	**FINAL EXAMS (ELECTIVES)**	
16º 6th to 11th December	**FINAL EXAMS**	

VIII. Bibliografía

- Andrew E. Dessler (2015). Introduction to Modern Climate Change - Cambridge University Press.
- Dryzek, Norgaard & Schlosberg (2013). Climate Challenged Society. OUP.

Below are several sources of possible reading that complement the course. They are not intended to be exhaustive.

- John Houghton (2009). Global Warming: The Complete Briefing. CUP, 4th Edition.

- Mike Hulme (2013). Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity. CUP, 1st Edition.
- David MacKay (2008). Sustainable Energy without the Hot Air.
- Anthony Giddens (2013). The politics of climate change. Polity.
- James Hansen (2011). Storms of my grandchildren. Bloomsbury.
- Naomi Oreskes & Erik Conway (2011). Merchants of Doubt. Bloomsbury.
- Nate Silver (2012). The signal and the noise. Penguin.

ARTICLES

- Annan, J. D. and Hargreaves, J. C. (2013): A new global reconstruction of temperature changes at the Last Glacial Maximum, Clim. Past, 9, 367–376
- Naomi Oreskes & Erik Conway, Dædalus. The Collapse of Western Civilization: A View from the Future. The Journal of the American Academy of Arts & Sciences.
- Maximum, Schmittner et al. (2011). Climate Sensitivity Estimated from Temperature Reconstructions of the Last Glacial. Science 334 1385.
- Manfred Milinski, et al. (2006). Stabilizing the Earth's Climate Is Not a Losing Game: Supporting Evidence from Public Goods Experiments - Proceedings of the National Academy of Sciences of the United States of America, Vol. 103, No. 11, pp. 3994-3998
- Gneezy et al (2004). The inefficiency of splitting the bill. The Economic Journal 114: 265-280
- David Mackay et al. Price carbon - I will if you will (article on a new rule for a successful climate negotiation)
- Garrett Hardin (1968). The tragedy of the commons. Science 162: 1243-1248
- Martin Weitzman's Max Weber Lecture on Climate Change Economics, at the European University Institute, November 2015

ONLINE RESOURCES

- SLIDESHOW: Exposing the Disinformation Playbook, linked from the website of the Union of Concerned Scientists, http://www.ucsusa.org/global_warming/

REPORTS

You should also consider looking at the IPCC reports, available - http://www.ipcc.ch/.

ADDITIONAL WEEKLY LEARNING RESOURCES WILL BE ADDED TO THE UE VIRTUAL PLATFORM

IX. Lecturer

Wayne Menary PhD e-mail: wmenary@esan.edu.pe