SCHOOL OF BUSINESS AND SOCIAL SCIENCES
AARHUS UNIVERSITET

Template for the preparation of course descriptions at Aarhus BSS Summer University courses

Course descriptions must be prepared in the template below. For further information in general please visit our website for Summer University guest lecturers.

Course Information	
Course name (English) **Insert here ►**	Applications of Game Theory to Environmental Problems
ECTS	Please select (**X**) your course ECTS: [X] 5 ECTS
Department	MGMT / ECON
Degree programme	Please select (**X**) your programme level: [ ] Bachelor [X] Master
Term 1 or Term 2	Please select (**X**) your preferred term: [X] Term 1 (Wednesday, July 2nd 2025 - Friday, July 18th 2025) [ ] Term 2 (Wednesday, July 23nd 2025 - Friday, August 8th 2025)
Forms of instruction	[X] Class instruction
Comments on the form of instruction **Insert here ►**	Classroom Instruction. This course will be taught in person, and its main focus is to examine environmental issues, such as climate change, green washing, pollution and waste management, from a strategic point of view. We will examine real-life examples (case studies) and study how these examples can be rationalized using game theory.

Description of qualifications **Insert here ►**	This course introduces students to examining game theoretical concepts and models, connecting them to environmental issues. Knowledge: The student will acquire knowledge about: - Different decision-making process. - Different concepts of game theory. - Recognize the role of information on the decision-making process. - How environmental issues can be rationalized from a strategic point of view. - Identify different tools that induce agents to solve environmental problems. - Rationalize the effects of environmental policies on firms. Skill: - The student can solve complex issues using a game theoretical approach. - The student is able to identify how firms react to different policies. - The student can anticipate how green technology impact the market structure. - The student is able to design different strategic settings. - The student can solve a decision-making problem considering externalities. Competencies - Apply independently concepts and key insights from game theory to real case studies and conciliate between the interests of polluting firms and the society. - Make academically well-founded and responsible policy recommendations and independent decisions. - Provide well justified argumentation, critically reflect upon reached decisions and possible solutions and subsequently select between different policy recommendations to tackle environmental problems.
Language of instruction	English
Exam language	English

Hours – Weeks – Periods	AU Summer University 9-13 every day (13 days of teaching) 
Contents	Societies are facing several challenges to deal with the negative effects of climate change. One of the main challenges is to identify tools that induce agents in the

	economy to reduce pollution and, thus, ameliorate the impact of climate change. Game theory is a well-known tool that helps us rationalize the decision-making process of agents and anticipate the effects of different policies promoting green practices. The European Union has implemented several policies, for instance, emission fees, subsidies of electric cars or subsidies of renewable energy, to promote a more sustainable economy and, ultimately, reduce emissions. The main question is: how do policies affect agents' behavior in the economy? Will firms invest more in green technologies? Will individuals acquire more electric cars? Are these policies welfare-improving? Do firms have more incentives to greenwash? The course examines these questions by, first, presenting the main concepts in game theory and, second, examining applications that describe the decision-making process of regulators, firms, and consumers when facing environmental problems. Course subject areas: - Static games of complete information - Static games of incomplete information - Climate change and pollution - Tragedy of the commons - Environmental policies (command-and-control regulation and market-based incentives) - Effects of policies on Investment in clean technology - Study of different environmental policies in the EU and their effects on firms' investment in abatement.
Insert here ►	We will test theories, tools and models during cases and real-life examples. It will be possible to connect parts of the project work of the course to your own master programs and interests.

<table>
<tr><td>Course coordinator</td><td>Ana Alina Tudoran, anat@econ.au.dk /

Eliane Choquette,</td></tr>
<tr><td>Lecturer (incl. email)

Insert here (name) ►</td><td>Please insert lecturer name and e-mail:

Ana Espinola-Arredondo</td></tr>
<tr><td>Insert here (e-mail) ►</td><td>anaespinola@wsu.edu</td></tr>
<tr><td>Academic term</td><td>Summer University</td></tr>
<tr><td>Syllabus

Insert here ►</td><td>Please provide a specific tentative syllabus that covers 13 days of teaching:

<table>
<tr><th></th><th>Topic(s)</th><th>Tentative readings</th></tr>
<tr><td>Day 1</td><td>Games of Complete Information</td><td>- Games, Strategies and Decision Making. Joseph Harrington Jr. Worth Publishers. (Second edition) 2014.
- Game Theory: An Introduction with Step-By-Step Examples, A. Espinola-Arredondo and F. Munoz-Garcia, Palgrave MacMillan, December 2023.</td></tr>
<tr><td>Day 2</td><td>Games of Incomplete Information</td><td>- Games, Strategies and Decision Making. Joseph Harrington Jr. Worth Publishers. (Second edition) 2014.</td></tr>
<tr><td>Day 3.</td><td>Signaling Games</td><td>- Game Theory for Applied Economists. Robert Gibbons. Princeton University Press. 1992.</td></tr>
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	Day 4	Externalities	- Andreu Mas-Colell, Michael Whinston, and Jerry Green. (MWG) Microeconomic Theory. Oxford University Press - The Problem of Social Cost, R. Coase (1960) - A Solution to the Problem of Externalities When Agents Are Well-Informed. Hal R. Varian. The American Economic Review, Vol. 84, No. 5 (Dec., 1994), pp. 1278-129
	.Day 5	Externalities, Property Rights and a case study	- Game Theory For Playing Games: Sophistication in A Negative-Externality Experiment. J. Spraggon and R. Oxoby (2009). Economic Inquiry. - Spraggon, J. Individual Decision Making in a Negative Externality Experiment. Experimental Economics 7, 249–269 (2004). - Charles Kolstad, Environmental Economics, Oxford University Press, 2000. (Chapter 6 – Property Rights) - Case Study: How climate change is increasing forest fires around the world

	Day 6	Common Pool Resources	- Common Pool Resources: Strategic Behavior, Inefficiencies, and Incomplete Information, A. Espinola-Arredondo and F. Munoz-Garcia, Cambridge University Press, October 2021. - Apesteguia, Jose, 2006. "Does information matter in the commons?: Experimental evidence," Journal of Economic Behavior & Organization, Elsevier, vol. 60(1), pages 55-69, May. - Mason, Charles F & Polasky, Stephen, 1994. "Entry Deterrence in the Commons," International Economic Review, vol. 35(2), pp 507-525. - Can incomplete information lead to under-exploitation in the commons?, A. Espínola-Arredondo and F. Muñoz-García, JEEM, Volume 62(3), 2011, pp. 402-413 - Case Study: Ground Water Basin Management

	Day 7	Environmental Policies	- Charles Kolstad, Environmental Economics, Oxford University Press, 2000. (Chapters 8 and 9) - The Net Benefits of Incentive-Based regulation: A Case Study of Environmental Standard Setting. Wallace E. Oates; Paul R. Portney; Albert M. McGartland. The American Economic Review, Vol. 79, No. 5. (Dec., 1989), pp. 1233-124
	Day 8	Environmental Policies	- Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements? Charles D. Kolstad, Thomas S. Ulen, Gary V. Johnson The American Economic Review, Vol. 80, No. 4 (Sep., 1990), pp. 888-901. - Case Study: Judge's Ruling on Gulf Oil Spill Lowers Ceiling on the Fine BP Is Facing. - Prices versus Quantities. Martin L. Weitzman. The Review of Economic Studies, Vol. 41, No. 4 (Oct., 1974), pp. 477-49.

Day 9	Environmental Policies	- Effluent Charges and Licenses Under Uncertainty Roberts, M.J. and M. Spence. Journal of Public Economics 5, 1976, pp. 93-208. - International Cooperation and the International Commons. Scott Barrett. Duke Environmental Law & Policy Forum , Vol. 10, 1999. - Case Study: The Aarhus Convention
Day 10	Environmental Policies	- Environmental Policy and International Trade when Governments and Producers Act Strategically. Alistar Ulph, JEEM, 1996, 30, pp. 265-281. - Equilibrium Pollution Taxes in Open Economies with Imperfect Competition. P. Kennedy, JEEM, 27, pp49-63 (1994). - Case Study: Environmental Effects of International Trade.
Day 11	Abatement, R&D and Patents	- Being green first: Simultaneous vs. sequential abatement decisions. Strandholm, J., A. Espinola-Arredondo and F. Munoz-Garcia. Economics Letters. 2023, 227, 111123 - Pollution Abatement with Disruptive R&D

			Investment. Strandholm, J., A. Espinola-Arredondo and F. Munoz-Garcia. Resource and Energy Economics. 2021, 66, 101258 - Di Maria et al. A paler shade of green: environmental policy under induced technical change. Eur. Econ. Rev. (2017) - Do emission subsidies reduce emission? In the context of environmental R&D organization. Econ. Modell. (2014)
	Day 12	Greenwashing	- Can Mandatory Certification Promote Greenwashing? A Signaling Approach. Garrido, D., A. Espinola-Arredondo and F. Munoz-Garcia. Journal of Public Economic Theory. 2020, 22(6), pp. 1801-1851. - Baski, S., & Bose, P. (2006). Credence goods, efficient labelling policies, and regulatory enforcement. Environmental and Resource Economics, 37, 411–430. - Crespi, J. M., & Marette, S. (2003). “Does contain” vs. “does not contain”: Does it matter which GMO label is used? European Journal of Law and Economics, 16(3), 327–344. -

	Day 13 | Applications |
Literature **Insert here ►**	Please provide some specific tentative examples of literature, academic journal articles, etc: Game Theory: An Introduction with Step-By-Step Examples, A. Espinola-Arredondo and F. Munoz-Garcia, Palgrave MacMillan, December 2023. Common Pool Resources: Strategic Behavior, Inefficiencies, and Incomplete Information, A. Espinola-Arredondo and F. Munoz-Garcia, Cambridge University Press, October 2021. Charles Kolstad, Environmental Economics, Oxford University Press, 2000 More examples are provided in the above section **"Syllabus."**
Maximum enrolment	40 participants
Academic prerequisites **Insert here ►**	See an example this previously published description If relevant (and only if relevant), please state any subject areas that students ought to be familiar with in order to participate in the course. The prerequisites are meant as guidelines for students to get a sense of what is expended of them if they enroll. Also, any stated subject areas may help students assess whether the topics relates to their academic background in a meaningful way: Intermediate Microeconomics is highly recommended, as well as intermediate calculus and algebra.
Location	Aarhus
Exam Details	
Assessment	7-point grading scale *A short description of the Danish 7-point grading scale can be found here*

Grading	No co-examination
Prerequisites for exam participation	In order to participate in the exam, there is an 80 % attendance requirement.
Description of the form of examination	
Form of examination	Take-home assignment
Exam duration	Non applicable / 4 Hours
Preparation time	Non applicable
Aids	All aids *AU stance on the use of generative AI can be found here*
Additional description of the exam	*Please start by consulting the Exam form guidelines here* Afterwards, please select (**X**) *either* Exam Form A *or* Exam Form B as your course exam and provide the requested information: X I want to use **Exam Form A** as my course exam **Exam Form A: Portfolio** WHAI: Take-home assignment submitted digitally in WISEflow. The exam consists of a portfolio of written assignments, which students work on during the course. The assignments are individual, and students receive collective feedback before submitting a finalized version for grading. The finalized version should contain all assignments in one PDF-file and be submitted through WISEflow at the end of the course. The portfolio consists of the following 3 assignments: Assignment 1: Game Theory Concepts (week 1) The objective of this assignment is to examine your understanding of basic concepts of game theory. This assignment will improve your knowledge of the elements of a game, the strategic interaction between agents and the role of

information in the decision-making process. Your discussion should address both the documented theoretical relationships as well as provide examples that characterize the theoretical concepts. You are assessed on the quality of your arguments, relation to course theory, coherence, and adherence to the guidelines.

Assignment 2: Case Study I (CPR and Market Based Policy, week 2)

The purpose of this assignment is to identify the strategic effect of a marked based policy and the management of a common pool resource (CPR). In this assignment you will critically analyze a case study that describes the depletion of a CPR, you will need to identify tools that induce the protection of the CPR and discuss how the strategic interaction between different agents can avoid the overexploitation of the resource. This assignment demonstrates your ability to recognize a diverse set of perspectives and use critical thinking to apply theoretical and case-based knowledge to real-life situations. You are assessed on your level of description, analysis, and connection to course concepts.

Assignment 3: Case Study II (Abatement and Labelling, week 3)

The objective of this assignment is to understand the strategic actions of firms to reduce their pollution. You will need to evaluate a case study where you need to identify a strategic action that helps a polluting firm or green firm to reduce emissions or inform consumers about its green practices. This assignment will help you to critical understand the strategic interactions between consumers, regulatory agencies and firms when facing pollution. This assignment demonstrates your ability to identify a diverse set of strategic actions and use critical thinking to apply theoretical and case-based knowledge to real-life situations. You are assessed on your level of description, analysis, and connection to course concepts.

The final portfolio should be no longer than 32,000 characters (incl. blanks). The assignment must conform with the guidelines for written assignments found on the study portal.

Exam form A – Portfolio:

Please insert the number of portfolio assignments (xx above in yellow) as well as the maximum allowed length of the finalized portfolio (yy above in yellow). The length should be stated as the maximum number of characters allowed including blanks (one page = 2400 characters).

The portfolio should contain a minimum of three assignments.

See an an example this previously published description or this previously published description

☐ I want to use **Exam Form B** as my course exam

Exam Form B: 4-Hour Take-Home Exam

WHAI: Take-home assignment submitted digitally in WISEflow.

In order to participate in the exam, students should complete the following compulsory, non-graded activities:

Activity 1:

Activity 2:

Activity 3:

…

Students who do not complete the activities will not be allowed to participate in the final exam and will loose one of their three exam attempts.

Exam form B – 4-Hour Take-Home Exam:

Please describe the compulsory, non-graded activities, which students must complete in order to sit for the final 4 hour take-home exam (Activity 1, Activity 2, etc. above).

Please specify any formal requirements for each activity (i.e. max. length of written submissions or oral presentations).

The length of any written assignments should be stated as the maximum number of characters allowed including blanks (one page = 2400 characters).

See an an example this previously published description or this previously published description

WISEflow	WHAI: Take-home assignment submitted digitally in WISEflow. 
Re-exam in the re-examination period	Re-exam  *Prerequisite for re-examination participation* Students who have fulfilled the "prerequisites for examination participation" stated above have the right to participate in the re-exam (2nd and 3rd attempts) without having to fulfill additional prerequisites. Students who have not fulfilled the "prerequisites for examination participation" stated above will have to fulfill the following prerequisite activity before being able to participate in the re-exam (either 2nd or 3rd attempt): Submit a critical reflection over the course's curriculum. The report should be entitled "Theoretical reflections on [course title]" and amount to max. 22,000 characters. The critical reflection could for instance be based on a focused review of the literature on one(or more) topic(s) included in the curriculum. The report's content should be meaningful for the prerequisite to be fulfilled, but will not be subject to a grade. The deadline for submitting the report is September 1st (to be allowed to participate in the 2nd attempt) and January 5th (to be allowed to participate in the 3rd attempt). Students who have fulfilled the prerequisite for re-examination participation for the 2nd attempt automatically fulfill the prerequisite for participating in the 3rd attempt.

	Students who have neither fulfilled the prerequisites for examination nor the prerequisite for re-examination before the 2nd attempt will be considered as having made use of their 2nd attempt and will have to wait to the 3rd attempt to take the re-exam (subject to fulfilling the prerequisite for re-examination participation in due time). *Re-exam: written take-home exam (max. 36.000 characters including spaces)* The dates for the first retake are: October 27th 2025 12.00 noon: You will receive your exam question via WISEflow. November 3rd 2025 12.00 noon: Deadline for submitting via WISEflow. The dates for the second retake are: January 30th 2026 12.00 noon: You will receive your exam question via WISEflow. February 6th 2026 12.00 noon: Deadline for submitting via WISEflow. The format for the second re-take (3rd attempt) is the same as for the re-take (2nd attempt).