

TECHNOLOGY

**IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.A.
GenAI**

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **JON OLEAGA GURIDI**

E-mail: joleaga@faculty.ie.edu

Jon has 15 years of experience in the digital media industry, and digital transformation. He has worked for Vocento, ABC, and Nuez, and has founded and launched Visualbox, an online mailing tool. Jon is also an adjunct professor at IE University, where he teaches courses on digital marketing, technology trends, web development, and AWS certifications. In addition, he has worked as a consultant for companies like Just Inc, Zapiens, and The Valley, and has experience in the Web 3 and crypto industries as the marketing director for AB2 and a consultant for Internxt. Jon holds a bachelor's degree in business administration, an executive MBA, a bachelor's degree in psychology, and a master's degree in cognitive therapy. He is currently finishing a degree in anthropology.

Office Hours

Office hours will be on request. Please contact at:

joleaga@faculty.ie.edu

SUBJECT DESCRIPTION

Course Title: Low Code, No Code and Generative AI

Learning Objectives:

Understand the concept of "no-code" and its relevance in modern technology environments.

Utilize website builders, web app builders, and mobile app builders effectively to develop digital products without coding.

Implement best practices for website design, content creation, and digital product design.

Gain knowledge of automation, robotic process automation (RPA), chatbot design, and generative AI at a foundational level.

Learn the process of creating and managing databases, integrating payment systems, and using various generative tools to produce innovative digital products.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours

Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

In this course, the use of generative artificial intelligence (GenAI) is encouraged, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT OVERVIEW

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

humanistic approaches to interpersonal relations, decision-making, and critical thinking;
familiarity with the technologies that are applied to solve some of the world’s greatest challenges;
and
entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Introduction

Overview of the course
Introduction to no-code tools and platforms
Introduction to artificial intelligence (AI)

SESSION 2 (LIVE IN-PERSON)

Websites Creation

Introduction to website builders
Best practices for website design and content creation

SESSION 3 (LIVE IN-PERSON)

Websites Creation

Introduction to website builders
Best practices for website design and content creation

SESSION 4 (LIVE IN-PERSON)

Web Apps and Mobile Apps Creation

Introduction to web app builders
Creating a web app using Bubble or Adalo
Creating a mobile app using Thunkable or Glide
Best practices for web app and mobile app design and content creation

SESSION 5 (LIVE IN-PERSON)

Web Apps and Mobile Apps Creation

Introduction to web app builders
Creating a web app using Bubble or Adalo
Creating a mobile app using Thunkable or Glide
Best practices for web app and mobile app design and content creation

SESSION 6 (ASYNCHRONOUS)

Automation

Automating workflows using Zapier or Integromat

SESSION 7 (LIVE IN-PERSON)

Automation

Robotic process automation (RPA) using UiPath or Automation Anywhere

SESSION 8 (LIVE IN-PERSON)

Forms

Creating forms using Google Forms or Typeform
Best practices for automation, forms, and databases

SESSION 9 (ASYNCHRONOUS)

Payments

Integrating payment systems using Stripe or PayPal

Best practices for automation, payment, and databases

SESSION 10 (LIVE IN-PERSON)

Databases

Introduction to databases

Creating and managing databases using Airtable or Google Sheets

Best practices for automation, forms, payment, and databases

SESSION 11 (LIVE IN-PERSON)

Chatbots

Introduction to chatbots

Creating a chatbot using ManyChat or Tars

Best practices for chatbot design and implementation

SESSION 12 (LIVE IN-PERSON)

Generative AI - Image Generation

Introduction to generative AI

Generating images using midjourney

SESSION 13 (LIVE IN-PERSON)

Generative AI - Text Generation and Other generative tools

Generating text using GPT-4 or Hugging Face

SESSIONS 14 - 15 (LIVE IN-PERSON)

Project presentations

EVALUATION CRITERIA

Participation – 15% (Total)?

Breakdown:?

10%: 5 graded pre-class work reading or video preparation: readings/videos for feedback fruits Q&A and comment threads. ?

5%: Overall in-class participation (does not include attendance). ?

Suggestion is for students to all receive a 5 out of 10 as default and receive more or lose points based on class attitude, participation in debates, conduct.?

Individual Work – 55% (Total)?

Breakdown:

10%: 2 reflections (400-700 words) ?

Start of semester: Reflection on why you chose this topic and expectations. Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.).? ?

Mid semester: Reflection on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society)

20%: At least 2 individual assignments specific to the course topic, involving critical thinking, technical aspects, case studies and/or problem-solving skills.?

?

25%: Final exam (Session 13):

19 question-multiple choice + 1 open, critical-thinking/analytical question with max. 400-word response.?

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		Class assignments per topic (Website, App, etc. finished)
Group Work	30 %		Final Group Presentation
Class Participation	15 %		Preclass work + Class Assignments

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., "notable" in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year).
The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

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Category: COMPULSORY

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Professor: **ANNA JABLONER**

E-mail: ajabloner@faculty.ie.edu

Dr. Anna Jabloner is an assistant professor of anthropology at IE University. She holds a Mag.Phil. from the University of Vienna (2004) and Ph.D. from the University of Chicago (2015). Between 2019-2023, Jabloner taught anthropology and Science & Technology Studies (STS) at Harvard University, where her teaching excellence was recognized each semester. She previously held postdoctoral fellowships at the Stanford and Columbia Medical Schools and at Goethe University Frankfurt. Jabloner's field of research is the anthropology of science and technology, with a regional specialization on California. Her work centers on the social and cultural dimensions of science, technology, medicine, and data, on biopolitics and bioethics, futurism, feminist epistemologies, gender and race, and on ethnographies of the US. Jabloner's research has been supported by the US National Institutes of Health, the Wenner-Gren Foundation, Social Science Research Council, and the Austrian Federal Ministry of Education, Science and Research, and she has authored recent articles in such journals as *Social Analysis*, *Science as Culture*, *Catalyst: Feminism, Theory, Technoscience*, *Anthropology Now*, and *Nature Biotechnology*.

Office Hours

Office hours will be on request. Please contact at:

ajabloner@faculty.ie.edu

SUBJECT DESCRIPTION

Technologies always develop in specific contexts. Groups of people think of and create technologies to solve problems and work together to build something new. In this process, society and culture make up the conditions in which technologies emerge and are thus an essential aspect of all technological progress. This course will draw on instances from a range of sectors where technologies are used and being developed – market industries, medicine, education, military, law, etc. – to learn about their social and cultural dimensions. For example, human suffering during the COVID-19 pandemic created intense pressure to quickly develop a vaccine. Within a year, lives around the globe were saved through a new bio-technology. A dark case in history is of course the atom bomb; here, war-time pressures led to rapid advances in a specific technological area. Once they are being developed or exist, technologies also impact society and culture, changing conditions in turn. For example, we are witnessing how information technologies influence political processes, such as in social media's role in organizing people into new movements, or create ethical puzzles, as we see in the debate around AI in college education. Another example is the use of genetic technologies in medicine, which is impacting how doctors practice their profession.

These ongoing dynamics – the conditions in which technologies develop, how technologies impact conditions – make it impossible to separate technology from society. Thus in this course, you will learn to put technologies into context. Doing so is essential to understanding where investment and development are needed and where technologies might actually cause new problems. In addition, studying the social contexts in which technologies develop is crucial for our ability to critically assess and manage technologies' impacts on society. At the end of the course, you will understand the entwined dynamics of technological and social change. Overall, in this basic introductory course, you will be introduced to theories and conceptualizations of technology & society. You will also have a chance to investigate specific cases and thereby apply the theories and concepts you learn about during the semester.

CASES WE WILL INVESTIGATE:

- Social media, Digital rights, and Global freedoms: What even becomes data? And what should become data but doesn't?
- Designing for inclusion and equality/Algorithmic discrimination; e.g., is facial recognition software racist? If so, can we change that?
- AI in Education: Does anyone still need to learn how to write if technology can do it for us?
- Nuclear technologies: If rapid technological development causes terrible social conditions, should we still invest in them? Or in turn, how do we weigh risks vis-a-vis sustainability, environment, and human lives?
- Reproductive technologies: Prenatal genetic testing can predict the gender of a fetus, but should such technologies be developed?

*****NOTE: There are only two books you need for class -- you can borrow them from the IE library or buy them (they should be available used for a low price):**

- Ludwik Fleck, 1979 [1935] *Genesis and Development of a Scientific Fact*. University of Chicago Press.
- Thomas Kuhn, 1996. *The Structure of Scientific Revolutions*, 3rd Edition. University of Chicago Press (please make sure you get the 3rd edition)

All other session materials will be provided on Blackboard (required and recommended readings).

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Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

PROGRAM

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PROGRAM

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SESSION 1 (LIVE IN-PERSON)

PLEASE NOTE THAT THE SCHEDULE BELOW IS SUBJECT TO CHANGE BASED ON THE INTERESTS AND NEEDS OF THE STUDENTS. THE MOST UPDATED INFORMATION ABOUT WHAT YOU NEED TO DO FOR EACH SESSION WILL ALWAYS BE FOUND IN THE ANNOUNCEMENTS SECTION OF BLACKBOARD.

Topic: *INTRODUCTION TO TECHNOLOGY & SOCIETY*. Discuss the course and the syllabus.

Pre-class: No readings due.

SESSION 2 (LIVE IN-PERSON)

Topic: *WHAT HAS CAUSED AND IS CAUSING THE TECHNOLOGICAL CHANGES WHOSE IMPACT WE ARE EXPERIENCING?*

Concepts covered: society, causation, technological determinism, social determinism

Learning objectives: To understand how the relationship between technology & society can be analyzed – and without getting stuck in a binary.

Pre-class: read Mackenzie & Wajcman: “Introductory Essay” in *The Social Shaping of Technology: How the Refrigerator Got Its Hum*.

Book Chapters: Mackenzie & Wajcman: “Introductory Essay” in The Social Shaping of Technology: How the Refrigerator Got Its Hum (CED)

SESSION 3 (LIVE IN-PERSON)

Topic: **DATA & JUSTICE WORKSHOP* or: “Technologies always reflect the culture that produces them...”*

Concepts covered: data, justice, social conditions & implications, approaches to ethics

Learning objectives: to understand how issues of justice exist “before” & “after” technology (e.g., national priority setting, values that shape design processes, ethical implications)

Pre-class: no readings due.

Reflection 1 due today (Details will be provided in advance).

SESSION 4 (LIVE IN-PERSON)

Topic: *THINKING AND REASONING*

Concepts covered: Thought collectives, approaches to technology & society

Learning objectives: to understand what happens in the practice of thinking and reasoning

Pre-class: read Ludwik Fleck, *Genesis and Development of a Scientific Fact*. Excerpt TBD.

Book Chapters: Ludwik Fleck, *Genesis and Development of a Scientific Fact*. Excerpt TBD (See Bibliography)

SESSION 5 (LIVE IN-PERSON)

Topic: *ARE TECHNOLOGIES THEMSELVES POLITICAL?*

Concepts covered: classic approaches in social studies of technology

Learning objectives: To understand how political processes shape technological design and how technological developments shape politics.

Pre-class: read Langdon Winner, *Do Artifacts Have Politics?* Excerpts TBD.

Article: Langdon Winner, *Do Artifacts Have Politics?* (*Daedalus*, Vol. 109, No. 1 (Winter. 1980), 121-36) (CED)

SESSION 6 (LIVE IN-PERSON)

Topic: **ALGORITHMIC DISCRIMINATION WORKSHOP** -- Is facial recognition software racist?, or, designing technology for equality

Concepts covered: new approaches to algorithmic oppression in the digital age

Learning objectives: to deepen the understanding of where issues of data and justice arise

Pre-class: read Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. Introduction. Excerpt TBD.

First deliverable due for final presentations. Details TBD.

Book Chapters: Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. Introduction (CED)

SESSION 7 (LIVE IN-PERSON)

Topic: *WHAT MAKES A FACT A FACT?*

Concepts covered: facts, truths, authoritative knowledge

Learning objectives: to understand elemental conceptualizations of facts

Pre-class: read Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*. Chapters 1, 2 and 4 (See also Bibliography).

Book Chapters: Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*. Princeton University Press, 2013. Chapter 1 (CED)

SESSION 8 (LIVE IN-PERSON)

FIRST 45 MINUTES: MIDTERM (multiple choice & reflection 2 on the course, 400 words)

Topic: In-class Workshop on Social Dimensions of Nuclear Technologies / Reproductive Technologies

We will divide into two groups that work on these topics respectively. I will have a list of questions to guide you in your research on these topics. You will learn some basics of these two fields of technological development (e.g. what scientific disciplines do they draw on? What machinery do they use? Are they digital technologies / how has the digital revolution changed these fields?) Given our class topic and to approach such technologies' societal embedding, you will generate a list of steps to take in a research project, centered on historical emergence, risks and benefits, sustainability, ethical implications, etc. For example, we might ask what problems in society lead to the development of these sectors in the first place, where you would need to look/go to answer questions about what cell free fetal DNA is, or what kind of expert you would need to interview to understand the risks of nuclear technologies.

Pre-class: no reading due.

SESSION 9 (LIVE IN-PERSON)

Topic: HOW DOES SCIENCE CHANGE? PART I

Concepts covered: paradigms, scientific process & progress, scientific revolutions

Learning objectives: To become familiar with a seminal text in philosophy of science and understand its core concept of the scientific paradigm.

Pre-class: read Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, Excerpt TBD & Barry Barnes, 3-page section on "Similarity Relations" in *T.S. Kuhn and Social Science*.

Book Chapters: Thomas Kuhn, The Structure of Scientific Revolutions, 3rd edition, Excerpt TBD (See Bibliography)

Book Chapters: Barry Barnes, 3-page section on "Similarity Relations" in T.S. Kuhn and Social Science (CED)

SESSION 10 (ASYNCHRONOUS)

Topic: HOW DOES SCIENCE CHANGE? PART II

In this asynchronous session, you will finish reading Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, and an excerpt from Emily Martin's article, "The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles."

We will have a short assignment on Blackboard due the same week as (but after) Session 9: on Wednesday for Segovia students and on Friday for Madrid students.

Article: Emily Martin, The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles (Signs, Vol. 16, No. 3 (Spring, 1991), pp. 485-501) (CED)

SESSION 11 (LIVE IN-PERSON)

Topic: HOW CAN WE STUDY CURRENT SCIENTIFIC AND TECHNOLOGICAL PRACTICE?

Concepts covered: epistemic culture, how humans relate to machines

Learning objectives: to understand the basics of empirical social science research on technology, understanding social analysis of technology

Pre-class: read Karin Knorr Cetina, *Epistemic Cultures: How the Sciences Make Knowledge*. Excerpt TBD.

Second deliverable due for final presentations. Details TBD.

Book Chapters: Karin Knorr Cetina, Epistemic Cultures: How the Sciences Make Knowledge. Chapters 1 and 5 (CED)

SESSION 12 (LIVE IN-PERSON)

Topic: *WHAT IS OBJECTIVITY AND WHO DO WE TRUST TO BE OBJECTIVE?*

Concepts covered: objectivity, subjectivity, authority, positionality, trust, expertise

Learning objectives: to understand how the contemporary idea of objectivity developed in history (objectivity used to mean the opposite of what it does now!)

Pre-class: read Daston, Lorraine & Galison, Peter, *Objectivity* Ch 1 and Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin* (or Donna Haraway, *Situated Knowledge*). Excerpts TBD.

Book Chapters: Daston, Lorraine & Galison, Peter, *Objectivity*. Ch 1 (CED)

Book Chapters: Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin*. Chapter 7 (CED)

SESSION 13 (LIVE IN-PERSON)

Final Exam (25%)

Details on the final exam will be provided in advance.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Student Presentations (7-10minutes for each group, Q&A, 20%)

Self and Peer Review of Presentations (numeric and with commentaries) due TBD (10%)

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		5% Reflection 1, 25% Midterm (incl Reflection 2), 25% Final Exam
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) • Self and Peer Review (10%)
Class Participation	15 %		10% graded pre-class work Reading or video preparation. • 5% Overall in-class participation (does not include attendance)

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit

evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)

- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
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After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

- Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.
- In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Compulsory

- Thomas Kuhn. (1996). *The Structure of Scientific Revolutions*. 3rd Edition. The University of Chicago Press. ISBN 0226458083 (Digital)
- Ludwik Fleck. (1979). *Genesis and Development of a Scientific Fact*. The University of Chicago Press. ISBN 0226253252 (Printed)

Recommended

- Bruno Latour. *Laboratory Life: The Construction of Scientific Facts*. Princeton Paperbacks. ISBN 9780691028323 (Digital)

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.C.Sustain

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **RUXANDRA IANCU BRATOSIN**

E-mail: riancubratosin@faculty.ie.edu

Ruxandra Iancu-Bratosin is an urban strategist and researcher with a focus on the urban environment, currently acting as Lead Researcher at IE Center for Sustainable Cities and an adjunct professor at IE University. Ruxandra combines ecological design processes, future thinking, data visualization, digital logic, cities, foresight, and strategy.

She is also the founder of 50(Super(Real)), a studio focused on multi-scalar spatial strategies, driven by the harmonious marriage of human values with technological innovation. Her research explores the interplay between ecology, social impact, and the design process to develop innovative, future-proof solutions. Ruxandra's work has been exhibited at prestigious international events, including the Venice Architecture Biennale of 2016, the Rotterdam Design Biennale of 2017, and the London Design Biennale of 2021. Her contributions to the field have also been featured in several publications, including books with a digital ecology focus.

Her tangent focus explores digital humanism, algorithmic driven decisions and the impact of digital technology on the social fabric and human behaviour. Ruxandra's work is driven by the quest of expanding the notion of collaborating with technology in order to address contemporary social or sustainability issues. She is also an active member of the Urban Regeneration Council inside the Urban Land Institute.

Office Hours

Office hours will be on request. Please contact at:

riancubratosin@faculty.ie.edu

SUBJECT DESCRIPTION

"Sustainable Cities," part of the IE Impact Technology track, offers an immersive exploration into the essence and evolution of urban environments. This course demystifies the complex networks that define a city, focusing on the transformative power of technology in urban development. From historical underpinnings to futuristic visions, students will traverse the terrain of urban ecosystems, examining water, energy, mobility, biodiversity, food, matter, and the digitized realms through sensorization and data analytics.

The curriculum is crafted to share a nuanced understanding of the multifaceted flows within cities and the technological innovations that drive their growth and future sustainable evolution. Through a blend of theoretical knowledge, exemplary practices, and in-depth case studies, students can cultivate a profound appreciation for the intricacies of sustainable urban planning and the technological levers that can propel cities toward a more resilient future.

In addition to the core curriculum, "Sustainable Cities" places a significant emphasis on the potential of technology as a catalyst for positive change, particularly in addressing the climate crisis and critical social issues. The course explores how innovative technological solutions can mitigate environmental impact, promote sustainability, and foster social equity within urban settings. Students will examine case studies where technology has been leveraged to reduce carbon footprints, enhance resource efficiency, improve public health, and increase access to essential services for underserved populations. This segment aims to inspire students to envision and develop technological interventions that advance urban sustainability and contribute to building more inclusive and resilient communities.

Through this lens, contemporary technology is presented as a tool for urban development and a vital component in the global effort to create more equitable and environmentally conscious cities.

Objectives:

1. **Historical Insights and Urban Evolution:** Gain insights into the historical development of cities and the multifaceted impact of technology, social dynamics, and environmental considerations on their growth and metamorphosis.
2. **Comprehensive Analysis of Urban Systems:** Acquire a holistic view of urban flows (including water, energy, mobility, biodiversity, food, and matter) and the role of technology in optimizing these systems for sustainability.
3. **Innovation and Practical Solutions:** Develop the ability to critically evaluate and implement sustainable urban practices and technologies, drawing inspiration from real-world scenarios and forward-thinking smart city initiatives.

Competencies:

1. **Critical Analysis and Strategic Thinking:** Enhance the capacity to critically assess urban systems and technology integration in city planning, fostering a strategic approach to identifying urban challenges and opportunities.
2. **Creative Problem-Solving:** Cultivate a creative and solution-oriented mindset, empowering students to devise innovative and sustainable solutions to contemporary urban issues, leveraging technological advancements.
3. **Collaborative Innovation:** Promote interdisciplinary teamwork, emphasizing the importance of combining insights from technology, environmental science, urban planning, and social sciences to craft multifaceted solutions for sustainable urban development.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.

Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.

Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).

Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Specific use cases of GenAI are encouraged

Generative artificial intelligence (GenAI) tools may be used in this course for research, ideation, generating an outline, proofreading, grammar check, coding, image generation, etc. with appropriate acknowledgement. GenAI may not be used for drawing conclusions, creating proposals for the capstone projects or individual works. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT OVERVIEW

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with “pillar courses” in three of IE’s core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

humanistic approaches to interpersonal relations, decision-making and critical thinking;
familiarity with the technologies that are applied to solve some of the world’s greatest challenges;
and
entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

The IE Challenge is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE’s core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN’s 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

SESSION 1 (LIVE IN-PERSON)

Introduction to Course and The History of Urban Development

Content: This session introduces the course framework, objectives, and methodologies. Following the introduction, the course delves into the history of urban development from ancient settlements to modern cities. This historical perspective includes the evolution of urban forms, major technological innovations, and the socio-economic forces that have shaped urban environments.

Objectives: Establish course expectations, understand the historical context of urban development, and connect past innovations to present urban challenges.

SESSION 2 (LIVE IN-PERSON)

Future Cities: Challenges and Opportunities

Content: Examination of contemporary and future challenges facing urban environments. Topics include climate change impacts, resource scarcity, urban sprawl, informal settlements, rapid urbanization, housing shortage, homelessness, and socio-economic disparities. The session also explores potential future scenarios and the role of resilience and adaptability in urban planning.

Objectives: Identify key future challenges and discuss the role of technology and policy in addressing these issues.

SESSION 3 (LIVE IN-PERSON)

Strategies for Shaping Urban Landscapes.

Content: Focus on current urban strategies and practical solutions as placemaking, 15-min city, superblocks, evolutionary urbanism, or tactical urbanism. The session also establishes a critical comparison with traditional and historical urban strategies as master planning or zoning.

Objectives: Understand the ideas and political ideologies behind contemporary urban strategies, for fostering sustainable and inclusive cities.

SESSION 4 (LIVE IN-PERSON)

Technology's Role in Shaping Urban Landscapes

Content: Overview of pivotal technological advancements that have influenced urban development, such as transportation systems, infrastructure, building components, security and communication technologies. Discussion on how these technologies have reshaped cities and their socio-economic landscapes.

Objectives: Link historical technological shifts to changes in urban form and function, fostering an understanding of technology as a driver of urban evolution.

SESSION 5 (ASYNCHRONOUS)

Technology in Modern Urban Management

Content: Focus on current technologies like IoT, AI, and big data analytics that support urban operations including traffic management, waste disposal, and energy distribution. Examination of cybersecurity and privacy issues related to urban sensor networks.

Objectives: Understand the technological backbone of contemporary smart cities and discuss the ethical implications of surveillance and data collection.

SESSION 6 (LIVE IN-PERSON)

Case Studies in Urban Strategy and Technology Implementation

Content: Analysis of three distinct case studies in each session that demonstrate the implementation, effects, and challenges of strategies and technologies in urban settings. These case studies will cover different continents and scales, providing a global perspective on urban strategies and tech solutions.

Objectives: Apply theoretical knowledge to real-world scenarios, critically evaluate the effectiveness of technological interventions in urban settings.

Information and reading material regarding the three case studies provided in class will be provided via blackboard to the students via Blackboard.

SESSION 7 (LIVE IN-PERSON)

Case Studies in Urban Technology Implementation

Content: Analysis of three distinct case studies in each session that demonstrate the implementation, effects, and challenges of strategies and technologies in urban settings. These case studies will cover different continents and scales, providing a global perspective on urban strategies and tech solutions.

Objectives: Apply theoretical knowledge to real-world scenarios, critically evaluate the effectiveness of technological interventions in urban settings.

SESSION 8 (LIVE IN-PERSON)

Regenerative Urban Practices and Technologies

Content: Exploration of large-scale urban sustainability projects that focus on regeneration and repair, such as green infrastructure, zero-waste cities, and water reclamation projects. Includes three case studies that highlight successful implementation of these practices.

Objectives: Learn from existing sustainable urban projects, understanding the impact and scalability of regenerative practices.

Information and reading material regarding the three case studies provided in class will be provided via blackboard to the students via Blackboard.

SESSION 9 (LIVE IN-PERSON)

Research and Innovation in Urban Sustainability

Content: Insight into ongoing research projects at the IE Center for Sustainable Cities and similar institutions worldwide. Focus on how academic and field research is translated into practical urban solutions.

Objectives: Expose students to current research methodologies and their practical applications in urban environments, emphasizing the connection between academia and urban policy-making.

SESSION 10 (LIVE IN-PERSON)

Capstone Project Introduction and Hackathon

Content: Introduction to the capstone project, formation of teams, and initial brainstorming. This session sets the stage for a project that challenges students to rethink and repurpose existing urban infrastructures and technologies for greater sustainability and societal benefit.

Objectives: Foster collaborative innovation, critical thinking, and creative problem-solving in developing sustainable urban technologies.

This exercise encourages students to "hack" existing urban technologies and infrastructures, uncovering opportunities to repurpose or enhance them for more significant communal and environmental benefit. Teams will critically assess the potential of these technologies, speculating on their future impact, proposing minor yet impactful modifications, and envisioning new connections to bolster existing services. This capstone project synthesizes the course's learning outcomes and offers a platform for students to contribute innovative ideas toward the sustainable evolution of urban environments.

A detailed Brief for the exercise will be provided via Blackboard, explaining the exercises, deadlines and project deliverables.

SESSION 11 (LIVE IN-PERSON)

Project Development and Critiques

Content: Ongoing project development with periodic critiques from the professor and peers, providing feedback and guidance. These sessions are interactive and allow for iterative refinement of project ideas and methodologies.

Objectives: Develop a strategic approach to sustainable urban technology solutions, refine project proposals through continuous feedback.

SESSION 12 (LIVE IN-PERSON)

Project Development and Critiques

Content: Ongoing project development with periodic critiques from the professor and peers, providing feedback and guidance. These sessions are interactive and allow for iterative refinement of project ideas and methodologies.

Objectives: Develop a strategic approach to sustainable urban technology solutions, refine project proposals through continuous feedback.

SESSION 13 (LIVE IN-PERSON)

Final exam

This session is dedicated to the final exam which represents 25% of the final grade and will cover general important topics discussed in class.

Details about the exam will be discussed in class in the beginning of the course.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final Presentations Group 1

Content: Groups present their final projects in two sessions, allowing for comprehensive feedback from classmates and instructors. These presentations showcase the culmination of the course's learning objectives and practical applications.

Objectives: Enhance communication skills, demonstrate mastery of course content, and present innovative solutions to urban challenges

Final Presentations Group 2

Content: Groups present their final projects in two sessions, allowing for comprehensive feedback from classmates and instructors. These presentations showcase the culmination of the course's learning objectives and practical applications.

Objectives: Enhance communication skills, demonstrate mastery of course content, and present innovative solutions to urban challenges.

EVALUATION CRITERIA

Participation – 15% (Total)

Breakdown:

10%: 5 graded pre-class work reading or video preparation: readings/videos for feedback fruits Q&A and comment threads.

5%: Overall in-class participation (does not include attendance).

Individual Work – 55% (Total)

Breakdown:

10% *2 reflections (400-700 words)*

1. Start of semester: Reflection on why you chose this topic and expectations.

Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.).

2. Mid semester: Reflection on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society)

20% At least 2 individual assignments specific to the course topic, involving critical thinking, technical aspects, case studies and/or problem-solving skills.

25% *Final exam (session 13)*: 19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

Group Work – 30% (Total)

Objective – demonstrate knowledge and critical analysis of a technology discussed in class that is applied to resolve a problem, and highlight the implications (positive, negative, expected, unexpected) of applying said technology (for all potential stakeholders and systems involved)

Presentation content:

20% Continuous Evaluation + Presentation + Submitted slides:

Problem Area (knowledge) + Technology Applied (knowledge) + What specific problem it was applied to resolve (use case) + Implications (Critical Thinking/Analysis)

Final presentation of 7-10 minutes (no less than 7 minutes, no longer than 10) and Q&A (professor and classmates). All team members must participate (in presentation and/or Q&A). All group projects must include at least 2 intermediate deliverables prior to the final presentations (continuous evaluation).

Details regarding the rubric for Continuous Evaluation + Presentation & Slides will be posted in the blackboard during the course.

10% Self and Peer Review (numeric and with commentaries).

criteria	percentage	Learning Objectives	Comments
Participation and Contributions in class	15 %		
Group Work	30 %		
Individual work	55 %		

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)

- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)

- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.

- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Michael Batty. (2024). *The Computable City: Histories, Technologies, Stories, Predictions*. ISBN 0262547570 (Digital)
- Lukas Feireiss. (2020). *Living the City. On Cities, People and Stories: Of Cities, People and Stories*. ISBN 3959054173 (Digital)
- Carlo Ratti. *The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life*. ISBN 0300204809 (Digital)

BEHAVIOR RULES

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.D.Blockch

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **ÍÑIGO CAVESTANY DE VILLEGAS**

E-mail: icavestany@faculty.ie.edu

My goal is to contribute to, collaborate with, engage in, and embrace open ecosystems focused on improving the world as we know it. I believe in the value and exponential growth that comes from rethinking the purpose of business and life. I am passionate about business transformation driven by people, technology, and innovation.

After five years of continuous growth at IBM, I decided to pursue my entrepreneurial dreams. I am the cofounder of Second World Games, a game studio created by players, for players. Our mission is to build an ecosystem that empowers players, transforming them into owners and decision-makers, and enabling them to thrive in the creator's economy.

As a proud IE University alumnus, I give back to our academic community as a professor and mentor in various programs and labs, primarily focusing on technology and entrepreneurship. I actively engage in the open innovation ecosystem, serving as an academic ambassador, and supporting multiple initiatives at IE University. Additionally, I am a partner advisor for several fast-moving startups, including Velca, Netspot, and Poly, and contribute in innovation hubs such as Call for Code, South Summit, Area 31, Barrabés, Founder Institute, Demium, and Codenotch.

I am incredibly fortunate to spend most of my time doing what I love.

Office Hours

Office hours will be on request. Please contact at:

icavestany@faculty.ie.edu // @inicavest // +34647087107

SUBJECT DESCRIPTION

Trust by Design: Blockchain for a Better World

Discover the transformative power of blockchain technology in creating a world marked by trusted relationships, decentralization, and unparalleled transparency. Learn how this technology is not just useful for cryptocurrencies or NFTs, but a foundational shift for trust in the digital age and beyond!

This course not only explores blockchain's impact on finance but also its power to empower individuals and communities, secure identities, and forge a new ethos of trust in the digital realm. What the internet did for information, blockchain will do it for trusted relationships and value transfers.

If you want to be an empowered digital user, this course is great to learn why and how!

Hint. It's much easier than most people think!

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

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If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

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I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

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PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Why Blockchain Technology

- Description: Overview of blockchain technology, its history, and its fundamental principles. Introduction to the course objectives and expectations.
- Learning Objectives: Understand the basics of blockchain and its significance.
- Concepts Covered: Blockchain fundamentals, Distributed Ledger Technology (DLT), Bitcoin, Cryptocurrencies...
- Assignments/Activities: Read Bitcoin Whitepaper. Group discussion on the potential impact of blockchain.

SESSION 2 (LIVE IN-PERSON)

Blockchain Technology Architectures

Description: In-depth look at how blockchain works, including consensus mechanisms, cryptographic hashes, and smart contracts.

Learning Objectives: Grasp the technical architecture and mechanisms of blockchain.

Concepts Covered: Consensus mechanisms (Proof of Work, Proof of Stake), Cryptographic hashes, Smart contracts

Assignments/Activities: Analyze the blockchain architecture of Bitcoin and Ethereum.

SESSION 3 (LIVE IN-PERSON)

Blockchain in Finance

Description: Exploration of blockchain applications in the financial industry, including decentralized finance (DeFi) and cryptocurrencies.

Learning Objectives: Understand the role of blockchain in transforming financial systems.

Concepts Covered: Decentralized Finance (DeFi), Cryptocurrencies, Tokenization, Smart Contracts

Assignments/Activities: Case study on a blockchain-based financial service.

SESSION 4 (ASYNCHRONOUS)

Asynchronous Session - Practical Blockchain Applications

Description: Self-paced session where students explore practical applications of blockchain through online resources and tutorials.

Learning Objectives: Apply blockchain concepts to real-world scenarios.

Concepts Covered: Various blockchain applications, Practical use cases

Assignments/Activities: Complete an online tutorial and use several blockchain applications.

SESSION 5 (LIVE IN-PERSON)

Blockchain and Supply Chain Management

Description: Investigation of blockchain's potential to enhance transparency and efficiency in supply chains.

Learning Objectives: Understand the application of blockchain in supply chain management.

Concepts Covered: Supply Chain Transparency, Traceability, Smart Contracts in Supply Chains

Assignments/Activities: Case study on a blockchain-based supply chain solution.

SESSION 6 (LIVE IN-PERSON)

Blockchain for Community Empowerment

Description: Exploration of how blockchain can empower communities and support social initiatives.
Learning Objectives: Understand how blockchain can empower communities.
Concepts Covered: Decentralization, Community Tokens, Social Impact
Assignments/Activities: Group project proposal on community empowerment.

SESSION 7 (LIVE IN-PERSON)

Security, Legal and Regulatory Aspects of Blockchain

Description: Examination of the legal and regulatory challenges and frameworks related to blockchain technology.
Learning Objectives: Understand the legal and regulatory environment of blockchain.
Concepts Covered: Regulatory Frameworks, Legal Challenges, Compliance
Assignments/Activities: Research on blockchain regulations in different countries.

SESSION 8 (LIVE IN-PERSON)

Blockchain Trilemma, Scalability, and Interoperability

Description: The Blockchain Trilemma. Examination of the challenges and solutions related to scaling blockchain networks and ensuring interoperability.
Learning Objectives: Understand the Blockchain Trilemma, scalability and interoperability challenges in blockchain.
Concepts Covered: Blockchain Scalability, Interoperability, Layer 2 Solutions
Assignments/Activities: Research on current solutions for blockchain scalability.

SESSION 9 (LIVE IN-PERSON)

Blockchain across Industries

Description: Exploration of blockchain's potential to improve industries.
Learning Objectives: Analyze the impact of blockchain on business.
Concepts Covered: Blockchain Ecosystem, Use Cases, Success Stories
Assignments/Activities: Case study on a blockchain application.

SESSION 10 (LIVE IN-PERSON)

Blockchain for Environmental Sustainability

Description: Discussion of how blockchain can contribute to environmental sustainability and address climate change.
Learning Objectives: Understand the role of blockchain in promoting environmental sustainability.
Concepts Covered: Carbon Credits, Renewable Energy, Sustainable Supply Chains
Assignments/Activities: Debate on blockchain sustainability.

SESSION 11 (LIVE IN-PERSON)

Blockchain and the Future of Work

Description: Exploration of how blockchain can transform the future of work, including decentralized autonomous organizations (DAOs) and gig economy platforms.
Learning Objectives: Understand the impact of blockchain on the future of work.
Concepts Covered: Decentralized Autonomous Organizations (DAOs), Gig Economy, Smart Contracts
Assignments/Activities: Analyze a case study on a DAO.

SESSION 12 (LIVE IN-PERSON)

Web3: The Decentralized Web

Description: Exploration of Web3 concepts, focusing on decentralization, user empowerment, and new internet paradigms.

Learning Objectives: Understand the fundamentals and implications of Web3.

Concepts Covered: Decentralization, User Empowerment, Decentralized Applications (DApps)

Assignments/Activities: Interact with a Web3 dApp.

Extended Materials: Web3 and the Metaverse

Description: Examination of how Web3 technologies are shaping the development and future of the Metaverse.

Learning Objectives: Explore the intersection of Web3 and the Metaverse and their combined potential.

Concepts Covered: Metaverse, Decentralized Virtual Worlds, Blockchain in the Metaverse

Assignments/Activities: Let's navigate a Metaverse platform.

SESSION 13 (LIVE IN-PERSON)

Ethical Considerations in Blockchain + FINAL EXAM

FINAL EXAM: Multiple Choice Test

Description: Examination of the ethical implications and challenges of blockchain technology.

Learning Objectives: Critically analyze the ethical considerations in blockchain development and implementation.

Concepts Covered: Privacy, Security, Decentralization Ethics

Assignments/Activities: Group discussion on ethical challenges in blockchain.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final Project Presentations

EVALUATION CRITERIA

Class Participation – 15% (Total)

Breakdown:

- 10%: 5 graded pre-class work reading or video preparation: readings/videos for feedback fruits Q&A and comment threads.

- 5%: Overall in-class participation (does not include attendance).

Suggestion is for students to all receive a 5 out of 10 as default and receive more or lose points based on class attitude, participation in debates, conduct.

Individual Work – 55% (Total)

Breakdown:

- 10%: 2 reflections (400-700 words)

Start of semester: Reflection on why you chose this topic and expectations. Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.).

Mid semester: Reflection on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society)

- 20%: At least 2 individual assignments specific to the course topic, involving critical thinking, technical aspects, case studies and/or problem-solving skills.

- 25% - Final exam (session 13): 19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

Group Work – 30% (Total)

Objective – demonstrate knowledge and critical analysis of a technology discussed in class that is applied to resolve a problem, and highlight the implications (positive, negative, expected, unexpected) of applying said technology (for all potential stakeholders and systems involved)

Breakdown:

- 20% Continuous Evaluation + Presentation + Submitted slides:

Problem Area (knowledge) + Technology Applied (knowledge) + What specific problem it was applied to resolve (use case) + Implications (Critical Thinking/Analysis)

Final presentation of 7-10 minutes (no less than 7 minutes, no longer than 10) and Q&A (professor and classmates). All team members must participate (in presentation and/or Q&A).

All group projects must include at least 2 intermediate deliverables prior to the final presentations (continuous evaluation).

Rubric for Continuous Evaluation + Presentation & Slides (to be done per course)

- 10% Self and Peer Review (numeric and with commentaries).

criteria	percentage	Learning Objectives	Comments
Class Participation	15 %		
Group Work	30 %		
Individual work	55 %		

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year).
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e. g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e. g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call.

Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.

- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

- Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.
- In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.E.Art&Tec

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **CLARA RIVERA**

E-mail: clarar@faculty.ie.edu

Clara E. Rivera's career spans almost 20 years at the intersection of technology and the arts, most notably through her co-founding of the [Google Art Project](#), which has brought many of the world's cultural treasures online. Before this landmark project, she led the pioneering collaboration between [Google and the Prado Museum](#), introducing art in ultra-high resolution to a global audience.

Her work with the EMEA Google Brand Studio further explored the fusion of art and technology, creating immersive experiences like [Performing Arts](#) and [Petra in VR](#). Transitioning to artificial intelligence, Clara focused on making language processing more inclusive, consulted on installations like [Found in Translation](#), and was a core contributor to Google's [Gemini Gen-AI models](#).

Her background in Psychology and Translation, combined with a deep passion for both technology's potential and mental well-being, positions her uniquely to lead discussions on art and technology's confluence. Clara's journey from digital marketing and strategy to the forefront of AI and cultural accessibility showcases her commitment to leveraging technology for global understanding and accessibility to art.

Office Hours

Office hours will be on request. Please contact at:

clarar@faculty.ie.edu

Available on request on Fridays between 10:30 and 12:30 (scheduling required).

SUBJECT DESCRIPTION

THE EVOLVING CANVAS: At the Intersection of Art & Technology

In today's world, the fusion of art and technology forms a dynamic landscape where creativity merges with cutting-edge innovation to redefine the realms of artistic expression. This transformative space is no longer reserved for the traditional artist or the seasoned technologist alone; it beckons everyone from diverse fields to explore, contribute, and reshape the future of art. Our course, "The Evolving Canvas - At the Intersection of Art & Technology" invites students from all disciplines, regardless of their prior experience with technology or art, to embark on an exploratory journey into the digital evolution of art and its profound implications on society and culture.

This course is designed to demystify the technological underpinnings of modern digital art, making the intricacies of digital creation, distribution, and consumption accessible to all. Understanding the intersection of art and technology is crucial for anyone aspiring to make a significant impact in today's world, where the boundaries of creativity are constantly expanding. Through this course, students will delve into the fascinating evolution of the internet and explore how groundbreaking technologies such as the Data Economy, Blockchain, Extended Reality, the Metaverse and Artificial Intelligence are revolutionizing the way we create, perceive, and interact with art.

By examining case studies of virtual museums, immersive experiences, and digital art platforms, students will gain insights into the challenges and opportunities presented by these technological advancements. The course will cover a broad spectrum of digital art forms highlighting the innovative ways artists and technologists are collaborating to push the boundaries of traditional art. Students will learn about the economic, social, and ethical implications of digital art, particularly how it intersects with issues of accessibility, copyright, and artist compensation in the digital age.

Furthermore, the course will provide hands-on experiences with the latest digital art tools and platforms, enabling students to experiment with creating their own digital artworks. This practical component, combined with theoretical knowledge, aims to cultivate a deep understanding of digital art's potential and its role in driving societal and cultural evolution.

As part of our broader educational journey, this course prepares students for a future where they can apply their creativity and technical skills to address complex challenges, bridging the gap between art and technology to inspire change and innovation. By the end of this course, students will not only have a comprehensive understanding of the digital art landscape but will also be equipped with the critical thinking and creative skills necessary to navigate and contribute to this rapidly evolving field.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course for content creation and optimization only in the context of home assignments and group project deliverables.

GenAI may not be used for new content generation for reflective or research assignments. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with your professor.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

From Cave to Code

Description:

In this introductory session, we will review the content of the course by tracing and comparing the historical development of art and technology, from prehistoric pigment development to recent installations. This journey will highlight key technological advancements and their impact on artistic expression. We will also outline the course structure, including the evaluation methodology and discuss the final assignments.

Learning objectives:

- Understand the evolution of art and technology across different historical periods, and recognize the impact of technological innovations on artistic mediums and styles.
- Gain insight into the course structure, assessment strategies, and final projects.

Key concepts:

- Art surfaces, forms of expression, art, technology.

Assignments / activities

- Students will chronologically list 5 technical innovations of their choice that have influenced the world of music. They'll include the year of innovation, a brief description of the technology and its impact on the music world / industry.

SESSION 2 (LIVE IN-PERSON)

The Evolution of Art in the Digital Age

Description:

Session 2 introduces the digital landscape in terms of internet penetration, mobile usage and digital products, and reviews how technology is reshaping our engagement with, and experience of, art. We will explore the transformation of art from physical exhibits to digital experiences, highlighting the roles of mobile apps, interactive experiences, and online platforms in enhancing audience interaction both within and beyond traditional museum spaces.

Learning objectives:

- Understand key Internet concepts including global access and usage rates, the significance of mobile access, and the characteristics and range of digital products.
- Discuss the transition of art experiences from physical to digital, and the characteristics of digital products related to art.
- Evaluate the broader implications of digital technology on global art accessibility and engagement.

Key concepts:

- Internet penetration, mobile usage, active users, digitalization, digital divide, accessibility, democratization, digital products, experiences and platforms.

Assignments / activities:

- Students will engage in a comparative analysis of digital and analogical Vittore Carpaccio's "A Young Knight". They will be required to visit the Thyssen-Bornemisza Museum (free access on Mondays), to view the painting on site, and to additionally explore the same artwork through the Google Arts & Culture platform, and report their experiences by reflecting and answering a set of questions.

SESSION 3 (LIVE IN-PERSON)

The Data Economy and Its Impact on Art and Technology

Description:

This session provides an overview of how the internet functions, focusing on digitalization and data processes—collection, storage, transmission, and monetization. It explores ethical, legal, and social implications of data collection and use, and the challenges of protecting privacy and security online. It also examines the vast amounts of data needed for artificial intelligence to function effectively and addresses the crucial question of who owns the data. Lastly, it introduces implications for artists and technologists.

Learning objectives:

- Understand the basic mechanics of the internet and data handling.
- Critically evaluate the ethical and legal concerns surrounding data in the digital era.
- Analyze how the data economy influences artistic creation and technological innovation.

Key concepts:

- Data point, data mining, anonymization, aggregation, data collection, crowdsourcing, bias.

Assignments / activities:

- Students will register as workers on Amazon Mechanical Turk, complete a set number of tasks, and reflect on their experiences. This activity is designed to deepen their understanding of how digital labor markets operate, including the perspective of workers completing microtasks.

SESSION 4 (LIVE IN-PERSON)

Data as an Artistic Medium

Description:

In this class we delve into the realm of data visualization within artistic contexts. Students will explore how artists transform abstract data into compelling visual narratives through charts, graphs, and interactive installations. Furthermore, they will explore dynamic artworks that respond to real-time data creating immersive experiences. Additionally, the session will cover participatory data art, where public contribution through crowdsourcing plays a crucial role in shaping the artwork.

Learning objectives:

- Understand the principles of data visualization in art.
- Analyze how real-time data can be integrated into interactive art installations.
- Explore the role of audience participation in creating data-driven art.

Key concepts:

- Data-driven art, data visualization, visual narratives, dynamic artworks, participatory data art.

Assignments / activities:

- Students will select an existing dataset relevant to their interests and create a visualization. They should explain their design choices and how the visualization helps convey the data's significance.

SESSION 5 (LIVE IN-PERSON)

Artificial Intelligence

Description:

This session will delve into the field of Artificial Intelligence (AI), exploring its evolution, defining its various subfields, and examining the roles of both traditional and generative AI technologies. We will cover the spectrum from basic AI applications to advanced generative AI models and their capabilities in generating text, images, video, and audio. Students will engage with AI tools for practical tasks and understand the ongoing challenges and limitations of current AI technologies.

Learning objectives:

- Gain a foundational understanding of AI and its subfields.
- Understand the evolution of AI and distinctions between different AI types: narrow vs. general vs. super AI; and supervised vs. unsupervised vs. reinforcement learning.
- Develop practical skills by using AI and generative AI tools to perform tasks and create content.

Key concepts:

- Narrow, general and super AI, supervised / unsupervised learning, machine learning, neural network, model, training inference, generative AI, LLM.

Assignments / activities:

- Students will choose a task for the LLM, then write and refine prompts to achieve the desired output. Through experimentation and analysis, they'll gain hands-on experience with prompt engineering techniques and explore its applications and limitations.

SESSION 6 (LIVE IN-PERSON)

The Rise of Machine Bards

Description:

This session focuses on the intersection of Artificial Intelligence (AI) and literary creation, exploring how AI technologies are being utilized to generate text-based art and literature. Students will engage in live exercises to understand different AI-driven writing styles and analyze specific applications of AI in creating literary works. Additionally, the session will address ethical considerations and copyright issues related to AI-generated content, highlighting recent developments and notable works in the field.

Learning objectives:

- Understand the capabilities of AI in enhancing and contributing to the process of literary creation.
- Analyze real-world examples of AI-generated literature and the technologies behind them.
- Discuss the ethical implications and copyright challenges associated with AI-generated literary works and the role of machine detection of AI prose.

Key concepts:

- NLP (natural language processing), GPT (generative, pre-trained transformer), prompt, prompt engineering, iterative refinement, zero-shot, few-shot, hallucination.

Assignments / activities:

- Students will choose a well-known haiku poem and use AI to create several different reinterpretations of the chosen haiku. Then, students will analyze the AI-generated variations, comparing them to the original haiku and choose the most effective reinterpretation and explain -using a provided framework- why it successfully captures the essence of the original poem while offering a fresh perspective.

SESSION 7 (LIVE IN-PERSON)

Generative AI and the Visual Arts

Description:

In this session, we will explore the impact of Artificial Intelligence (AI) on the field of visual art. Students will learn how AI technologies such as generation, style transfer, and fusion are not only assisting artists but also creating new art types. Additionally, we will showcase various examples of AI-generated artworks that have made significant impacts on the art world, including those exhibited in prestigious galleries and sold at major auction houses.

Learning objectives:

- Understand the various AI techniques used in the creation of visual art.
- Recognize the role and influence of AI generative artists in the modern art scene.
- Analyze the impact of AI-generated artworks on traditional notions of art and art criticism.

Key concepts:

- Diffusion models, AI-assisted art, AI-generated artworks, style transfer, reference images, base images.

Assignments / activities:

- Students will choose a classic fairytale and use an AI image generator to create a new scene depicting a key moment in the story from a different perspective (e.g., from the villain's point of view). They then will compare the AI-generated image to traditional illustrations of the fairytale and discuss how AI reinterprets visual storytelling. Students will choose a book they've read and use an AI image generator to create several possible book cover designs. They will analyze how effectively each AI-generated cover reflects the book's themes, genre, and overall mood.

SESSION 8 (LIVE IN-PERSON)

Intro to Blockchain and Web3

Description:

This session provides an in-depth look at blockchain technology, covering its origins, mechanics, and distinctive features. The focus will be on how blockchain technology ensures authenticity, provenance, and ownership of digital assets, particularly within the realm of digital art. Students will explore the decentralized and transparent nature of blockchain and its impact on the digital art world.

Learning objectives:

- Understand the foundational concepts of blockchain technology, including its origins and key characteristics.
- Analyze how blockchain ensures the authenticity, provenance, and ownership of digital assets.
- Explore the implications of blockchain's decentralized and transparent nature for the digital art market.

Key concepts:

- Blockchain, ledger, centralized vs decentralized, decentralized autonomous organization (DAO), hash, nodes, consensus protocol, token, mining, smart contract, wallet, bitcoin, ethereum.

Assignments / activities:

- Students set up a wallet.

SESSION 9 (LIVE IN-PERSON)

Digital Collectibles

Description:

This session will provide a comprehensive overview of blockchain technology, focusing on its application in the art world through Non-Fungible Tokens (NFTs) and smart contracts. Students will explore how blockchain technology is revolutionizing the art market by enabling the tokenization and authentication of artworks. Notable examples, including the tokenization of Banksy's "Morons (White)" and Damien Hirst's "The Currency," will be discussed to illustrate these points. The session will conclude with a practical exercise where students will create and mint NFTs, leveraging their understanding of digital ownership in virtual spaces.

Learning objectives:

- Understand the foundational concepts of NFTs and how they interact with blockchain technology.
- Analyze the impact of tokenization on the authenticity, provenance, and ownership of artworks.
- Explore the influence of blockchain on traditional and digital art markets.
- Gain practical experience in creating and minting NFTs.

Key concepts:

- NFT, tokenization, minting, provenance, digital art markets.

Assignments / activities:

- Mint 2 NFTs
- Watch NFT:WTF? feature documentary and complete a short questionnaire.

SESSION 10 (ASYNCHRONOUS)

Extended reality and the metaverse

Description:

This session will introduce students to key concepts and technologies of Extended Reality (XR), including its subfields: Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR). Students will gain insight into a variety of XR devices and their technical requirements, understand the adoption and use cases of XR across different industries, and differentiate among various types of metaverses.

Learning objectives:

- Understand the definitions and differentiate between Assisted Reality, Augmented Reality, Mixed Reality, and Virtual Reality.
- Recognize the technical requirements and the different types of devices used in XR.
- Gain insight into the adoption and practical applications of XR technologies in various sectors.
- Identify and compare major metaverse platforms and their unique characteristics.

Key concepts:

- Extended Reality (XR), Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), devices, controllers, headset, gyroscope, accelerometer, depth sensor, proximity sensor, 3D spatial audio.

Assignments / activities:

- Students will select an industry (eg healthcare, education, entertainment, real state or manufacturing) and research how one of the XR subfields (AR, VR, MR) is currently being used. They will provide a short description of the technology, specific examples of applications in the chosen industry and a brief analysis of how this technology improves or could potentially

improve processes, customer experiences or outcomes in that industry.

SESSION 11 (LIVE IN-PERSON)

When the whole world is a canvas

Description:

In this session, students will delve into the role of Augmented Reality (AR) in the art world, highlighting how this technology expands the traditional canvas to include the entire world around us. Students will explore the specific technical requirements of AR such as spatial awareness, marker or surface recognition, and adaptation to surrounding environments. Through the analysis of prominent AR art installations students will learn how AR technology is employed to create immersive and interactive art experiences that integrate real-world elements seamlessly.

Learning objectives:

- Understand the technical foundations of AR
- Appreciate how AR is used to enhance artistic expression and create new forms of interactive art
- Analyze specific AR art installations to see how artists leverage AR technology to engage audiences and transform public spaces

Key concepts:

- Computer vision, spatial awareness, marker recognition, surface recognition, environmental adaptation, field of view (FOV), user interaction, gamification, haptic feedback

Assignments / activities:

- Students will create their own AR experience choosing from a set of available options.

SESSION 12 (LIVE IN-PERSON)

From Two-Dimensional to Multidimensional Environments

Description:

This week's session will explore how Virtual Reality (VR) shifts artistic expression from traditional two-dimensional spaces to immersive multi-dimensional environments. Students will learn about the specific requirements of VR, such as storytelling techniques, creating immersive environments, interactivity, user engagement, and spatial design. We will also analyze how these elements are integrated into VR art installations to create compelling and memorable experiences.

Learning objectives:

- Understand the fundamental requirements for creating effective VR environments, including technical and creative components.
- Analyze how storytelling within VR differs from traditional mediums and its impact on viewer engagement.
- Explore the role of interactivity and user engagement in enhancing the immersive experience of VR.
- Gain insights into how spatial design and viewpoints are crucial in VR settings.

Key concepts:

- Immersive storytelling, spacial design, viewpoints, sound design, storyboard, visual cues.

Assignments / activities:

- Students will design a VR storyboard incorporating elements of storytelling, immersive design,

spatial dynamics, and interactivity. They should include a brief written description explaining the concept, intended user experience, and artistic goals of their VR installation.

SESSION 13 (LIVE IN-PERSON)

The Metaverse

Description:

In this session, we will explore the Metaverse with a focus on avatars and spaces. We will examine how artists and institutions are leveraging the Metaverse to create virtual museums and galleries, discussing both the benefits and challenges of exhibiting art in these spaces. We will also explore how avatars serve as a medium for artistic expression and the complexities of identity within virtual spaces. Additionally, we will delve into popular Metaverse platforms like Decentraland and CryptoVoxels, highlighting notable artists such as who are pioneering this digital frontier.

The final exam will take place during this session.

Learning objectives:

- Analyze how virtual spaces like museums and galleries are designed and function within the Metaverse.
- Discuss the advantages and challenges associated with exhibiting art in the Metaverse.
- Explore the impact of digital identities on personal and collective expression in virtual environments.
- Understand the role of avatars in the Metaverse as a form of artistic expression.

Key concepts:

- Avatar, digital identity, web3, massively multiplayer online role-playing game (MMORPG).

Assignments / activities:

- Students will experiment with a VR headset to reflect on immersive storytelling, virtual environments for art and create their own VR art piece.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Group project presentations

Description:

Group project presentations and wrap up.

Key concepts:

- n/a

Assignments / activities:

- Group presentations
- Course wrap

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
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Individual work	55 %		10%: Personal reflections; 20% Individual assignments; 25%: Final exam
Class Participation	15 %		10%: Pre-class work; 5%: Overall in-class participation (does not include attendance).
Group Work	30 %		20%: Continuous evaluation, final submission and discussion of final submission; 10%: Self and peer evaluation

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., "notable" in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

UNIVERSITY

TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.F.ClimTec

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **JUAN CARLOS SILVA TAMAYO**

E-mail: jsilva@faculty.ie.edu

Education:

- BSc Geology (EEAFIT University, Medellin, Colombia)
- MSc in Environmental Sciences (UFPE, Recife, Brazil)
- PhD Natural Sciences-Isotope geochemistry (Universitat Bern, Bern, Switzerland)

Research interests: Global Biogeochemical Cycles, Climate and Environmental Change, Nature Based Climate Solutions.

Research Experience:

Postdoctoral stages.

- Smithsonian Tropical Research Institute, Panama.
- Stanford University, Palo Alto, California, USA.
- University of Leeds, Leeds, UK.
- Universitat Hannover, Hannover, Germany.
- Helmholtz of Ocean Research, Geomar Kiel, Kiel Germany.

Senior Researcher.

- Colombian Marine Research Institute, Invemar, Santa Marta, Colombia.
- Stratigraphy and Sedimentology Research Institute, Manizales, Colombia

Academic Experience:

Professorships.

- Earth And Atmospheric Sciences Department, Houston University, Houston, Texas, USA
- Geological Sciences Department, Universidad de Caldas, Manizales, Colombia
- Geological Sciences Department, Universidad Nacional de Colombia, Bogota, Colombia

Office Hours

Office hours will be on request. Please contact at:

Office hours: After-class/Before-class (upon appointment). Contact details: jsilva@faculty.ie.edu

WHEN QUESTIONS ARISE OUT OF CLASS:

Email: If you have a question(s) that was not answered in class, you are welcome to ask your question(s) via email. I can be reached at: jsilva@faculty.ie.edu. I will make every effort to respond to your question(s) as quickly and thoroughly as possible. Expect an answer within 24 hours and if not, please send another email reminding me.

SUBJECT DESCRIPTION

Embark on a transformative journey with our Climate Technology course, designed to empower you with a deep understanding of climate change and its profound impact on our daily lives. This course is not just about learning; it's about becoming a part of the solution.

Our holistic, transdisciplinary, and integrative approach will guide you through the complexities of global change. We believe that to tackle such a multifaceted issue, an interdisciplinary perspective is essential. Our first step is to comprehend the climate system itself, to grasp the changes it's undergoing, and to understand the far-reaching consequences at all levels.

We will then move into mitigation and adaptation strategies and technological solutions. It's in our hands to act within our areas of expertise to build the solutions of the future. Through adaptation and mitigation actions, we can build a more resilient society. Join us and be a part of this crucial journey towards a sustainable future.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

IE IMPACT OVERVIEW

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with "pillar courses" in three of IE's core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

- humanistic approaches to interpersonal relations, decision-making and critical thinking;
- familiarity with the technologies that are applied to solve some of the world's greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

The IE Challenge is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE's core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN's 2030 Agenda.

This course aims to educate students on the that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Technology course – Climate Solutions

- Explain course dynamics.
- Start of the course challenge, group configuration and countries
- What do you know: exploratory quiz.

SESSION 2 (ASYNCHRONOUS)

Sustainability Topics:

- Environment

Introduction to the Climate system and its dynamics

- Know the components of the climatic system: spheres, sinks, flows.
- Learn how the climate system works: heat budget and flow, atmospheric circulation, ocean circulation, feedback.
- Biogeochemical Cycles-link carbon and water cycle.

Supporting material.

Book Chapters: The Climate System: an Overview (IPCC)

SESSION 3 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Climate Change

- Understanding the basics of climate change
- The science behind global warming and greenhouse gases

Supporting material:

Article: What Is Climate Change? (UN)

Article: What Is Climate Change? (NASA)

SESSION 4 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Impact of Climate Change

- Discussing the environmental, economic, and social impacts of climate change
- Case studies on the effects of climate change, primary and secondary, students will research and present.

Supporting material:

Article: Consequences of climate change (European Commission)

Article: The Basics of Climate Change (The Royal Society)

SESSION 5 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Climate Change Mitigation and adaptation

- Understanding the concept of climate change mitigation and adaptation, resistance, and resilience.
- Exploring various strategies for reducing greenhouse gas emissions.
- What are we adapting to?

Supporting materials:

Article: Responding to climate change: mitigation and adaptation (NASA)

Book Chapters: Inter-relationships between adaptation and mitigation (IPCC)

SESSION 6 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Industrial)

- Understanding the technology behind carbon capture and storage: Where and how.
- Geoengineering
- Discussing the potential and limitations of this technology-approach.

Supporting materials: articles will be provided.

Article: Negative emissions technologies and practices: the way forward (EU)

SESSION 7 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Nature Based)

- Exploration of various nature-based NETs such as afforestation, reforestation, blue carbon (carbon captured by oceans and coastal ecosystems), and soil carbon sequestration.

- Examination of real-world applications and case studies of nature-based NETs.

Supporting materials: articles will be provided.

Other / Complementary Documentation: Could negative emissions actually help curb climate change? (EC)

SESSION 8 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Regenerative agroecology and land management, going beyond sustainable agriculture.

- Exploring the connection between agriculture, farming, and climate change
- Techniques for promoting real sustainable food production systems agriculture.

Supporting materials: Movies Kiss the Ground (available on Netflix) or Ganado o Desierto,

Other / Complementary Documentation: Ganado o Desierto (Desert or Livestock)

SESSION 9 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Green Cities

- Understanding the concept of green cities
- Role of green cities in reducing greenhouse gas emissions and improving water use
- Madrid Deep Demonstration project, EIT Climate KIC
- Towns in Transition

Supporting materials.

Article: Supporting municipalities to develop collaboration capability to facilitate urban transitions and sustainability: Role of transition intermediaries in Madrid (Journal of Cleaner Production 426, 2023) (ResearchGate)

Other / Complementary Documentation: Towns in Transition (transitionnetwork.org)

SESSION 10 (ASYNCHRONOUS)

Sustainability Topics:

- Environment
- Governance

Climate Change Policy

- Discussing the role of policy in climate change mitigation and adaptation
- Review of international climate agreements and policies

Supporting materials: COP meetings

Other / Complementary Documentation: COP meetings

SESSION 11 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Climate Change and Society

- Understanding the social dimensions of climate change
- Role of individual and collective action in climate change mitigation

Supporting materials: articles will be provided.

Working Paper: Climate Change 2022: Impacts, Adaptation and Vulnerability (IPCC)

Article: Social Dimensions of Climate Change (The World Bank)

SESSION 12 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Climate Change Communication

- Importance of effective communication in climate change mitigation
- Techniques for communicating about climate change to diverse audiences.
- Discussing the role of innovation in climate change mitigation

Supporting materials: articles, booklets will be provided.

Article: Climate Communication (UN)

SESSION 13 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Final EXAM

SESSIONS 14 - 15 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Challenge Presentation

Climate Change Innovation

Students present their work.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		Class participation should be active, engaged and always respectful with the professor and fellow students.

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., "notable" in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

- Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.
- In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Puay Yok Tan, Chi Yung Jim. *Greening Cities*. Springer Link. ISBN 9789811041 (Digital)

<https://link.springer.com/book/10.1007/978-981-10-4113-6>

- José Carlos Magalhães Pires and Ana Luísa Da Cunha Gonçalves. *Bioenergy with Carbon Capture and Storage Using Natural Resources for Sustainable Development*. ISBN 9780128162 (Digital)

- Puay Yok Tan (Editor), Chi Yung Jim (Editor). *Greening Cities: Forms and Functions (Advances in 21st Century Human Settlements)*. ISBN 9811350515 (Digital)

- Jose Carlos Magalhaes Pires (Redactor), Ana Luisa da Cunha Goncalves (Redactor). *Bioenergy with Carbon Capture and Storage: Using Natural Resources for Sustainable Development*. Academic press. ISBN 0128162295 (Digital)

RECOMMENDED BIBLIOGRAPHY

- <https://www.ipcc.ch/reports/>
- <https://link.springer.com/book/10.1007/978-981-10-4113-6>
- <https://www.sciencedirect.com/book/9780128162293/bioenergy-with-carbon-capture-and-storage>

BEHAVIOR RULES

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ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.G.Art&Tec

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **CLARA RIVERA**

E-mail: clarar@faculty.ie.edu

Clara E. Rivera's career spans almost 20 years at the intersection of technology and the arts, most notably through her co-founding of the [Google Art Project](#), which has brought many of the world's cultural treasures online. Before this landmark project, she led the pioneering collaboration between [Google and the Prado Museum](#), introducing art in ultra-high resolution to a global audience.

Her work with the EMEA Google Brand Studio further explored the fusion of art and technology, creating immersive experiences like [Performing Arts](#) and [Petra in VR](#). Transitioning to artificial intelligence, Clara focused on making language processing more inclusive, consulted on installations like [Found in Translation](#), and was a core contributor to Google's [Gemini Gen-AI models](#).

Her background in Psychology and Translation, combined with a deep passion for both technology's potential and mental well-being, positions her uniquely to lead discussions on art and technology's confluence. Clara's journey from digital marketing and strategy to the forefront of AI and cultural accessibility showcases her commitment to leveraging technology for global understanding and accessibility to art.

Office Hours

Office hours will be on request. Please contact at:

clarar@faculty.ie.edu

Available on request on Fridays between 10:30 and 12:30 (scheduling required).

SUBJECT DESCRIPTION

THE EVOLVING CANVAS: At the Intersection of Art & Technology

In today's world, the fusion of art and technology forms a dynamic landscape where creativity merges with cutting-edge innovation to redefine the realms of artistic expression. This transformative space is no longer reserved for the traditional artist or the seasoned technologist alone; it beckons everyone from diverse fields to explore, contribute, and reshape the future of art. Our course, "The Evolving Canvas - At the Intersection of Art & Technology" invites students from all disciplines, regardless of their prior experience with technology or art, to embark on an exploratory journey into the digital evolution of art and its profound implications on society and culture.

This course is designed to demystify the technological underpinnings of modern digital art, making the intricacies of digital creation, distribution, and consumption accessible to all. Understanding the intersection of art and technology is crucial for anyone aspiring to make a significant impact in today's world, where the boundaries of creativity are constantly expanding. Through this course, students will delve into the fascinating evolution of the internet and explore how groundbreaking technologies such as the Data Economy, Blockchain, Extended Reality, the Metaverse and Artificial Intelligence are revolutionizing the way we create, perceive, and interact with art.

By examining case studies of virtual museums, immersive experiences, and digital art platforms, students will gain insights into the challenges and opportunities presented by these technological advancements. The course will cover a broad spectrum of digital art forms highlighting the innovative ways artists and technologists are collaborating to push the boundaries of traditional art. Students will learn about the economic, social, and ethical implications of digital art, particularly how it intersects with issues of accessibility, copyright, and artist compensation in the digital age.

Furthermore, the course will provide hands-on experiences with the latest digital art tools and platforms, enabling students to experiment with creating their own digital artworks. This practical component, combined with theoretical knowledge, aims to cultivate a deep understanding of digital art's potential and its role in driving societal and cultural evolution.

As part of our broader educational journey, this course prepares students for a future where they can apply their creativity and technical skills to address complex challenges, bridging the gap between art and technology to inspire change and innovation. By the end of this course, students will not only have a comprehensive understanding of the digital art landscape but will also be equipped with the critical thinking and creative skills necessary to navigate and contribute to this

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course for content creation and optimization only in the context of home assignments and group project deliverables.

GenAI may not be used for new content generation for reflective or research assignments. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with your professor.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

From cave to code

Description:

In this introductory session, we will review the content of the course by tracing and comparing the historical development of art and technology, from prehistoric pigment development to recent installations. This journey will highlight key technological advancements and their impact on artistic expression. We will also outline the course structure, including the evaluation methodology and discuss the final assignments.

Learning objectives:

- Understand the evolution of art and technology across different historical periods, and recognize the impact of technological innovations on artistic mediums and styles.
- Gain insight into the course structure, assessment strategies, and final projects.

Key concepts:

- Art surfaces, forms of expression, art, technology.

Assignments / activities

- Students will chronologically list 5 technical innovations of their choice that have influenced the world of music. They'll include the year of innovation, a brief description of the technology and its impact on the music world / industry.

SESSION 2 (LIVE IN-PERSON)

The Evolution of Art in the Digital Age

Description:

Session 2 introduces the digital landscape in terms of internet penetration, mobile usage and digital products, and reviews how technology is reshaping our engagement with, and experience of, art. We will explore the transformation of art from physical exhibits to digital experiences, highlighting the roles of mobile apps, interactive experiences, and online platforms in enhancing audience interaction both within and beyond traditional museum spaces.

Learning objectives:

- Understand key Internet concepts including global access and usage rates, the significance of mobile access, and the characteristics and range of digital products.
- Discuss the transition of art experiences from physical to digital, and the characteristics of digital products related to art.
- Evaluate the broader implications of digital technology on global art accessibility and engagement.

Key concepts:

- Internet penetration, mobile usage, active users, digitalization, digital divide, accessibility, democratization, digital products, experiences and platforms.

- Assignments / activities:

Students will engage in a comparative analysis of digital and analogical Vittore Carpaccio's "A Young Knight". They will be required to visit the Thyssen-Bornemisza Museum (free access on Mondays), to view the painting on site, and to additionally explore the same artwork through the Google Arts & Culture platform, and report their experiences by reflecting and answering a set of questions.

SESSION 3 (LIVE IN-PERSON)

The Data Economy and Its Impact on Art and Technology

Description:

This session provides an overview of how the internet functions, focusing on digitalization and data processes—collection, storage, transmission, and monetization. It explores ethical, legal, and social implications of data collection and use, and the challenges of protecting privacy and security online. It also examines the vast amounts of data needed for artificial intelligence to function effectively and addresses the crucial question of who owns the data. Lastly, it introduces implications for artists and technologists.

Learning objectives:

- Understand the basic mechanics of the internet and data handling.
- Critically evaluate the ethical and legal concerns surrounding data in the digital era.
- Analyze how the data economy influences artistic creation and technological innovation.

Key concepts:

- Data point, data mining, anonymization, aggregation, data collection, crowdsourcing, bias.

Assignments / activities:

- Students will register as workers on Amazon Mechanical Turk, complete a set number of tasks, and reflect on their experiences. This activity is designed to deepen their understanding of how digital labor markets operate, including the perspective of workers completing microtasks.

SESSION 4 (LIVE IN-PERSON)

Data as an Artistic Medium

Description:

In this class we delve into the realm of data visualization within artistic contexts. Students will explore how artists transform abstract data into compelling visual narratives through charts, graphs, and interactive installations. Furthermore, they will explore dynamic artworks that respond to real-time data creating immersive experiences. Additionally, the session will cover participatory data art, where public contribution through crowdsourcing plays a crucial role in shaping the artwork.

Learning objectives:

- Understand the principles of data visualization in art.
- Analyze how real-time data can be integrated into interactive art installations.
- Explore the role of audience participation in creating data-driven art.

Key concepts:

- Data-driven art, data visualization, visual narratives, dynamic artworks, participatory data art.

Assignments / activities:

- Students will select an existing dataset relevant to their interests and create a visualization. They should explain their design choices and how the visualization helps convey the data's significance.

SESSION 5 (LIVE IN-PERSON)

Artificial Intelligence

Description:

This session will delve into the field of Artificial Intelligence (AI), exploring its evolution, defining its various subfields, and examining the roles of both traditional and generative AI technologies. We will cover the spectrum from basic AI applications to advanced generative AI models and their capabilities in generating text, images, video, and audio. Students will engage with AI tools for practical tasks and understand the ongoing challenges and limitations of current AI technologies.

Learning objectives:

- Gain a foundational understanding of AI and its subfields.
- Understand the evolution of AI and distinctions between different AI types: narrow vs. general vs. super AI; and supervised vs. unsupervised vs. reinforcement learning.
- Develop practical skills by using AI and generative AI tools to perform tasks and create content.

Key concepts:

- Narrow, general and super AI, supervised / unsupervised learning, machine learning, neural network, model, training inference, generative AI, LLM.

Assignments / activities:

- Students will choose a task for the LLM, then write and refine prompts to achieve the desired output. Through experimentation and analysis, they'll gain hands-on experience with prompt engineering techniques and explore its applications and limitations.

SESSION 6 (LIVE IN-PERSON)

The rise of Machine Bards

Description:

This session focuses on the intersection of Artificial Intelligence (AI) and literary creation, exploring how AI technologies are being utilized to generate text-based art and literature. Students will engage in live exercises to understand different AI-driven writing styles and analyze specific applications of AI in creating literary works. Additionally, the session will address ethical considerations and copyright issues related to AI-generated content, highlighting recent developments and notable works in the field.

Learning objectives:

- Understand the capabilities of AI in enhancing and contributing to the process of literary creation.
- Analyze real-world examples of AI-generated literature and the technologies behind them.
- Discuss the ethical implications and copyright challenges associated with AI-generated literary works and the role of machine detection of AI prose.

Key concepts:

- NLP (natural language processing), GPT (generative, pre-trained transformer), prompt, prompt engineering, iterative refinement, zero-shot, few-shot, hallucination.

Assignments / activities:

- Students will choose a well-known haiku poem and use AI to create several different reinterpretations of the chosen haiku. Then, students will analyze the AI-generated variations, comparing them to the original haiku and choose the most effective reinterpretation and explain -using a provided framework- why it successfully captures the essence of the original poem while offering a fresh perspective.

SESSION 7 (LIVE IN-PERSON)

Generative AI and the Visual Arts

Description:

In this session, we will explore the impact of Artificial Intelligence (AI) on the field of visual art. Students will learn how AI technologies such as generation, style transfer, and fusion are not only assisting artists but also creating new art types. Additionally, we will showcase various examples of AI-generated artworks that have made significant impacts on the art world, including those exhibited in prestigious galleries and sold at major auction houses.

Learning objectives:

- Understand the various AI techniques used in the creation of visual art.
- Recognize the role and influence of AI generative artists in the modern art scene.
- Analyze the impact of AI-generated artworks on traditional notions of art and art criticism.

Key concepts:

- Diffusion models, AI-assisted art, AI-generated artworks, style transfer, reference images, base images.

Assignments / activities:

- Students will choose a classic fairytale and use an AI image generator to create a new scene depicting a key moment in the story from a different perspective (e.g., from the villain's point of view). They then will compare the AI-generated image to traditional illustrations of the fairytale and discuss how AI reinterprets visual storytelling.
- Students will choose a book they've read and use an AI image generator to create several possible book cover designs. They will analyze how effectively each AI-generated cover reflects the book's themes, genre, and overall mood.

SESSION 8 (LIVE IN-PERSON)

SESSION 8: Intro to Blockchain and Web3

Description:

This session provides an in-depth look at blockchain technology, covering its origins, mechanics, and distinctive features. The focus will be on how blockchain technology ensures authenticity, provenance, and ownership of digital assets, particularly within the realm of digital art. Students will explore the decentralized and transparent nature of blockchain and its impact on the digital art world.

Learning objectives:

- Understand the foundational concepts of blockchain technology, including its origins and key characteristics.
- Analyze how blockchain ensures the authenticity, provenance, and ownership of digital assets. Explore the implications of blockchain's decentralized and transparent nature for the digital art market.

Key concepts:

- Blockchain, ledger, centralized vs decentralized, decentralized autonomous organization (DAO), hash, nodes, consensus protocol, token, mining, smart contract, wallet, bitcoin, ethereum.

Assignments / activities:

- Students set up a wallet.

SESSION 9 (LIVE IN-PERSON)

Digital Collectibles

Description:

This session will provide a comprehensive overview of blockchain technology, focusing on its application in the art world through Non-Fungible Tokens (NFTs) and smart contracts. Students will explore how blockchain technology is revolutionizing the art market by enabling the tokenization and authentication of artworks. Notable examples, including the tokenization of Banksy's "Morons (White)" and Damien Hirst's "The Currency," will be discussed to illustrate these points. The session will conclude with a practical exercise where students will create and mint NFTs, leveraging their understanding of digital ownership in virtual spaces.

Learning objectives:

- Understand the foundational concepts of NFTs and how they interact with blockchain technology.
- Analyze the impact of tokenization on the authenticity, provenance, and ownership of artworks.
- Explore the influence of blockchain on traditional and digital art markets.
- Gain practical experience in creating and minting NFTs.

Key concepts:

- NFT, tokenization, minting, provenance, digital art markets.

Assignments / activities:

- Mint 2 NFTs
- Watch NFT:WTF? feature documentary and complete a short questionnaire.

SESSION 10 (ASYNCHRONOUS)

Extended Reality and the Metaverse

Description:

This session will introduce students to key concepts and technologies of Extended Reality (XR), including its subfields: Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR). Students will gain insight into a variety of XR devices and their technical requirements, understand the adoption and use cases of XR across different industries, and differentiate among various types of metaverses.

Learning objectives:

- Understand the definitions and differentiate between Assisted Reality, Augmented Reality, Mixed Reality, and Virtual Reality.
- Recognize the technical requirements and the different types of devices used in XR.
- Gain insight into the adoption and practical applications of XR technologies in various sectors.
- Identify and compare major metaverse platforms and their unique characteristics.

Key concepts:

- Extended Reality (XR), Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), devices, controllers, headset, gyroscope, accelerometer, depth sensor, proximity sensor, 3D spatial audio.

Assignments / activities:

- Students will select an industry (eg healthcare, education, entertainment, real state or manufacturing) and research how one of the XR subfields (AR, VR, MR) is currently being used. They will provide a short description of the technology, specific examples of applications in the chosen industry and a brief analysis of how this technology improves or could potentially improve processes, customer experiences or outcomes in that industry.

SESSION 11 (LIVE IN-PERSON)

When the Whole World is a Canvas

Description:

In this session, students will delve into the role of Augmented Reality (AR) in the art world, highlighting how this technology expands the traditional canvas to include the entire world around us. Students will explore the specific technical requirements of AR such as spatial awareness, marker or surface recognition, and adaptation to surrounding environments. Through the analysis of prominent AR art installations students will learn how AR technology is employed to create immersive and interactive art experiences that integrate real-world elements seamlessly.

Learning objectives:

- Understand the technical foundations of AR
- Appreciate how AR is used to enhance artistic expression and create new forms of interactive art
- Analyze specific AR art installations to see how artists leverage AR technology to engage audiences and transform public spaces

Key concepts:

- Computer vision, spatial awareness, marker recognition, surface recognition, environmental adaptation, field of view (FOV), user interaction, gamification, haptic feedback

Assignments / activities:

- Students will create their own AR experience choosing from a set of available options.

SESSION 12 (LIVE IN-PERSON)

From two-dimensional to multidimensional environments

Description:

This week's session will explore how Virtual Reality (VR) shifts artistic expression from traditional two-dimensional spaces to immersive multi-dimensional environments. Students will learn about the specific requirements of VR, such as storytelling techniques, creating immersive environments, interactivity, user engagement, and spatial design. We will also analyze how these elements are integrated into VR art installations to create compelling and memorable experiences.

Learning objectives:

- Understand the fundamental requirements for creating effective VR environments, including technical and creative components.
- Analyze how storytelling within VR differs from traditional mediums and its impact on viewer engagement.
- Explore the role of interactivity and user engagement in enhancing the immersive experience of VR.

- Gain insights into how spatial design and viewpoints are crucial in VR settings.

Key concepts:

- Immersive storytelling, spacial design, viewpoints, sound design, storyboard, visual cues.

Assignments / activities:

- Students will design a VR storyboard incorporating elements of storytelling, immersive design, spatial dynamics, and interactivity. They should include a brief written description explaining the concept, intended user experience, and artistic goals of their VR installation.

SESSION 13 (LIVE IN-PERSON)

The Metaverse

Description:

In this session, we will explore the Metaverse with a focus on avatars and spaces. We will examine how artists and institutions are leveraging the Metaverse to create virtual museums and galleries, discussing both the benefits and challenges of exhibiting art in these spaces. We will also explore how avatars serve as a medium for artistic expression and the complexities of identity within virtual spaces. Additionally, we will delve into popular Metaverse platforms like Decentraland and CryptoVoxels, highlighting notable artists such as who are pioneering this digital frontier.

The final exam will take place during this session.

Learning objectives:

- Analyze how virtual spaces like museums and galleries are designed and function within the Metaverse.
- Discuss the advantages and challenges associated with exhibiting art in the Metaverse.
- Explore the impact of digital identities on personal and collective expression in virtual environments.
- Understand the role of avatars in the Metaverse as a form of artistic expression.

Key concepts:

- Avatar, digital identity, web3, massively multiplayer online role-playing game (MMORPG).

Assignments / activities:

- Students will experiment with a VR headset to reflect on immersive storytelling, virtual environments for art and create their own VR art piece.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Group project presentations

Description:

- Group project presentations and wrap up.

Key concepts:

- n/a

Assignments / activities:

- Group presentations
- Course wrap

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		10%: Personal reflections; 20% Individual assignments; 25%: Final exam
Participation and contributions in class	15 %		10%: Pre-class work; 5%: Overall in-class participation (does not include attendance).
Group Work	30 %		20%: Continuous evaluation, final submission and discussion of final submission; 10%: Self and peer evaluation

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., "notable" in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

UNIVERSITY

TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.H.Securit

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **LUIS ANGEL GALINDO SANCHEZ**

E-mail: lgalindo@faculty.ie.edu

- PhD Telecommunication Engineer (2012). Polytechnic University of Madrid. ANECA accredited.
- Executive MBA (2006). IESE Business School – University of Navarra.
- Master, Service and Security in IP Networks (2005). Polytechnic University of Madrid.
- Specialist, Network and Advanced Internet Systems (1998). Carlos III University of Madrid.
- Specialist, Voice Codification (1997). Carlos III University of Madrid.
- Adjunct Professor at IE teaching ADSS, Technology Scouting, Cybercrime, IE Impact/Technology, Cybersecurity, Automation and Security Engineering and Advanced Databases.
- Visiting Associate Professor at HEC Montreal (from 2018 till now), where I teach Entrepreneurship with my own methodology to assess the business potential of a value proposal.
- Professor in the Master of Cybercrime Master at Nebrija University (from 2018 till now).
- Responsible of the AI area applied to the detection of cybercriminals. Teaching police officers how to use Big Data and Machine Learning Technologies to be more efficient working with deep and dark web at Nebrija University.
- Associate Professor at Carlos III University of Madrid (from 2007 till now). Professor of Computer networks, Secure Communications, Cybersecurity and Data protection.
- Defined, developed and implemented a successful open innovation model, generating new relevant revenue streams results. Selective results include an increase of +200 startups working under this model with +6000 companies analyzed. Increase in revenue of +10% y-o-y leveraged on the innovative assets.
- He has defined, developed and implemented a successful Digital Transformation Learning Program for more than 8 years and +2000 people trained, receiving Telefonica Excellent

Teacher award along 7 consecutive years.

- Principal Investigator in 7 EU funded projects ((previously in 4 more) based on the technological skills that Luis has in fields like Cybersecurity, Cyber Defense, AI, Cloud Computing or IoT. He personally researches in the application of AI to the cybersecurity and cybercrime.
- Teacher in several recognised universities and business schools with excellent marks from 2007.
- Luis, as High Performance Senior Consultant, has implemented +20 consultancy complex projects worldwide for large enterprises in AI, economical intelligence, cybersecurity, business development, digital transformation, risk assessment, process optimization and people management issues.
- Luis is an expert at understanding customers and translating their needs into actual sales by developing new markets or new products & services and Digital mindset within everyone in the organization.
- He has had a leading role in complex M&A processes with digital assess acquisition like in the first world integration of a MVNO and a social network.
- Frequent speaker at Innovation and Tech international conferences. He considers himself a creovator.
- He participates in several startups using AI (ML, Computer Vision...), Robotics and Sensing.

Office Hours

Office hours will be on request. Please contact at:

lgalindo@faculty.ie.edu (email me in advance, if you wish to schedule a chat or a meeting).

SUBJECT DESCRIPTION

Insights into Modern Intelligence: Exploring Technology's Role in National Security

Join us for an illuminating journey into the world of modern intelligence operations and the pivotal role technology plays in safeguarding national security. In "Insights into Modern Intelligence," we delve into the fascinating realm of espionage, surveillance, and intelligence gathering, offering a comprehensive overview accessible to all audiences.

Through engaging discussions and captivating case studies, we explore how governments leverage technology to enhance their intelligence capabilities, ensuring the safety and security of their citizens in an ever-evolving geopolitical landscape. From traditional methods of information gathering to cutting-edge cyber tactics, we unravel the intricacies of intelligence operations and shed light on the ethical considerations and societal implications of these practices.

By participating in this course, students will gain a deeper understanding of:

1. The evolution of intelligence gathering techniques and the role of technology in shaping modern geopolitics.
2. The utilization of advanced surveillance systems, data analytics, and artificial intelligence in intelligence operations.
3. The ethical dilemmas and legal frameworks surrounding intelligence gathering and surveillance practices.

4. The impact of cyber threats and digital vulnerabilities on national security and the strategies employed to mitigate these risks.
5. The importance of interdisciplinary collaboration and information sharing in fostering effective intelligence operations.
6. The emerging field of cyber intelligence and its significance in addressing contemporary security challenges.
7. The principles of resilience and adaptive governance in building resilient cities and communities in the face of threats and disruptions.

By mastering these concepts and acquiring hands-on experience with cutting-edge technologies, students will develop invaluable skills in critical thinking, problem-solving, data analysis, and strategic decision-making. Join us in unraveling the complexities of modern intelligence and shaping the future of national security.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course for research, ideation, generating an outline, proofreading, grammar check, coding, image generation with appropriate acknowledgement. GenAI may not be used for exams. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with “pillar courses” in three of IE’s core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

- humanistic approaches to interpersonal relations, decision-making and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

The **IE Challenge** is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE’s core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN’s 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

SESSION 1 (LIVE IN-PERSON)

Introduction to Modern Intelligence and National Security

Course overview and discussion of basic intelligence and national security concepts. We will see the different sessions, objectives and expected work to be done along the sessions.

Intro to the Course

Course summary: contents description.

IE and Students expectations.

Assignments and Grading.

SESSION 2 (LIVE IN-PERSON)

Big Data

In this session, we will explore the world of Big Data, focusing on how it is collected, stored and used in the intelligence domain. We will also examine data regulation, including the laws and regulations governing the collection, storage and use of big data.

Learning objectives for the session

- Understand the fundamental concepts of Big Data and its application in the field of intelligence.
- Become familiar with the methods and technologies used to collect and store large volumes of data.
- Explore the ethical and legal challenges related to the collection and use of Big Data.
- Understand the regulations and standards that affect the management of big data.

List concepts covered in this session

- Definition and characteristics of Big Data.
- Methods of large-scale data collection.
- Applications of Big Data in the field of intelligence and security.
- Ethical and legal aspects of Big Data use.
- Relevant regulations and standards, such as GDPR, CCPA

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: How to find out what Google knows about you and limit the data it collects (CNBC)

Other / Complementary Documentation: The Dangers of Video Surveillance and A.I. (Youtube)

Other / Complementary Documentation: Big Data: A Revolution That Will Transform How We Live,

SESSION 3 (LIVE IN-PERSON)

IoT and Smart Technologies

In this session we will explore the fascinating world of smart technology and the Internet of Things (IoT), examining how these advances are transforming our daily lives and their relevance to national security.

We will look at how internet-connected smart devices are collecting real-time data, from sensors in smart cities to home devices, and how this information can be used to improve decision-making in intelligence and security operations.

Learning objectives for the session

- Understand what the Internet of Things is and how it works.
- Explore the practical applications of IoT in different sectors, such as health, agriculture, industry, etc.
- Analyse smart technologies, such as sensors, actuators, and control systems, and their role in building smart environments.
- Discuss the security and privacy challenges associated with the mass deployment of IoT devices.
- Consider the opportunities and risks presented by smart cities and the Internet of Things in general.

List concepts covered in this session

- Definition and characteristics of the Internet of Things.
- Typical architecture of an IoT solution.
- IoT applications in different sectors, such as health, agriculture, industry, etc.
- Key technologies used in smart systems, such as sensors, actuators and control systems.
- IoT security and privacy: threats, vulnerabilities and best practices for protection.
- The role of IoT in the development of smart cities and the improvement of urban quality of life.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Security and Privacy Challenges in the Internet of Things (IEEE)

Article: Smart City Architecture and its Applications Based on IoT (Procedia Computer Science Volume 52, 2015, Pages 1089-1094) (Elsevier)

SESSION 4 (LIVE IN-PERSON)

Artificial Intelligence

In this session, we will dive into the exciting field of Artificial Intelligence (AI), exploring how this advanced technology is fundamentally transforming the way intelligence and national security services operate. We will look at how machine learning algorithms and artificial neural networks are being applied in a variety of scenarios, from detecting patterns in large datasets to automating complex intelligence analysis tasks.

Learning objectives for the session

- Understand the basic concepts of Artificial Intelligence and its subfields.
- Explore applications of AI in sectors such as health, education, commerce and industry.
- Discuss the ethical and social implications of AI, including issues such as privacy, algorithmic

discrimination and employment automation.

List concepts covered in this session

- Definition and types of Artificial Intelligence.
- Practical applications of AI in everyday life and in various sectors.
- AI algorithms and techniques, such as machine learning, neural networks, etc.
- AI ethics and social considerations. Future challenges and opportunities in the field of AI.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Other / Complementary Documentation: Machine Learning vs Deep Learning (Youtube)

Other / Complementary Documentation: Supervised vs. Unsupervised Learning (Youtube)

Technical note & tutorials: Types of Algorithms (ENT020208-U-ENG-VID)

SESSION 5 (LIVE IN-PERSON)

Robotics and Aerial Surveillance

In this session, we will delve into the impact of robotics and aerial surveillance on data collection and target surveillance, exploring how these technologies are revolutionising traditional methods of intelligence gathering and providing an unprecedented perspective on homeland security. We will look in detail at how drones and other robotic systems are being used to conduct surveillance, reconnaissance and data collection missions in remote or hard-to-reach environments, as well as in urban and critical areas.

Learning objectives for the session

- Understand the role of robotics and aerial surveillance in data collection and target surveillance.
- Explore the applications of drones and other robotic systems in intelligence and security missions.
- Analyse the challenges and opportunities associated with the use of aerial surveillance technologies.
- Discuss the ethical and legal implications of aerial surveillance in society.

List concepts covered in this session

- Introduction to robotics and aerial surveillance.
- Types of drones and robotic systems used in surveillance.
- Applications of aerial surveillance in civilian and military environments.
- Technical and operational challenges of aerial surveillance.
- Impact of aerial surveillance on privacy and civil rights.
- Strategies to mitigate risks associated with aerial surveillance.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Unmanned Aerial Vehicles for Civil Applications: A Review (MDPI)

Article: Robotic Vision for Human-Robot Interaction and Collaboration: A Survey and Systematic Review (Transactions on Human-Robot Interaction, Vol. 12, No. 1, Article 12, 2023) (ACM)

Article: Societal acceptance of urban drones: A scoping literature review (Technology in Society 75, 2023) (Elsevier)

SESSION 6 (LIVE IN-PERSON)

Generative AI and Content Automation

In this session, we will see what is Generative AI, the main tools, etc We will explore how generative AI is transforming the production of information and content and how can be used in the national intelligence.

Learning objectives for the session

- Understand the basic concepts of Generative Artificial Intelligence (AI) and Content Automation.
- Explore the practical applications of generative AI in the creation of visual, auditory and textual content.
- Analyse examples of the use of generative AI in the national intelligence.
- Discuss the ethical and social implications of content automation and generative AI.

List concepts covered in this session

- Definition and principles of Generative Artificial Intelligence.
- Techniques and algorithms used in content generation by AI, such as GANs, recurrent neural networks, among others.
- Practical applications of generative AI in the creation of audiovisual content, generative text, etc. and the use by national intelligence.
- Outstanding examples of generative AI projects and applications.
- Discussion of ethical challenges and concerns related to content automation and generative AI.

PRACTICE

Using prompts to get useful insights in national security.

Article: Generative AI: A New Frontier in Artificial Intelligence (Deloitte)

Other / Complementary Documentation: Introduction to Generative AI (Google; Youtube)

Other / Complementary Documentation: Algorithmic Bias and Fairness (Crash Course; Youtube)

SESSION 7 (LIVE IN-PERSON)

XR. Extended Reality

Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR): Exploring how AR, VR and MR are being used in intelligence and security applications, enabling visualisation of complex data, simulation of security scenarios, training of personnel, remote surveillance and collaboration in virtual environments.

Learning objectives for the session

- Understand the concepts of augmented reality, virtual reality and mixed reality.
- Explore the applications of AR, VR and MR in the field of intelligence and security.
- Become familiar with the technologies and devices used in AR, VR and MR by immersing in this virtual ecosystem.
- Analyse how these technologies can enhance data visualisation and simulation of security scenarios.
- Discuss the challenges and ethical considerations in the use of AR, VR and RM in security applications.

List concepts covered in this session

- Definition and differences between augmented reality, virtual reality and mixed reality.
- Applications of AR, VR and MR in intelligence and security, such as remote surveillance, scenario simulation, personnel training, etc.

- Technologies and devices used in AR, VR and MR, such as virtual reality glasses, augmented reality viewers, etc.
- Examples of XR use cases in security and defence applications.
- Challenges and ethical considerations in the use of these technologies.

PRACTICE

We will use the IE Metaverse platform to take an important decision in our role inside this virtual environment with an immersive experience.

Article: Use of virtual reality simulators for training programs in the areas of security and defense: a systematic review (Multimedia Tools and Applications (2020) 79: 3495–3515) (CED)

Article: No pain, no gain? The effects of adding a pain stimulus in virtual training for police officers (Taylor&Francis)

SESSION 8 (LIVE IN-PERSON)

Blockchain

In this session, we will discuss on blockchain technology and its impact on information security, along with cryptocurrencies and their role in financial transactions.

Learning objectives for the session

- Understand the fundamental concepts of blockchain technology and how it works.
- Analyse the impact of blockchain technology on information security and data management.
- Explore the applications of blockchain in different sectors.
- Study the characteristics and operation of cryptocurrencies, such as Bitcoin and Ethereum.
- Assess the risks and challenges associated with the use of cryptocurrencies in financial transactions.

List concepts covered in this session

- Blockchain technology: definition, characteristics and operation.
- Types of blockchains: public, private and consortium.
- Applications of blockchain in information security and data management.
- Cryptocurrencies: characteristics, operation and types.
- Blockchain use cases in different industries.
- Security and privacy in financial transactions with cryptocurrencies.

PRACTICE

In this session, we will create our own crypto wallet to understand better how a Blockchain is.

Technical note & tutorials: Moving Forward: The Blockchain Opportunity (IST020192-U-ENG-VID)

Technical note & tutorials: Cryptocurrencies and Bitcoin (IST020387-U-ENG-VID)

SESSION 9 (LIVE IN-PERSON)

Cybersecurity

In the session dedicated to Cyber Security, we will delve into the analysis of the growing cyber threats facing governments and organisations today, from ransomware and phishing attacks to sophisticated intrusions backed by state actors and hacker groups. We will explore in detail the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and information systems, as well as the motivations behind these attacks, ranging from data theft and extortion to sabotage and interference in government operations.

Learning objectives for the session

- Understand the current cyber threats facing governments and organisations.
- Become familiar with the different forms of cyber attacks, such as ransomware, phishing and intrusions.
- Understand the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and systems.
- Analyse the motivations behind cyber attacks and their potential impacts.
- Explore strategies and best practices to mitigate and prevent cyber attacks.

List concepts covered in this session

- Types of cyber threats: ransomware, phishing, state-sponsored intruders, etc.
- Tactics, techniques and procedures (TTPs) used by cybercriminals.
- Motivations behind cyber attacks.
- Impact of cyber attacks on the security and functioning of organisations.
- Strategies for mitigating and preventing cyber attacks.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Technical note & tutorials: Cybersecurity: Protecting your Digital Self (IST020120-U-ENG-VID)

Technical note & tutorials: Cybersecurity; The risk of Data and Algorithms (IST020268-U-ENG-VID)

SESSION 10 (ASYNCHRONOUS)

Biometrics and Facial Recognition

In this session, we will explore biometric techniques and their use in the identification of individuals, with a special focus on facial recognition. Students will learn about the principles behind biometrics, how biometric data is collected and used, and the current and potential uses of facial recognition technology in various fields.

Description of the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

Learning objectives for the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

List concepts covered in this session

- Definition and principles of biometrics.
- Types of biometric features: facial, fingerprint, iris, voice, etc.
- Processes for capturing and analysing biometric data.
- Algorithms and techniques used in facial recognition.

- Current and potential uses of facial recognition in society.
- Ethical and privacy considerations in the use of biometric technology.

PRACTICE

Analysis of the accuracy of face recognition using an online tool.

Article: Facial Recognition Technology: A Survey of Policy and Implementation Issues (Center for Catastrophe Preparedness and Response, New York University, 2009) (CED)

Article: The ethical application of biometric facial recognition technology (AI & SOCIETY (2022) 37:167–175) (Springer)

SESSION 11 (LIVE IN-PERSON)

Open Source Intelligence

In this session, we will explore the importance of Open Source Information in Intelligence (OSINT), looking at how it is used in intelligence and security information gathering. We will delve into the key concepts of OSINT and examine how it can be effectively applied in the collection, analysis and use of information to support intelligence and security operations.

Learning objectives for the session

- Understand the concept of Open Source Information in Intelligence (OSINT) and its importance in intelligence gathering.
- Become familiar with the different types of open sources available and how to access them.
- Explore the techniques and tools used in OSINT collection.
- Analyse OSINT use cases in intelligence and security operations.

List concepts covered in this session

- Definition and scope of Open Source Information in Intelligence (OSINT).
- Types of open sources, including social media, public databases, government websites, etc.
- OSINT search and collection techniques, such as advanced search engine searching, web scraping, social network analysis, etc.
- Common tools used in OSINT collection and analysis.
- OSINT use cases in intelligence and security, including threat detection, risk assessment, incident investigation, etc.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Open source intelligence (crowdstrike.com)

Article: A quantitative study of the law enforcement in using open source intelligence techniques through undergraduate practical training (Forensic Science International: Digital Investigation 47 (2023) (CED)

SESSION 12 (LIVE IN-PERSON)

Emerging Technologies and National Security

Description of the session

In this session, we will explore emerging technologies and their impact on national security. We will discuss future trends in technology and how they may affect a country's security. We will analyse how innovations in areas such as artificial intelligence, quantum computing, biotechnology, cybersecurity and robotics can transform national security and geopolitical landscapes.

Learning objectives for the session

- Identify the most relevant emerging technologies and their potential impact on national security.
- Understand how technological trends can influence national security policy-making.
- Analyse the challenges and opportunities posed by new technologies for national security.
- Explore case studies and concrete examples that illustrate the use of emerging technologies in the field of homeland security.

List concepts covered in this session

- Future trends in technology and their relevance to national security.
- Potential of quantum computing for cryptography and cyber security.
- Biotechnology applications in defence and health security.
- Ethical and legal challenges associated with the use of emerging technologies in national security.
- Mitigation and response strategies to address emerging threats.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Quantum technologies in defence & security (NATO)

SESSION 13 (LIVE IN-PERSON)

Resilience and Adaptive Governance

Description of the session

In this session, we will explore the principles of resilience and adaptive governance in homeland security. We will look at how organisations and governments can develop resilient capacities to cope with and recover from crises and threats in the national security domain. We will also examine adaptive governance approaches, which involve the ability to adapt and respond effectively to complex and changing environments.

Learning objectives for the session

- Understand the concept of resilience in the context of national security.
- Explore the key principles and components of organisational and governmental resilience.
- Analyse case studies and examples of crises and threats in homeland security and how they were addressed through resilient approaches.
- Become familiar with the principles of adaptive governance and their application in homeland security environments.
- Reflect on the importance of collaboration and coordination between different actors in building resilience and adaptive governance.

List concepts covered in this session

- Definition of resilience and its components.
- Examples of crises and threats in national security.
- Principles of organisational and governmental resilience.
- Adaptive governance approaches and their application in homeland security. Importance of collaboration and coordination in building resilience.

FINAL EXAM (25%)

19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Group Work Presentations

In the first session, Students will present the work done designing intelligence, security and crisis response strategies using the technologies discussed in class. In groups, Students will take on specific roles, such as intelligence analysts, cyber security officers, political leaders, etc.

In the second session, based on the previous strategies defined, Students will play a role in the Space and Cyber Affairs Game ([SpaceGov](#)). During the game, students will face collective action problems related to two very important challenges: space governance and cyber warfare.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

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for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.I.IoTs

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **MARIBEL ORTIZ GARCÍA**

E-mail: mortizg@faculty.ie.edu

Born in 1968, Maribel Ortiz holds a Master in Telecommunications Engineering by Madrid Polytechnical University, PDG by IESE Business School in 2006 and Women on Board Program by IESE Business School in 2017. Fluent in Spanish (Mother tongue), French, English and German she has spent her professional carrier in the Telecommunications industry, starting on technical positions and then evolving to business area, driving direct and indirect sales in international corporations in executive roles (Business unit management, general management). She has led integration of acquired companies and handled business transition when being acquired. Her main interests include STEAM innovation and disruptive Technologies, Startup entrepreneurship and Change management. Member of WA4STEAM (Women Business Angel association) since April 2019, she is since 2022 Vice president of WA4STEAM and Board Member of WA4STEAM SLU. Since August 2023 she is Adjunct professor on technology at IE IMPACT Program at IE University in Madrid, Spain.

Office Hours

Office hours will be on request. Please contact at:

mortizg@faculty.ie.edu

SUBJECT DESCRIPTION

Empowering Innovation: Exploring IoT's Practical Applications

Embark on an immersive journey into the Internet of Things (IoT) in our engaging course tailored for learners of all backgrounds. Explore the real-world applications and transformative potential of IoT across diverse industries, from healthcare to smart cities. Through captivating case studies, interactive discussions and hands-on projects, discover how IoT solutions are revolutionizing business operations, enhancing customer experiences, and addressing pressing societal challenges like sustainability.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course, with appropriate acknowledgement, except for the Reflections assignments and exam (QUIZ on Session 13). If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with the professor.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of *[AI systems link]* to *[specify how you used generative AI]*. The prompts used include *[list of prompts]*. The output of these prompts was used to *[explain how you used the outputs in your work]*

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with “pillar courses” in three of IE’s core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

- humanistic approaches to interpersonal relations, decision-making and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

The IE Challenge is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE’s core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN’s 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world’s most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

SESSION 1 (LIVE IN-PERSON)

Introduction to IoT course, SDGs and Innovation Engineering Project

Description: This session provides an overview of the Internet of Things (IoT), its core concepts, significance in modern society, synergies with Sustainability Development Goals (SDGs), and the course structure.

Learning Objectives:

Understand the course structure, assignments, grading criteria, and Innovation Engineering Project. Define the Internet of Things (IoT).

Explain the impact and significance of IoT in modern society and SDGs.

Content

- IoT and SDGS
- IoT assignments and gradings

Assignment: Semester reflection

Technical note & tutorials: Internet of Things (IST020081-U-ENG-HTM)

SESSION 2 (LIVE IN-PERSON)

Couse Methodology, Tools & groups formation

Description:

This session provides an overview of the Innovation Engineering Project (IEP) methodology, to guide the group projects, as well as introduces the Arduino Explore Kit Platform that will be used along the semester.

Learning Objectives:

Learn Course Project Methodology
Understand the Arduino Explore IoT Platform

Content:

- IoT Group Project description
- Introduction of Arduino Explore IoT Platform
- Methodology and expectations. IoT Lab access.

Group Formation

Technical note: Explorer IoT Kit Rev 2 Onboarding-guide (Arduino)

SESSION 3 (LIVE IN-PERSON)

IoT devices and sensors

Description: This session focuses on different types of IoT devices (based on function and form factor) and explores various sensors used in IoT applications

Learning Objectives:

Identify different types of IoT devices based on function and form factor.

Learn about various sensors used in IoT and their data acquisition methods.

Analyze how sensors and devices work together to collect and transmit data.

Content:

- Introduction to IoT stack: devices, communications, platforms and applications
- Key characteristics of devices in different use cases

IoT Group Project

IoT Arduino Kit in class practice

Assignment: IoT project NABC

Article: What are IoT devices (Medium.com)

SESSION 4 (LIVE IN-PERSON)

IoT communication protocols

Description: This session explores different communication protocols used in IoT applications, their strengths, weaknesses, and impact on data transmission.

Learning Objectives:

Explain the role of communication protocols in IoT data transmission

Compare and contrast different communication protocols (e.g., RFID, Bluetooth, LoRaWAN, Narrow Band IoT).

Understand the impact of communication protocols on data transfer speed, range, and security.

Content:

- Network topologies
- Communication protocols
- Key factors: (range, activity, power consumption, security)
- Short range examples: Wifi vs. RFID vs. Bluetooth
- Long range examples: LoraWan vs Narrow Band IoT

IoT Group Project

- Assignment: low tech demo
- Assignment: lab work (1/3)

SESSION 5 (LIVE IN-PERSON)

Internet of Things (IoT) platforms

Description: This session explores the world of Internet of Things (IoT) platforms, comparing different options, getting insight into the functionalities and differentiators

Learning Objectives:

Understand the core functionalities of IoT platforms (device management, data handling, analytics, security, application enablement).

Analyze the key features and deployment models of cloud-based and on-premise IoT platforms.

Evaluate the trade-offs between cloud and on-premise deployments considering factors like cost, scalability, security, and control.

Identify the appropriate platform type (cloud, on-premise, or hybrid) based on specific project needs.

Content:

Device management, Data processing, App enablement

Cloud vs. on-premise

Arduino IoT platform showcase

SESSION 6 (LIVE IN-PERSON)

IoT in the consumer domain. Real world use cases

Description: This session explores smart home technologies and their benefits for comfort and security, and wearable sensors and devices used for health monitoring and remote patient care.

Learning Objectives:

Understand the concept and benefits of IoT applications in smart homes.

Analyze real-world examples of IoT solutions in smart homes (e.g., smart lighting, automated thermostats, security systems).

Learn about wearable sensors and devices used for health monitoring (e.g., fitness trackers, smartwatches) and remote patient care.

Identify potential applications of IoT in smart homes or healthcare relevant to the group project.

Content:

Smart home uses cases
IoT health applications. Remote patient monitoring.

SESSION 7 (LIVE IN-PERSON)

IoT in the b2b domain. Real world use cases

Description: This session explores the concept of smart cities and how IoT enables efficient infrastructure management. It also covers connected vehicle technologies and their impact on transportation safety and efficiency, and explores IoT applications in smart agriculture for optimizing resource usage and crop yield.

Learning Objectives:

Understand the concept of smart cities and how IoT enables efficient infrastructure management (e.g., traffic control, waste management, energy use).

Learn about connected vehicle technologies (e.g., vehicle-to-everything communication) and their impact on transportation.

Explore IoT applications in smart agriculture (e.g., precision irrigation, soil monitoring, remote field management).

Identify potential applications of IoT in smart cities, connected vehicles, or smart agriculture relevant to the group project.

Content:

IoT in the primary sector. Smart agriculture.

Connected vehicles. V2X models. Telematics.

Smart Cities. Sustainable living.

SESSION 8 (LIVE IN-PERSON)

Industrial IoT (IIoT), energy management, retail. Real world use cases.

Description: This session defines Industrial IoT (IIoT) and explores its key applications in manufacturing and automation. It also covers how IoT can optimize energy use and improve sustainability in various sectors, and explores IoT applications in retail for inventory management, customer experience personalization, and supply chain optimization.

Learning Objectives:

Define Industrial IoT (IIoT) and understand its key applications in manufacturing and automation (e.g., predictive maintenance, process optimization).

Learn about IoT applications for energy management and improving sustainability (e.g., smart grids, building automation).

Explore how IoT is used in retail for inventory management, customer experience personalization, and supply chain optimization.

Identify potential applications of IoT in IIoT, energy management, or retail relevant to the group project.

Understand a detailed Case study in water management: IoT to better manage the water cycle, from water collection to water sewage.

Content:

Predictive maintenance, process optimization, quality assurance

Smart grids; Building automation.

Retail applications: Inventory, supply chain, customer experience

Case study: IoT to better manage the water cycle

IoT Group Project

Assignment Lab work (2/3)

Assignments:

Critical thinking exercise.

Mid semester reflection: IoT real-world problem and solution proposed

Other / Complementary Documentation: How IoT works and manufacturing (bing.com)

SESSION 9 (LIVE IN-PERSON)

AI integration in the Internet of Things

Description: This session explores how Artificial Intelligence (AI) can be integrated with IoT for data analysis and decision-making. Students will learn about the benefits of using AI in IoT applications.

Learning Objectives:

Understand how AI can be integrated with IoT for data analysis and decision-making.

Explore the benefits of using AI in IoT applications (e.g., anomaly detection, predictive maintenance).

Learn about different AI techniques (e.g., machine learning) used in conjunction with IoT data.

Content:

Intro to AI and Machine Learning

Benefits of combining AI and IoT

Anomaly detection. Predictive maintenance

AI Risks and Challenges

Other / Complementary Documentation: Supervised vs. Unsupervised Learning (Youtube)

SESSION 10 (LIVE IN-PERSON)

Emerging trends: Blockchain, edge computing

Description: This session explores emerging trends in IoT, including blockchain technology and its potential applications in IoT security and data ownership, and edge computing for processing data closer to devices.

Learning Objectives:

Understand the concept of blockchain technology and its potential applications in IoT security and data ownership. Describe blockchain and web 3.0 disruptions

Explore the benefits of edge computing in processing data closer to IoT devices.

Analyze the impact of emerging trends on the future of IoT development and applications.

Content:

Intro to Web 3.0 and blockchain

Potential application of blockchain in the IoT domain

Benefits of edge computing in processing data closer to IoT devices.

Other IoT trends

Assignment:

Critical thinking exercise

SESSION 11 (ASYNCHRONOUS)

Ethical considerations in IoT

Description: This session explores the ethical implications of widespread IoT adoption, focusing on data privacy and user consent. Students will discuss the importance of responsible development and deployment of IoT solutions.

Learning Objectives:

Analyze the ethical implications of widespread IoT adoption (e.g., data privacy, user consent, algorithmic bias).

Discuss the importance of responsible development and deployment of IoT solutions.

Explore potential ethical challenges related to security vulnerabilities and biases in AI algorithms used with IoT.

Content:

Data privacy; User consent; Algorithm Bias
Responsible development practices

Asynchronous activity: Discuss the ethical implications of IoT

Other / Complementary Documentation: Ethical Aspects of the Internet of things (Youtube)

SESSION 12 (LIVE IN-PERSON)**Security, data privacy and regulations in IoT**

Description: This session focuses on security vulnerabilities and risks associated with IoT devices and networks, and relevant regulation considerations to make when designing and deploying IoT solutions. Students will learn about best practices for securing IoT deployments.

Learning Objectives:

Understand the regulatory framework that governs data collection and ownership (with a focus on GDPR).

Identify potential security vulnerabilities and risks in IoT systems (e.g., device hacking, data breaches).

Understand best practices for securing IoT deployments (e.g., data encryption, network authentication, device management).

Learn about security protocols and frameworks designed for secure communication in IoT environments.

Content:

Regulatory framework that governs data collection and ownership

Security vulnerabilities in IoT

Best practices for securing IoT deployments

Data protection in general and impact of IoT

GDPR regulation review

Group project

Assignment: Lab work (3/3)

Article: IOT Security Issues in 2022: A Business Perspective (Thales)

SESSION 13 (LIVE IN-PERSON)

Quiz (30 min) – Sessions 1-12

Insights to Group Presentations and gradings.

SESSIONS 14 - 15 (LIVE IN-PERSON)**Teams final project presentations**

Teams 1 to 10 Final project presentations

Course wrap up**EVALUATION CRITERIA**

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)

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BEHAVIOR RULES

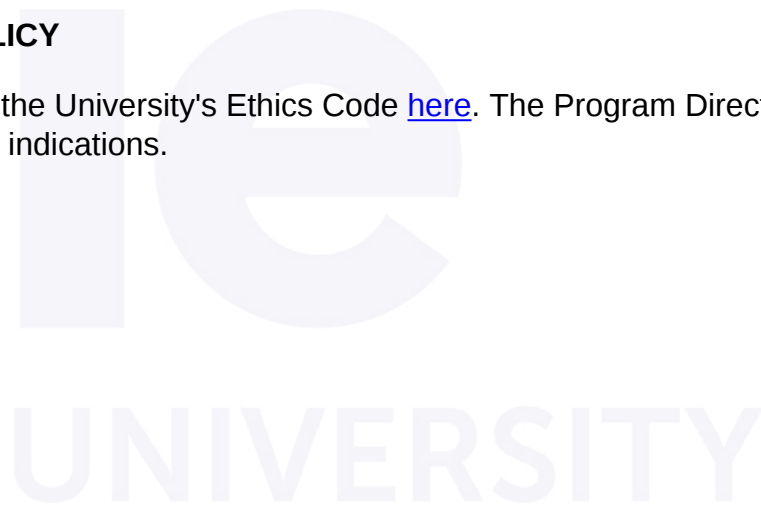
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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.L.WatScap

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **JUAN CABELLO ARRIBAS**

E-mail: jcabello@faculty.ie.edu

Juan Cabello Arribas is an Adjunct Professor at IE School of Architecture and Design (Segovia and Madrid, Spain). He holds a Bachelor of Architecture and Urbanism from Escuela Técnica Superior de Arquitectura de Madrid (UPM, Spain), a Ph.D in Architectural Design from the same University, and a Postdoc Scholarship in Architecture, completed in 2020 at PUC-RJ (Rio de Janeiro, Brazil). His teaching and interests are focused on: 1) Architectural Design Methodology, by a transdisciplinary practice (art and science) 2) Environmental techniques, technologies, systems and communities 3) Ecological Industry: aquatic ecosystems and technology.

Beyond Academia, Juan is the co-founder of PAISAJE DOMÉSTICO studio, a multi-layered practice anchored between Madrid and Granada. He also works as a collage-assemblage maker at his studio where he develops his transdisciplinary studies joining art, ecology, botany and architecture.

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Office Hours

Office hours will be on request. Please contact at:

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SUBJECT DESCRIPTION

WATER SCAPES. Multidisciplinary technologies for a sustainable

Water is the most important landscape where life takes place.

In all of its states - fog, snow, vapour, liquid- water is the main field where all the species develop their life, human beings also. The clima conditions which define our current moment as an emergency for living

However, who takes command on its health as a living ecosystem? Who warrants that water is going to be present as the most important need to stay alive on Earth? Who are the responsables of its natural characteristics as a promoter of life? Which are the disciplines involved on this process of sustainability? Which are the technologies devoted to resolve this problems? How the multidisciplinary world of hard workers - thinkers, designers, lawyers, entrepreneurs- combines their ideas to assemble a total system of technological solutions to this problem?

In other words because we are in the same boat, How could you help to resolve this situation from the discipline you are developing your studies at IE University? Which are the technologies you want to develop together with other students of the same field of action? Which are the ideas you have in your mind to face our technological future?

The course is open to IE students in order to make them concerned about the relationships between their fields of knowledge and the direct connection to technological solutions focused on waterscapes. New lawyers, designers, entrepreneurs, architects, engineers and art&humanities students are welcome to think and dream together new possibilities for the water ecosystems we share with other species as a Total Living Environment.

The course is based on an interdisciplinary approach to ecological technologies. It was organised in order to make the students aware not only about the connections of their different fields of knowledge and the world of technology but also, to invite them to share a multidisciplinary experience devoted to dream bigger and promote together different solutions for the environmental situation we are living in today. Shared knowledge, technological solutions, hope and future are the bases of this course.

The course is based on theoretical lessons and practical workshops and presentations. Different concepts on technology will be presented in class and they will be the impulses of an specific research about different tech-solutions in order to create together new ecological artefacts at the studio. From a new ecological approach, all the students will be invited to assemble together new environmental prototypes, new technological systems and new strategical mediations. The pedagogy of this course is based on the role of “play together” and “learn by playing” in order to put everybody enjoying and finding new possibilities for the future.

From different perspectives - from consumer's necessities to the world's hydrological system; from technology to the daily life; from dreams and solutions to reality; from the tap to the cloud, etc - students will get concerned about how different tech-solutions could provide different solutions for better ecological conditions.

They will get concerned about the future of the planet: it is in their hands, it is theirs. Young minds, new solutions.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences

lifestyles, behaviours, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).

- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
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Group work	20.0 %	15.0 hours
Individual studying	13.3 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Critical GenAI use is encouraged

In this course, **the use of generative artificial intelligence (GenAI) is encouraged**, with the goal of developing an informed critical perspective on potential uses and generated outputs. However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT OVERVIEW

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with “pillar courses” in three of IE’s core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

humanistic approaches to interpersonal relations, decision-making and critical thinking;
familiarity with the technologies that are applied to solve some of the world’s greatest challenges;
and
entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

The IE Challenge is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE’s core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN’s 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world’s most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

SESSION 1 (LIVE IN-PERSON)

Lecture: Introduction to Waterscapes. Multidisciplinary technologies for a sustainable world.

During this session, we will introduce the content of the course.

We will divide the section in working groups

SESSION 2 (LIVE IN-PERSON)

Lecture: Aquatic environments. Cities, lakes, rivers and seas.

During this session, it will be discussed geographical variables for human settlements.

It will be presented the content of the first workshop.

SESSION 3 (LIVE IN-PERSON)

Workshop: Make it visible!. Ideas, images and diagrams from different disciplines.

During this session, students will present a portrait of different waterscapes.

Assignment: Diverse layers of knowledge about water will be presented.

SESSION 4 (LIVE IN-PERSON)

Lecture: Consume and consumers.

During this session, it will be discussed how water systems work and how we deal with natural resources.

It will be presented the content of the second workshop.

SESSION 5 (LIVE IN-PERSON)

Workshop: Let's face the possibilities! Ideas, images and diagrams from different disciplines.

During this session, students will present strategies about possible balances between demands and consume.

Assignment: Diverse scales of consume will be presented and discussed.

SESSION 6 (LIVE IN-PERSON)

Lecture: Technology, systems and scales of approach.

During this session, it will be discussed how water systems works in different scales.

It will be presented the content of the third workshop.

SESSION 7 (LIVE IN-PERSON)

Workshop: Technological systems!

During this session, students will present a map of technological solutions on water.

Assignment: Water, market and solutions: a big map.

SESSION 8 (ASYNCHRONOUS)

Lecture: From the tap to the world.

During this session, it will be discussed how water comes and why-how-where-when it goes.

It will be presented the content of the fourth workshop.

SESSION 9 (LIVE IN-PERSON)

Workshop: Tiny responses and bigger solutions!

During this session, students will present a map of tiny technological solutions on water.

Assignment: Students will present a storyboard of daily habits and water solutions.

SESSION 10 (LIVE IN-PERSON)

Lecture: Assembling solutions: water, power and communities.

During this session, it will be discussed how different technologies work together.

It will be presented the content of the fifth workshop.

SESSION 11 (LIVE IN-PERSON)

Workshop: Let's play together!

During this session, students will discuss ways to plug-in different tech-solutions.

Assignment: Students will present a map of possible assembled solutions.

SESSION 12 (LIVE IN-PERSON)

Lecture: Trans-scalar technological infrastructures.

During this session, it will be discussed how different tech-scales could work together.

It will be presented the content of the sixth workshop.

SESSION 13 (LIVE IN-PERSON)

FINAL EXAM: Let's create a new artefact!

During this session, students will discuss how technological artefacts could work.

Assignment: Students will present a diagram of a new ecological tech-invention.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final Review: Reflections about learnings and concerns.

Students will present a portfolio of hopes, strategies, solutions and awareness

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%) individual assignments (20%) final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Final Exam (25%)
Class Participation	15 %		5 graded pre-class work reading or video preparation

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Walter K. Doods, Matt E. Whiles. (2019). *Freshwater Ecology: Concepts and Environmental Applications of Limnology*. Elsevier Science Publishing Co Inc.

ISBN 0122191358 (Digital)

- Buckminster Fuller. (2008). *Operating Manual for Spaceship Earth*. Lars Muller Publishers. ISBN 9783037781265 (Digital)

BEHAVIOR RULES

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.M.GenAI

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **JON OLEAGA GURIDI**

E-mail: joleaga@faculty.ie.edu

Jon Oleaga is the Academic Director of the Master in Digital Transformation. He is a professor at IE University, where he teaches courses in digital transformation, technology trends, coding, programming, digital marketing, big data and AI. As well as teaching at other universities in Spain and in the United States, he also delivers in-company education and consultancy on Agile methodologies for a wide range of organizations. Jon has worked in the digital arena and in digital transformation for his entire career. He worked in the digital media industry for over 20 years, with roles in SEO, SEM, social media management and web project management at Vocento (Spain's leading media group), where he was also the head of Spain's leading tech news site at the time. For the last ten years, he has also covered tech news and worked as an advisor for ABC News in Spain.

Jon's entrepreneurial experience includes founding and launching the online mailing tool VisualBox (whose clients included the Red Cross, IKEA, and the United Nations, among others). He remains connected to the startup/HUB world, traveling and working with companies in Europe, the United States and South America and with Web3 companies, crypto companies, and ICEX.

He holds Bachelor's degrees in Business Administration specialized in Marketing (University of Deusto, Spain) and Psychology (UNED, Spain) and Master's degrees in Marketing Management (University of Deusto) and Psychology (UNED), as well as an Executive MBA (IE University). A lifelong learner, he is currently finishing a degree in Anthropology.

Office Hours

Office hours will be on request. Please contact at:

joleaga@faculty.ie.edu

SUBJECT DESCRIPTION

Course Title: Low Code, No Code and Generative AI

Learning Objectives:

- Understand the concept of "no-code" and its relevance in modern technology environments.
- Utilize website builders, web app builders, and mobile app builders effectively to develop digital products without coding.
- Implement best practices for website design, content creation, and digital product design.
- Gain knowledge of automation, robotic process automation (RPA), chatbot design, and generative AI at a foundational level.
- Learn the process of creating and managing databases, integrating payment systems, and using various generative tools to produce innovative digital products.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
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IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

humanistic approaches to interpersonal relations, decision-making, and critical thinking;
familiarity with the technologies that are applied to solve some of the world’s greatest challenges;
and
entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Introduction

Overview of the course
Introduction to no-code tools and platforms
Introduction to artificial intelligence (AI)

SESSION 2 (LIVE IN-PERSON)

Websites Creation

Introduction to website builders
Best practices for website design and content creation

SESSION 3 (LIVE IN-PERSON)

Websites Creation

Introduction to website builders
Best practices for website design and content creation

SESSION 4 (LIVE IN-PERSON)

Web Apps and Mobile Apps Creation

Introduction to web app builders
Creating a web app using Bubble or Adalo
Creating a mobile app using Thunkable or Glide
Best practices for web app and mobile app design and content creation

SESSION 5 (LIVE IN-PERSON)

Web Apps and Mobile Apps Creation

Introduction to web app builders
Creating a web app using Bubble or Adalo
Creating a mobile app using Thunkable or Glide
Best practices for web app and mobile app design and content creation

SESSION 6 (ASYNCHRONOUS)

Automation 1

Automating workflows using Zapier or Integromat

SESSION 7 (LIVE IN-PERSON)

Automation 2

Robotic process automation (RPA) using UiPath or Automation Anywhere
Best practices for automation, forms, payment, and databases

SESSION 8 (LIVE IN-PERSON)

Forms

Creating forms using Google Forms or Typeform

Best practices for automation, forms, and databases

SESSION 9 (ASYNCHRONOUS)

Payments

Integrating payment systems using Stripe or PayPal

Best practices for automation, payment, and databases

SESSION 10 (LIVE IN-PERSON)

Databases

Introduction to databases

Creating and managing databases using Airtable or Google Sheets

Best practices for automation, forms, payment, and databases

SESSION 11 (LIVE IN-PERSON)

Chatbots

Introduction to chatbots

Creating a chatbot using ManyChat or Tars

Best practices for chatbot design and implementation

SESSION 12 (LIVE IN-PERSON)

Generative AI - Image Generation

Introduction to generative AI

Generating images using midjourney

SESSION 13 (LIVE IN-PERSON)

Generative AI - Text Generation

Generating text using GPT-4 or Hugging Face and other generative AI Tools

SESSIONS 14 - 15 (LIVE IN-PERSON)

Project presentations

EVALUATION CRITERIA

Participation – 15% (Total)?

Breakdown:?

10%: 5 graded pre-class work reading or video preparation: readings/videos for feedback fruits Q&A and comment threads. ?

5%: Overall in-class participation (does not include attendance). ?

Suggestion is for students to all receive a 5 out of 10 as default and receive more or lose points based on class attitude, participation in debates, conduct.?

Individual Work – 55% (Total)?

Breakdown:

10%: 2 reflections (400-700 words) ?

Start of semester: Reflection on why you chose this topic and expectations. Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society).? ?

Mid semester: Reflection on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society)

20%: At least 2 individual assignments specific to the course topic, involving critical thinking, technical aspects, case studies and/or problem-solving skills.?

?

25%: Final exam (Session 13): 19 question-multiple choice + 1 open, critical-thinking/analytical question with max. 400-word response.?

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		Class assignments per topic (Website, App, etc. finished)
Group Work	30 %		Final Group Presentation
Class Participation	15 %		Preclass work + Class Assignments

RE-SIT / RE-TAKE POLICY

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Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

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- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year).

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ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.N.Society

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1^o

Category: COMPULSORY

Language: English

Professor: **ANNA JABLONER**

E-mail: ajabloner@faculty.ie.edu

Dr. Anna Jabloner is an assistant professor of anthropology at IE University. She holds a Mag.Phil. from the University of Vienna (2004) and Ph.D. from the University of Chicago (2015). Between 2019-2023, Jabloner taught anthropology and Science & Technology Studies (STS) at Harvard University, where her teaching excellence was recognized each semester. She previously held postdoctoral fellowships at the Stanford and Columbia Medical Schools and at Goethe University Frankfurt. Jabloner's field of research is the anthropology of science and technology, with a regional specialization on California. Her work centers on the social and cultural dimensions of science, technology, medicine, and data, on biopolitics and bioethics, futurism, feminist epistemologies, gender and race, and on ethnographies of the US. Jabloner's research has been supported by the US National Institutes of Health, the Wenner-Gren Foundation, Social Science Research Council, and the Austrian Federal Ministry of Education, Science and Research, and she has authored recent articles in such journals as *Social Analysis*, *Science as Culture*, *Catalyst: Feminism, Theory, Technoscience*, *Anthropology Now*, and *Nature Biotechnology*.

Office Hours

Office hours will be on request. Please contact at:

ajabloner@faculty.ie.edu

SUBJECT DESCRIPTION

Technologies always develop in specific contexts. Groups of people think of and create technologies to solve problems and work together to build something new. In this process, society and culture make up the conditions in which technologies emerge and are thus an essential aspect of all technological progress. This course will draw on instances from a range of sectors where technologies are used and being developed – market industries, medicine, education, military, law, etc. – to learn about their social and cultural dimensions. For example, human suffering during the COVID-19 pandemic created intense pressure to quickly develop a vaccine. Within a year, lives around the globe were saved through a new bio-technology. A dark case in history is of course the atom bomb; here, war-time pressures led to rapid advances in a specific technological area. Once they are being developed or exist, technologies also impact society and culture, changing conditions in turn. For example, we are witnessing how information technologies influence political processes, such as in social media's role in organizing people into new movements, or create ethical puzzles, as we see in the debate around AI in college education. Another example is the use of genetic technologies in medicine, which is impacting how doctors practice their profession.

These ongoing dynamics – the conditions in which technologies develop, how technologies impact conditions – make it impossible to separate technology from society. Thus in this course, you will learn to put technologies into context. Doing so is essential to understanding where investment and development are needed and where technologies might actually cause new problems. In addition, studying the social contexts in which technologies develop is crucial for our ability to critically assess and manage technologies' impacts on society. At the end of the course, you will understand the entwined dynamics of technological and social change. Overall, in this basic introductory course, you will be introduced to theories and conceptualizations of technology & society. You will also have a chance to investigate specific cases and thereby apply the theories and concepts you learn about during the semester.

CASES WE WILL INVESTIGATE:

- Social media, Digital rights, and Global freedoms: What even becomes data? And what should become data but doesn't?
- Designing for inclusion and equality/Algorithmic discrimination; e.g., is facial recognition software racist? If so, can we change that?
- AI in Education: Does anyone still need to learn how to write if technology can do it for us?
- Nuclear technologies: If rapid technological development causes terrible social conditions, should we still invest in them? Or in turn, how do we weigh risks vis-a-vis sustainability, environment, and human lives?
- Reproductive technologies: Prenatal genetic testing can predict the gender of a fetus, but should such technologies be developed?

*****NOTE: There are only two books you need for class -- you can borrow them from the IE library or buy them (they should be available used for a low price):**

- Ludwik Fleck, 1979 [1935] *Genesis and Development of a Scientific Fact*. University of Chicago Press.
- Thomas Kuhn, 1996. *The Structure of Scientific Revolutions*, 3rd Edition. University of Chicago Press (please make sure you get the 3rd edition)

All other session materials will be provided on Blackboard (required and recommended readings).

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

PROGRAM

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

PLEASE NOTE THAT THE SCHEDULE BELOW IS SUBJECT TO CHANGE BASED ON THE INTERESTS AND NEEDS OF THE STUDENTS. THE MOST UPDATED INFORMATION ABOUT WHAT YOU NEED TO DO FOR EACH SESSION WILL ALWAYS BE FOUND IN THE ANNOUNCEMENTS SECTION OF BLACKBOARD.

Topic: *INTRODUCTION TO TECHNOLOGY & SOCIETY*. Discuss the course and the syllabus.

Pre-class: No readings due.

SESSION 2 (LIVE IN-PERSON)

Topic: *WHAT HAS CAUSED AND IS CAUSING THE TECHNOLOGICAL CHANGES WHOSE IMPACT WE ARE EXPERIENCING?*

Concepts covered: society, causation, technological determinism, social determinism

Learning objectives: To understand how the relationship between technology & society can be analyzed – and without getting stuck in a binary.

Pre-class: read Mackenzie & Wajcman: “Introductory Essay” in *The Social Shaping of Technology: How the Refrigerator Got Its Hum*.

Book Chapters: Mackenzie & Wajcman: “Introductory Essay” in The Social Shaping of Technology: How the Refrigerator Got Its Hum (CED)

SESSION 3 (LIVE IN-PERSON)

Topic: **DATA & JUSTICE WORKSHOP* or: “Technologies always reflect the culture that produces them...”*

Concepts covered: data, justice, social conditions & implications, approaches to ethics

Learning objectives: to understand how issues of justice exist “before” & “after” technology (e.g., national priority setting, values that shape design processes, ethical implications)

Pre-class: no readings due.

Reflection 1 due today (Details will be provided in advance).

SESSION 4 (LIVE IN-PERSON)

Topic: *THINKING AND REASONING*

Concepts covered: Thought collectives, approaches to technology & society

Learning objectives: to understand what happens in the practice of thinking and reasoning

Pre-class: read Ludwik Fleck, *Genesis and Development of a Scientific Fact*. Excerpt TBD.

Book Chapters: Ludwik Fleck, *Genesis and Development of a Scientific Fact*. Excerpt TBD (See Bibliography)

SESSION 5 (LIVE IN-PERSON)

Topic: *ARE TECHNOLOGIES THEMSELVES POLITICAL?*

Concepts covered: classic approaches in social studies of technology

Learning objectives: To understand how political processes shape technological design and how technological developments shape politics.

Pre-class: read Langdon Winner, *Do Artifacts Have Politics?* Excerpts TBD.

Article: Langdon Winner, *Do Artifacts Have Politics?* (*Daedalus*, Vol. 109, No. 1 (Winter. 1980), 121-36) (CED)

SESSION 6 (LIVE IN-PERSON)

Topic: **ALGORITHMIC DISCRIMINATION WORKSHOP** -- Is facial recognition software racist?, or, designing technology for equality

Concepts covered: new approaches to algorithmic oppression in the digital age

Learning objectives: to deepen the understanding of where issues of data and justice arise

Pre-class: read Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. Introduction. Excerpt TBD.

First deliverable due for final presentations. Details TBD.

Book Chapters: Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. Introduction (CED)

SESSION 7 (LIVE IN-PERSON)

Topic: *WHAT MAKES A FACT A FACT?*

Concepts covered: facts, truths, authoritative knowledge

Learning objectives: to understand elemental conceptualizations of facts

Pre-class: read Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*. Chapters 1, 2 and 4 (See also Bibliography).

Book Chapters: Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*. Princeton University Press, 2013. Chapter 1 (CED)

SESSION 8 (LIVE IN-PERSON)

FIRST 45 MINUTES: MIDTERM (multiple choice & reflection 2 on the course, 400 words)

Topic: In-class Workshop on Social Dimensions of Nuclear Technologies / Reproductive Technologies

We will divide into two groups that work on these topics respectively. I will have a list of questions to guide you in your research on these topics. You will learn some basics of these two fields of technological development (e.g. what scientific disciplines do they draw on? What machinery do they use? Are they digital technologies / how has the digital revolution changed these fields?) Given our class topic and to approach such technologies' societal embedding, you will generate a list of steps to take in a research project, centered on historical emergence, risks and benefits, sustainability, ethical implications, etc. For example, we might ask what problems in society lead to the development of these sectors in the first place, where you would need to look/go to answer questions about what cell free fetal DNA is, or what kind of expert you would need to interview to understand the risks of nuclear technologies.

Pre-class: no reading due.

SESSION 9 (LIVE IN-PERSON)

Topic: HOW DOES SCIENCE CHANGE? PART I

Concepts covered: paradigms, scientific process & progress, scientific revolutions

Learning objectives: To become familiar with a seminal text in philosophy of science and understand its core concept of the scientific paradigm.

Pre-class: read Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, Excerpt TBD & Barry Barnes, 3-page section on "Similarity Relations" in *T.S. Kuhn and Social Science*.

Book Chapters: Thomas Kuhn, The Structure of Scientific Revolutions, 3rd edition, Excerpt TBD (See Bibliography)

Book Chapters: Barry Barnes, 3-page section on "Similarity Relations" in T.S. Kuhn and Social Science (CED)

SESSION 10 (ASYNCHRONOUS)

Topic: HOW DOES SCIENCE CHANGE? PART II

In this asynchronous session, you will finish reading Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, and an excerpt from Emily Martin's article, "The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles."

We will have a short assignment on Blackboard due the same week as (but after) Session 9: on Wednesday for Segovia students and on Friday for Madrid students.

Article: Emily Martin, The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles (Signs, Vol. 16, No. 3 (Spring, 1991), pp. 485-501) (CED)

SESSION 11 (LIVE IN-PERSON)

Topic: HOW CAN WE STUDY CURRENT SCIENTIFIC AND TECHNOLOGICAL PRACTICE?

Concepts covered: epistemic culture, how humans relate to machines

Learning objectives: to understand the basics of empirical social science research on technology, understanding social analysis of technology

Pre-class: read Karin Knorr Cetina, *Epistemic Cultures: How the Sciences Make Knowledge*. Excerpt TBD.

Second deliverable due for final presentations. Details TBD.

Book Chapters: Karin Knorr Cetina, Epistemic Cultures: How the Sciences Make Knowledge. Chapters 1 and 5 (CED)

SESSION 12 (LIVE IN-PERSON)

Topic: *WHAT IS OBJECTIVITY AND WHO DO WE TRUST TO BE OBJECTIVE?*

Concepts covered: objectivity, subjectivity, authority, positionality, trust, expertise

Learning objectives: to understand how the contemporary idea of objectivity developed in history (objectivity used to mean the opposite of what it does now!)

Pre-class: read Daston, Lorraine & Galison, Peter, *Objectivity* Ch 1 and Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin* (or Donna Haraway, *Situated Knowledge*). Excerpts TBD.

Book Chapters: Daston, Lorraine & Galison, Peter, *Objectivity*. Ch 1 (CED)

Book Chapters: Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin*. Chapter 7 (CED)

Article: *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective* (*Feminist Studies*, Vol. 14, No. 3 (Autumn, 1988), pp. 575-599) (CED)

SESSION 13 (LIVE IN-PERSON)

Final Exam (25%)

Details on the final exam will be provided in advance.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Student Presentations (7-10minutes for each group, Q&A, 20%)

Self and Peer Review of Presentations (numeric and with commentaries) due TBD (10%)

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		5% Reflection 1, 25% Midterm (incl Reflection 2), 25% Final Exam
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) • Self and Peer Review (10%)
Class Participation	15 %		10% graded pre-class work Reading or video preparation. • 5% Overall in-class participation (does not include attendance)

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Compulsory

- Thomas Kuhn. (1996). *The Structure of Scientific Revolutions*. 3rd Edition. The University of Chicago Press. ISBN 0226458083 (Printed)
- Ludwik Fleck. (1979). *Genesis and Development of a Scientific Fact*. The University of Chicago Press. ISBN 0226253252 (Printed)

Recommended

- Bruno Latour. *Laboratory Life: The Construction of Scientific Facts*. Princeton Paperbacks. ISBN 9780691028323 (Digital)

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.



TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.P.Securit

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **LUIS ANGEL GALINDO SANCHEZ**

E-mail: lgalindo@faculty.ie.edu

- PhD Telecommunication Engineer (2012). Polytechnic University of Madrid. ANECA accredited.
- Executive MBA (2006). IESE Business School – University of Navarra.
- Master, Service and Security in IP Networks (2005). Polytechnic University of Madrid.
- Specialist, Network and Advanced Internet Systems (1998). Carlos III University of Madrid.
- Specialist, Voice Codification (1997). Carlos III University of Madrid.
- Adjunct Professor at IE teaching ADSS, Technology Scouting, Cybercrime, IE Impact/Technology, Cybersecurity, Automation and Security Engineering and Advanced Databases.
- Visiting Associate Professor at HEC Montreal (from 2018 till now), where I teach Entrepreneurship with my own methodology to assess the business potential of a value proposal.
- Professor in the Master of Cybercrime Master at Nebrija University (from 2018 till now).
- Responsible of the AI area applied to the detection of cybercriminals. Teaching police officers how to use Big Data and Machine Learning Technologies to be more efficient working with deep and dark web at Nebrija University.
- Associate Professor at Carlos III University of Madrid (from 2007 till now). Professor of Computer networks, Secure Communications, Cybersecurity and Data protection.
- Defined, developed and implemented a successful open innovation model, generating new relevant revenue streams results. Selective results include an increase of +200 startups working under this model with +6000 companies analyzed. Increase in revenue of +10% y-o-y leveraged on the innovative assets.
- He has defined, developed and implemented a successful Digital Transformation Learning Program for more than 8 years and +2000 people trained, receiving Telefonica Excellent

Teacher award along 7 consecutive years.

- Principal Investigator in 7 EU funded projects ((previously in 4 more) based on the technological skills that Luis has in fields like Cybersecurity, Cyber Defense, AI, Cloud Computing or IoT. He personally researches in the application of AI to the cybersecurity and cybercrime.
- Teacher in several recognised universities and business schools with excellent marks from 2007.
- Luis, as High Performance Senior Consultant, has implemented +20 consultancy complex projects worldwide for large enterprises in AI, economical intelligence, cybersecurity, business development, digital transformation, risk assessment, process optimization and people management issues.
- Luis is an expert at understanding customers and translating their needs into actual sales by developing new markets or new products & services and Digital mindset within everyone in the organization.
- He has had a leading role in complex M&A processes with digital assess acquisition like in the first world integration of a MVNO and a social network.
- Frequent speaker at Innovation and Tech international conferences. He considers himself a creovator.
- He participates in several startups using AI (ML, Computer Vision...), Robotics and Sensing.

Office Hours

Office hours will be on request. Please contact at:

lgalindo@faculty.ie.edu (email me in advance, if you wish to schedule a chat or a meeting).

SUBJECT DESCRIPTION

Insights into Modern Intelligence: Exploring Technology's Role in National Security

Join us for an illuminating journey into the world of modern intelligence operations and the pivotal role technology plays in safeguarding national security. In "Insights into Modern Intelligence," we delve into the fascinating realm of espionage, surveillance, and intelligence gathering, offering a comprehensive overview accessible to all audiences.

Through engaging discussions and captivating case studies, we explore how governments leverage technology to enhance their intelligence capabilities, ensuring the safety and security of their citizens in an ever-evolving geopolitical landscape. From traditional methods of information gathering to cutting-edge cyber tactics, we unravel the intricacies of intelligence operations and shed light on the ethical considerations and societal implications of these practices.

By participating in this course, students will gain a deeper understanding of:

1. The evolution of intelligence gathering techniques and the role of technology in shaping modern geopolitics.
2. The utilization of advanced surveillance systems, data analytics, and artificial intelligence in intelligence operations.
3. The ethical dilemmas and legal frameworks surrounding intelligence gathering and surveillance practices.

4. The impact of cyber threats and digital vulnerabilities on national security and the strategies employed to mitigate these risks.
5. The importance of interdisciplinary collaboration and information sharing in fostering effective intelligence operations.
6. The emerging field of cyber intelligence and its significance in addressing contemporary security challenges.
7. The principles of resilience and adaptive governance in building resilient cities and communities in the face of threats and disruptions.

By mastering these concepts and acquiring hands-on experience with cutting-edge technologies, students will develop invaluable skills in critical thinking, problem-solving, data analysis, and strategic decision-making. Join us in unraveling the complexities of modern intelligence and shaping the future of national security.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course for research, ideation, generating an outline, proofreading, grammar check, coding, image generation with appropriate acknowledgement. GenAI may not be used for exams. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with “pillar courses” in three of IE’s core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

- humanistic approaches to interpersonal relations, decision-making and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

The **IE Challenge** is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE’s core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN’s 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

SESSION 1 (LIVE IN-PERSON)

Introduction to Modern Intelligence and National Security

Course overview and discussion of basic intelligence and national security concepts. We will see the different sessions, objectives and expected work to be done along the sessions.

Intro to the Course

Course summary: contents description.

IE and Students expectations.

Assignments and Grading.

SESSION 2 (LIVE IN-PERSON)

Big Data

In this session, we will explore the world of Big Data, focusing on how it is collected, stored and used in the intelligence domain. We will also examine data regulation, including the laws and regulations governing the collection, storage and use of big data.

Learning objectives for the session

- Understand the fundamental concepts of Big Data and its application in the field of intelligence.
- Become familiar with the methods and technologies used to collect and store large volumes of data.
- Explore the ethical and legal challenges related to the collection and use of Big Data.
- Understand the regulations and standards that affect the management of big data.

List concepts covered in this session

- Definition and characteristics of Big Data.
- Methods of large-scale data collection.
- Applications of Big Data in the field of intelligence and security.
- Ethical and legal aspects of Big Data use.
- Relevant regulations and standards, such as GDPR, CCPA

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: How to find out what Google knows about you and limit the data it collects (CNBC)

Other / Complementary Documentation: The Dangers of Video Surveillance and A.I. (Youtube)

Other / Complementary Documentation: Big Data: A Revolution That Will Transform How We Live,

SESSION 3 (LIVE IN-PERSON)

IoT and Smart Technologies

In this session we will explore the fascinating world of smart technology and the Internet of Things (IoT), examining how these advances are transforming our daily lives and their relevance to national security.

We will look at how internet-connected smart devices are collecting real-time data, from sensors in smart cities to home devices, and how this information can be used to improve decision-making in intelligence and security operations.

Learning objectives for the session

- Understand what the Internet of Things is and how it works.
- Explore the practical applications of IoT in different sectors, such as health, agriculture, industry, etc.
- Analyse smart technologies, such as sensors, actuators, and control systems, and their role in building smart environments.
- Discuss the security and privacy challenges associated with the mass deployment of IoT devices.
- Consider the opportunities and risks presented by smart cities and the Internet of Things in general.

List concepts covered in this session

- Definition and characteristics of the Internet of Things.
- Typical architecture of an IoT solution.
- IoT applications in different sectors, such as health, agriculture, industry, etc.
- Key technologies used in smart systems, such as sensors, actuators and control systems.
- IoT security and privacy: threats, vulnerabilities and best practices for protection.
- The role of IoT in the development of smart cities and the improvement of urban quality of life.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Security and Privacy Challenges in the Internet of Things (IEEE)

Article: Smart City Architecture and its Applications Based on IoT (Procedia Computer Science Volume 52, 2015, Pages 1089-1094) (Elsevier)

SESSION 4 (LIVE IN-PERSON)

Artificial Intelligence

In this session, we will dive into the exciting field of Artificial Intelligence (AI), exploring how this advanced technology is fundamentally transforming the way intelligence and national security services operate. We will look at how machine learning algorithms and artificial neural networks are being applied in a variety of scenarios, from detecting patterns in large datasets to automating complex intelligence analysis tasks.

Learning objectives for the session

- Understand the basic concepts of Artificial Intelligence and its subfields.
- Explore applications of AI in sectors such as health, education, commerce and industry.
- Discuss the ethical and social implications of AI, including issues such as privacy, algorithmic

discrimination and employment automation.

List concepts covered in this session

- Definition and types of Artificial Intelligence.
- Practical applications of AI in everyday life and in various sectors.
- AI algorithms and techniques, such as machine learning, neural networks, etc.
- AI ethics and social considerations. Future challenges and opportunities in the field of AI.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Other / Complementary Documentation: Machine Learning vs Deep Learning (Youtube)

Other / Complementary Documentation: Supervised vs. Unsupervised Learning (Youtube)

Technical note & tutorials: Types of Algorithms (ENT020208-U-ENG-VID)

SESSION 5 (LIVE IN-PERSON)

Robotics and Aerial Surveillance

In this session, we will delve into the impact of robotics and aerial surveillance on data collection and target surveillance, exploring how these technologies are revolutionising traditional methods of intelligence gathering and providing an unprecedented perspective on homeland security. We will look in detail at how drones and other robotic systems are being used to conduct surveillance, reconnaissance and data collection missions in remote or hard-to-reach environments, as well as in urban and critical areas.

Learning objectives for the session

- Understand the role of robotics and aerial surveillance in data collection and target surveillance.
- Explore the applications of drones and other robotic systems in intelligence and security missions.
- Analyse the challenges and opportunities associated with the use of aerial surveillance technologies.
- Discuss the ethical and legal implications of aerial surveillance in society.

List concepts covered in this session

- Introduction to robotics and aerial surveillance.
- Types of drones and robotic systems used in surveillance.
- Applications of aerial surveillance in civilian and military environments.
- Technical and operational challenges of aerial surveillance.
- Impact of aerial surveillance on privacy and civil rights.
- Strategies to mitigate risks associated with aerial surveillance.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Unmanned Aerial Vehicles for Civil Applications: A Review (MDPI)

Article: Robotic Vision for Human-Robot Interaction and Collaboration: A Survey and Systematic Review (Transactions on Human-Robot Interaction, Vol. 12, No. 1, Article 12, 2023) (ACM)

Article: Societal acceptance of urban drones: A scoping literature review (Technology in Society 75, 2023) (Elsevier)

SESSION 6 (LIVE IN-PERSON)

Generative AI and Content Automation

In this session, we will see what is Generative AI, the main tools, etc We will explore how generative AI is transforming the production of information and content and how can be used in the national intelligence.

Learning objectives for the session

- Understand the basic concepts of Generative Artificial Intelligence (AI) and Content Automation.
- Explore the practical applications of generative AI in the creation of visual, auditory and textual content.
- Analyse examples of the use of generative AI in the national intelligence.
- Discuss the ethical and social implications of content automation and generative AI.

List concepts covered in this session

- Definition and principles of Generative Artificial Intelligence.
- Techniques and algorithms used in content generation by AI, such as GANs, recurrent neural networks, among others.
- Practical applications of generative AI in the creation of audiovisual content, generative text, etc. and the use by national intelligence.
- Outstanding examples of generative AI projects and applications.
- Discussion of ethical challenges and concerns related to content automation and generative AI.

PRACTICE

Using prompts to get useful insights in national security.

Article: Generative AI: A New Frontier in Artificial Intelligence (Deloitte)

Other / Complementary Documentation: Introduction to Generative AI (Google; Youtube)

Other / Complementary Documentation: Algorithmic Bias and Fairness (Crash Course; Youtube)

SESSION 7 (LIVE IN-PERSON)

XR. Extended Reality

Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR): Exploring how AR, VR and MR are being used in intelligence and security applications, enabling visualisation of complex data, simulation of security scenarios, training of personnel, remote surveillance and collaboration in virtual environments.

Learning objectives for the session

- Understand the concepts of augmented reality, virtual reality and mixed reality.
- Explore the applications of AR, VR and MR in the field of intelligence and security.
- Become familiar with the technologies and devices used in AR, VR and MR by immersing in this virtual ecosystem.
- Analyse how these technologies can enhance data visualisation and simulation of security scenarios.
- Discuss the challenges and ethical considerations in the use of AR, VR and RM in security applications.

List concepts covered in this session

- Definition and differences between augmented reality, virtual reality and mixed reality.
- Applications of AR, VR and MR in intelligence and security, such as remote surveillance, scenario simulation, personnel training, etc.

- Technologies and devices used in AR, VR and MR, such as virtual reality glasses, augmented reality viewers, etc.
- Examples of XR use cases in security and defence applications.
- Challenges and ethical considerations in the use of these technologies.

PRACTICE

We will use the IE Metaverse platform to take an important decision in our role inside this virtual environment with an immersive experience.

Article: Use of virtual reality simulators for training programs in the areas of security and defense: a systematic review (Multimedia Tools and Applications (2020) 79: 3495–3515) (CED)

Article: No pain, no gain? The effects of adding a pain stimulus in virtual training for police officers (Taylor&Francis)

SESSION 8 (LIVE IN-PERSON)

Blockchain

In this session, we will discuss on blockchain technology and its impact on information security, along with cryptocurrencies and their role in financial transactions.

Learning objectives for the session

- Understand the fundamental concepts of blockchain technology and how it works.
- Analyse the impact of blockchain technology on information security and data management.
- Explore the applications of blockchain in different sectors.
- Study the characteristics and operation of cryptocurrencies, such as Bitcoin and Ethereum.
- Assess the risks and challenges associated with the use of cryptocurrencies in financial transactions.

List concepts covered in this session

- Blockchain technology: definition, characteristics and operation.
- Types of blockchains: public, private and consortium.
- Applications of blockchain in information security and data management.
- Cryptocurrencies: characteristics, operation and types.
- Blockchain use cases in different industries.
- Security and privacy in financial transactions with cryptocurrencies.

PRACTICE

In this session, we will create our own crypto wallet to understand better how a Blockchain is.

Technical note & tutorials: Moving Forward: The Blockchain Opportunity (IST020192-U-ENG-VID)

Technical note & tutorials: Cryptocurrencies and Bitcoin (IST020387-U-ENG-VID)

SESSION 9 (LIVE IN-PERSON)

Cybersecurity

In the session dedicated to Cyber Security, we will delve into the analysis of the growing cyber threats facing governments and organisations today, from ransomware and phishing attacks to sophisticated intrusions backed by state actors and hacker groups. We will explore in detail the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and information systems, as well as the motivations behind these attacks, ranging from data theft and extortion to sabotage and interference in government operations.

Learning objectives for the session

- Understand the current cyber threats facing governments and organisations.
- Become familiar with the different forms of cyber attacks, such as ransomware, phishing and intrusions.
- Understand the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and systems.
- Analyse the motivations behind cyber attacks and their potential impacts.
- Explore strategies and best practices to mitigate and prevent cyber attacks.

List concepts covered in this session

- Types of cyber threats: ransomware, phishing, state-sponsored intruders, etc.
- Tactics, techniques and procedures (TTPs) used by cybercriminals.
- Motivations behind cyber attacks.
- Impact of cyber attacks on the security and functioning of organisations.
- Strategies for mitigating and preventing cyber attacks.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Technical note & tutorials: Cybersecurity: Protecting your Digital Self (IST020120-U-ENG-VID)

Technical note & tutorials: Cybersecurity; The risk of Data and Algorithms (IST020268-U-ENG-VID)

SESSION 10 (ASYNCHRONOUS)

Biometrics and Facial Recognition

In this session, we will explore biometric techniques and their use in the identification of individuals, with a special focus on facial recognition. Students will learn about the principles behind biometrics, how biometric data is collected and used, and the current and potential uses of facial recognition technology in various fields.

Description of the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

Learning objectives for the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

List concepts covered in this session

- Definition and principles of biometrics.
- Types of biometric features: facial, fingerprint, iris, voice, etc.
- Processes for capturing and analysing biometric data.
- Algorithms and techniques used in facial recognition.

- Current and potential uses of facial recognition in society.
- Ethical and privacy considerations in the use of biometric technology.

PRACTICE

Analysis of the accuracy of face recognition using an online tool.

Article: Facial Recognition Technology: A Survey of Policy and Implementation Issues (Center for Catastrophe Preparedness and Response, New York University, 2009) (CED)

Article: The ethical application of biometric facial recognition technology (AI & SOCIETY (2022) 37:167–175) (Springer)

SESSION 11 (LIVE IN-PERSON)

Open Source Intelligence

In this session, we will explore the importance of Open Source Information in Intelligence (OSINT), looking at how it is used in intelligence and security information gathering. We will delve into the key concepts of OSINT and examine how it can be effectively applied in the collection, analysis and use of information to support intelligence and security operations.

Learning objectives for the session

- Understand the concept of Open Source Information in Intelligence (OSINT) and its importance in intelligence gathering.
- Become familiar with the different types of open sources available and how to access them.
- Explore the techniques and tools used in OSINT collection.
- Analyse OSINT use cases in intelligence and security operations.

List concepts covered in this session

- Definition and scope of Open Source Information in Intelligence (OSINT).
- Types of open sources, including social media, public databases, government websites, etc.
- OSINT search and collection techniques, such as advanced search engine searching, web scraping, social network analysis, etc.
- Common tools used in OSINT collection and analysis.
- OSINT use cases in intelligence and security, including threat detection, risk assessment, incident investigation, etc.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Open source intelligence (crowdstrike.com)

Article: A quantitative study of the law enforcement in using open source intelligence techniques through undergraduate practical training (Forensic Science International: Digital Investigation 47 (2023) (CED)

SESSION 12 (LIVE IN-PERSON)

Emerging Technologies and National Security

Description of the session

In this session, we will explore emerging technologies and their impact on national security. We will discuss future trends in technology and how they may affect a country's security. We will analyse how innovations in areas such as artificial intelligence, quantum computing, biotechnology, cybersecurity and robotics can transform national security and geopolitical landscapes.

Learning objectives for the session

- Identify the most relevant emerging technologies and their potential impact on national security.
- Understand how technological trends can influence national security policy-making.
- Analyse the challenges and opportunities posed by new technologies for national security.
- Explore case studies and concrete examples that illustrate the use of emerging technologies in the field of homeland security.

List concepts covered in this session

- Future trends in technology and their relevance to national security.
- Potential of quantum computing for cryptography and cyber security.
- Biotechnology applications in defence and health security.
- Ethical and legal challenges associated with the use of emerging technologies in national security.
- Mitigation and response strategies to address emerging threats.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Quantum technologies in defence & security (NATO)

SESSION 13 (LIVE IN-PERSON)

Resilience and Adaptive Governance

Description of the session

In this session, we will explore the principles of resilience and adaptive governance in homeland security. We will look at how organisations and governments can develop resilient capacities to cope with and recover from crises and threats in the national security domain. We will also examine adaptive governance approaches, which involve the ability to adapt and respond effectively to complex and changing environments.

Learning objectives for the session

- Understand the concept of resilience in the context of national security.
- Explore the key principles and components of organisational and governmental resilience.
- Analyse case studies and examples of crises and threats in homeland security and how they were addressed through resilient approaches.
- Become familiar with the principles of adaptive governance and their application in homeland security environments.
- Reflect on the importance of collaboration and coordination between different actors in building resilience and adaptive governance.

List concepts covered in this session

- Definition of resilience and its components.
- Examples of crises and threats in national security.
- Principles of organisational and governmental resilience.
- Adaptive governance approaches and their application in homeland security. Importance of collaboration and coordination in building resilience.

FINAL EXAM (25%)

19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Group Work Presentations

In the first session, Students will present the work done designing intelligence, security and crisis response strategies using the technologies discussed in class. In groups, Students will take on specific roles, such as intelligence analysts, cyber security officers, political leaders, etc.

In the second session, based on the previous strategies defined, Students will play a role in the Space and Cyber Affairs Game ([SpaceGov](#)). During the game, students will face collective action problems related to two very important challenges: space governance and cyber warfare.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade

for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.

- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE- IMPACT.2.M.Q.ClimTec

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **PATRICIA JIMENEZ AMAT**

E-mail: pjimeneza@faculty.ie.edu

Patricia Jiménez is an ecologist and PhD in Environmental Science and Technology. She is an independent consultant and researcher in soil ecology and climate change mitigation and adaptation strategies focused on land management.

She has dedicated her professional career to studying and understanding the functioning of ecosystems. She started focusing on oceanography, working in CSIC as a research technician in laboratory and oceanographic campaigns. She did her PhD working on paleoceanography and marine paleoclimatology, reconstructing natural past climate variability during the last two glacial-interglacial transitions. After working in academic research, she moved on to the business development and project management areas where she focused on the implementation of science in tangible strategies and tools in order to improve mitigation and adaptation to climate change.

She is passionate about terrestrial ecosystems and soil regeneration as a key mitigation and adaptation global strategy. She applies her experience, skills and knowledge in boosting and fostering initiatives and tools that provide long-term resilience of our ecosystems.

Academic Background:

- Bachelor Degree in Biology, specializing in Ecology, UCM.
- Master's degree in Oceanography from the Spanish Council for Scientific Research, CSIC.
- PhD in Environmental Science and Technology, on past climate variability, ICTA-UAB.
- Expert Diploma in Promotion and Management of International Projects and Actions in R+D+i, UPM.
- Consultant and microscopy technician certified by the Soil Food Web School.

Office Hours

Office hours will be on request. Please contact at:

Office hours: After-class (upon appointment)

Contact details: pjimeneza@faculty.ie.edu

SUBJECT DESCRIPTION

Embark on a transformative journey with our Climate Technology course, designed to empower you with a deep understanding of climate change and its profound impact on our daily lives. This course is not just about learning; it's about becoming a part of the solution.

Our holistic, transdisciplinary, and integrative approach will guide you through the complexities of global change. We believe that to tackle such a multifaceted issue, an interdisciplinary perspective is essential. Our first step is to comprehend the climate system itself, to grasp the changes it's undergoing, and to understand the far-reaching consequences at all levels.

We will then move into mitigation and adaptation strategies and technological solutions. It's in our hands to act within our areas of expertise to build the solutions of the future. Through adaptation and mitigation actions, we can build a more resilient society. Join us and be a part of this crucial journey towards a sustainable future.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours

Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Technology course – Climate Solutions

- o Explain course dynamics.
- o Start of the course challenge, group configuration and countries
- o What do you know: exploratory quiz.

SESSION 2 (ASYNCHRONOUS)

Sustainability Topics:

- Environment

Introduction to the Climate system and its dynamics

- o Know the components of the climatic system: spheres, sinks, flows.
- o Learn how the climate system works: heat budget and flow, atmospheric circulation, ocean circulation, feedback.
- o Biogeochemical Cycles-link carbon and water cycle.

Article: The Climate System: an Overview (IPCC)

SESSION 3 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Climate Change

- o Understanding the basics of climate change
- o The science behind global warming and greenhouse gases

Article: What is climate change (UN)

Article: What is climate change (NASA)

SESSION 4 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Impact of Climate Change

- o Discussing the environmental, economic, and social impacts of climate change
- o Case studies on the effects of climate change, primary and secondary, students will research and present.

Article: Consequences of Climate Change (European Commission)

Article: Greenhouse gases affect Earth's energy balance and climate (The Royal Society)

SESSION 5 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Climate Change Mitigation and adaptation

- o Understanding the concept of climate change mitigation and adaptation, resilience, and resilience.
- o Exploring various strategies for reducing greenhouse gas emissions.
- o What are we adapting to?

Article: Responding to climate change: mitigation and adaptation (NASA)

Book Chapters: Inter-relationships between adaptation and mitigation (IPCC)

SESSION 6 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Industrial)

- o Understanding the technology behind carbon capture and storage: Where and how.
- o Geoengineering
- o Discussing the potential and limitations of this technology-approach.

Article: Negative emissions technologies and practices: the way forward (European Commission)

SESSION 7 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Nature Based)

- o Exploration of various nature-based NETs such as afforestation, reforestation, blue carbon (carbon captured by oceans and coastal ecosystems), and soil carbon sequestration.
- o Examination of real-world applications and case studies of nature-based NETs.

Article: Could negative emissions actually help curb climate change? (European Commission)

Supporting materials: articles will be provided.

SESSION 8 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Regenerative agroecology and land management, going beyond sustainable agriculture.

- Exploring the connection between agriculture, farming, and climate change
- Techniques for promoting real sustainable food production systems agriculture.

Other / Complementary Documentation: Ganado o Desierto (Desert or Livestock)

Supporting materials: Movies Kiss the Ground (available on Netflix) or Ganado o Desierto.

SESSION 9 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Green Cities

- Understanding the concept of green cities
- Role of green cities in reducing greenhouse gas emissions and improving water use.
- Madrid Deep Demonstration project, EIT Climate KIC
- Towns in Transition

Article: Supporting municipalities to develop collaboration capability to facilitate urban transitions and sustainability: Role of transition intermediaries in Madrid (Journal of Cleaner Production 426 (2023) (CED)

Other / Complementary Documentation: Towns in Transition

SESSION 10 (ASYNCHRONOUS)

Sustainability Topics:

- Environment
- Governance

Climate Change Policy

- o Discussing the role of policy in climate change mitigation and adaptation
- o Review of international climate agreements and policies

Other / Complementary Documentation: COP meetings

SESSION 11 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Social Challenge

Climate Change and Society

- o Understanding the social dimensions of climate change
- o Role of individual and collective action in climate change mitigation

Article: Social Dimensions of Climate Change (The World Bank)

Other / Complementary Documentation: IPCC 6th Report: Climate Change 2022: Impacts, Adaptation and Vulnerability

SESSION 12 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Climate Change Communication

- o Importance of effective communication in climate change mitigation
- o Techniques for communicating about climate change to diverse audiences.
- o Discussing the role of innovation in climate change mitigation

Other / Complementary Documentation: Communicating on Climate Change (UN)

Supporting materials: articles, booklets will be provided.

SESSION 13 (LIVE IN-PERSON)**Sustainability Topics:**

- Environment
- Governance
- Social Challenge

FINAL EXAM

SESSIONS 14 - 15 (LIVE IN-PERSON)**Sustainability Topics:**

- Environment
- Governance
- Social Challenge

Climate Change Innovation

Students present their work.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		Class participation should be active, engaged and always respectful with the professor and fellow students.

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

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- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

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In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- José Carlos Magalhães Pires and Ana Luísa Da Cunha Gonçalves. *Bioenergy*

with Carbon Capture and Storage Using Natural Resources for Sustainable Development. ISBN 9780128162 (Digital)

- Puay Yok Tan (Editor), Chi Yung Jim (Editor). *Greening Cities: Forms and Functions (Advances in 21st Century Human Settlements)*. ISBN 9811350515 (Digital)

- Jose Carlos Magalhaes Pires (Redactor), Ana Luisa da Cunha Goncalves (Redactor). *Bioenergy with Carbon Capture and Storage: Using Natural Resources for Sustainable Development*. Academic press. ISBN 0128162295 (Digital)

- Puay Yok Tan (Editor), Chi Yung Jim (Editor). *Greening Cities: Forms and Functions (Advances in 21st Century Human Settlements)*. ISBN 9811350515 (Digital)

- Jose Carlos Magalhaes Pires (Redactor), Ana Luisa da Cunha Goncalves (Redactor). *Bioenergy with Carbon Capture and Storage: Using Natural Resources for Sustainable Development*. Academic press. ISBN 0128162295 (Digital)

- Puay Yok Tan, Chi Yung Jim. *Greening Cities*. Springer Link. ISBN 9789811041 (Digital)

<https://link.springer.com/book/10.1007/978-981-10-4113-6>

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.R.AlinAct

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **CRISTINA GARCÍA JIMÉNEZ**

E-mail: cristinag@faculty.ie.edu

Cristina's career has been a journey across the automotive, banking, fintech, and insurance sectors. She is currently pioneering a new business category at MASORANGE: Telco-Insurance, where leveraging data and AI stands as a pivotal success factor. Cristina is dedicated to harnessing technology to surpass customer expectations.

At Bankinter, positioned at the crucial intersection of finance and technology, she thrived in an environment where decisions were always made with people's welfare in mind, grounded in trust and data. She then explored the startup world with Masmovil, captivated by technology's transformative potential. As the leader of PSN Group, she transformed a traditional insurance company into a modern, tech-forward mutual insurer.

Cristina's educational achievements include a double degree in European Business Administration from ICADE (Madrid) and a BSc in Business Administration from Northeastern University (Boston). Among others, she has also earned advanced certifications from IESE and IC-A (Instituto de Consejeros-Administradores), further solidifying her expertise and commitment to excellence in her field.

Office Hours

Office hours will be on request. Please contact at:

cristinag@faculty.ie.edu

SUBJECT DESCRIPTION

In today's rapidly evolving business landscape, staying ahead of technological advancements is both a challenge and a necessity. The pace and depth of innovation in fields like Artificial Intelligence (AI) are staggering, making it increasingly difficult to remain updated. Continuous learning is no longer optional; it's essential. This is where "AI in Action: Transforming Business Futures" steps in, offering a comprehensive exploration of AI's transformative role across various industries.

This course is designed to equip students with the knowledge and skills to navigate the complexities of the modern business world. Through a curriculum that covers AI fundamentals, the impact of generative AI, and the nuances of prompt engineering, participants will build a robust toolkit for innovation and problem-solving.

The course emphasizes practical application, from ideation to implementation, allowing students to engage in hands-on activities and team projects. Under professor's mentorship, students will not only devise AI-driven business solutions but also delve into the ethical implications and cybersecurity challenges associated with deploying AI technologies. The program also highlights the critical leadership qualities needed to excel in an era dominated by AI.

"AI in Action: Transforming Business Futures" is a valuable resource for those eager to carve out a successful path in the business world, harnessing the extraordinary capabilities of AI. In a time when keeping abreast of technological advancements is imperative, this course offers a roadmap for continuous learning and adaptation.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Critical GenAI use is encouraged.

In this course, the use of generative artificial intelligence (GenAI) is encouraged, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with "pillar courses" in three of IE's core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world's greatest challenges; and

- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Introduction to the Course

- Overview of the course, objectives, and the significance of understanding AI in the current business landscape.
- Icebreaker activity where students share their expectations and get to know each other.
- Rules, assignments and grading.
- Group project: Project introduction, ideas on how to choose a project.

Article: Driving Innovation with Generative AI (McKinsey)

SESSION 2 (LIVE IN-PERSON)

An Exponential World

In this session, we dive into the concept of exponential growth in technology and its profound impact on innovation and business landscapes. Students will explore how advancements such as Moore's Law have not only shaped the tech world but also set the pace for rapid, transformative changes in various sectors. The session aims to foster an understanding of the significance and implications of exponential technological growth.

Learning Objectives for the Session:

1. Understand the principle of exponential growth in technology and its historical context.
2. Identify the effects of exponential technological advancements on innovation and business models.
3. Analyze real-world examples of technological growth and discuss their implications on society and industry.
4. Develop critical thinking about how AI might evolve and impact various aspects of life and work.

List of concepts covered in the Session:

- Exponential Growth Fundamentals
- Linear Thinking versus Exponential Thinking
- From Moore's Law to Nvidia's Blackwell chips
- AI's Role in Exponential Growth

List assignment/activities:

- Group discussion on recent technological advancements students have noticed in their daily lives.

Group project: Selection of possible topics. Pitch initial ideas.

SESSION 3 (LIVE IN-PERSON)

B2C vs. B2B Business

In this session, we will explore the distinct landscapes of Business-to-Consumer (B2C) and Business-to-Business (B2B) models, highlighting their unique challenges and opportunities. Students will understand critical differences in design, user experience (UX), IT architecture, and the utilization of big data within each model. Through a combination of lectures and case study analyses, participants will gain insights into the operational and strategic nuances that define success in B2C and B2B environments.

Learning Objectives for the Session:

1. Understand the core distinctions between B2C and B2B business models.
2. Recognize the importance of design and user experience in shaping customer interactions in both B2C and B2B contexts.
3. Identify the role of IT architecture and big data in developing effective business strategies.
4. Analyze real-world examples of successful B2C and B2B businesses to extract actionable insights.
5. Develop the ability to apply B2C and B2B concepts to hypothetical business scenarios, enhancing strategic thinking and decision-making skills.

List of Concepts Covered in the Session:

- B2C and B2B Fundamentals
- Design and UX: The impact of design and user experience on customer engagement and satisfaction in B2C and B2B settings.
- IT Architecture: How the underlying IT infrastructure supports business operations, scalability, and data management in both models.
- The Role of Big Data: Exploring the use of big data in driving business decisions, personalization, and operational efficiency.

List assignment/activities:

Leverage Figma (or a comparable design tool) to create a detailed customer journey workflow.

Group project: Groups creation. Teams choose project.

SESSION 4 (LIVE IN-PERSON)

AI Fundamentals

This session introduces the foundational concepts of Artificial Intelligence (AI), providing students with a solid understanding of what AI is, its history, and the key technologies that drive it. We will explore the different types of AI, how they are developed, and their applications in various industries. The lecture will cover the basics, from machine learning and neural networks to more advanced concepts such as deep learning and natural language processing. Through practical exercises, students will get hands-on experience with simple AI tools or apps, gaining insights into how AI operates and is applied in real-world scenarios.

Learning Objectives for the Session:

1. Grasp the basic concepts and history of Artificial Intelligence.
2. Understand the various types of AI technologies and their applications.
3. Recognize the significance of machine learning, neural networks, and deep learning in the development of AI solutions.
4. Explore the use of AI in different industries and its impact on innovation and efficiency.
5. Gain practical experience with AI through the use of simple tools, enhancing comprehension of AI capabilities and limitations.

List of Concepts Covered in the Session:

- History of AI: A brief history of AI development and major milestones.
- Types of AI: Understanding the different categories of AI (e.g., narrow AI, general AI) and their implications.
- Machine Learning and Neural Networks: Exploring the basics of how machines learn from data (supervised and unsupervised learning) and the role of neural networks in simulating human intelligence.
- Deep Learning: Introduction to deep learning and how it enables advanced AI capabilities, such as image and speech recognition.
- AI Applications: Examination of AI applications across various sectors, showcasing the versatility and transformative potential of AI technologies.

List assignment/activities:

Exploratory session using simple AI tools or apps to understand AI applications.

Group project:

Groups are tasked to draft a project proposal that leverages AI technology. The proposal should outline the idea, AI technology to be used, how it adds value, potential challenges, and how to address them.

SESSION 5 (LIVE IN-PERSON)

Generative AI: An Introduction

In this session, we explore the realm of Generative AI, examining its history, fundamental concepts, and how it differs from other types of AI. Generative AI encompasses technologies capable of creating new content, from text and images to music and video, that resemble human-like creativity. This lecture aims to demystify the workings of Generative AI, showcasing its potential to revolutionize processes across various industries. Students will engage in hands-on activities, using basic generative AI models to create simple texts or images, providing a practical understanding of the technology's capabilities and limitations.

Learning Objectives for the Session:

1. Understand the core concepts of Generative AI and its historical development.
2. Differentiate Generative AI from other AI technologies based on its unique capabilities to generate new content.
3. Explore the impact of Generative AI on creative industries and beyond.
4. Gain practical experience by using generative AI models to produce texts, images, voice, code...
5. Consider the future potential and challenges of Generative AI, including how it could further transform creative work, innovation, and industry practices.

List of Concepts Covered in the Session:

- Definitions and an overview of what makes Generative AI unique.
- History of Generative AI: A brief look at the evolution of generative models and significant advancements.
- How Generative AI Works: Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), transformer models...
- Applications of Generative AI
- Hands-on with Generative AI
- Future Potential and Challenges

List assignment/activities:

Use a generative AI tool to create content or media (e.g., text summarization, image synthesis, music composition, video editing, etc.)

Group project: Where to start.

SESSION 6 (LIVE IN-PERSON)

Generative AI: Disruptive Models (I)

This session builds on the introduction to Generative AI by diving deeper into its disruptive capabilities across various sectors. We will explore cutting-edge generative AI models that have significantly impacted several business fields such as software development advertising, law, banking... The practice component involves group brainstorming sessions where students will ideate on how generative AI could transform traditional industries, fostering creativity and strategic thinking.

Learning Objectives for the Session:

1. Deepen understanding of the advanced technologies that power generative AI and their development.
2. Analyze the impact of disruptive generative AI models in various creative and professional fields.
3. Encourage innovative thinking by exploring potential applications of generative AI in transforming traditional industries.
4. Enhance collaborative skills through group brainstorming sessions, focusing on real-world challenges and opportunities for generative AI.

List of Concepts Covered in the Session:

- Advanced Generative AI Technologies: Exploring the mechanics and capabilities of state-of-the-art generative models.
- Impact of Disruptive Models: Detailed examination of case studies where generative AI has revolutionized industries, highlighting the practical and theoretical implications.
- Innovation through Generative AI: Discussion on how generative AI is paving new paths for innovation.
- Brainstorming Generative AI Applications: Guided group activities to ideate on the application of generative AI models in traditional sectors, encouraging a forward-thinking approach to industry transformation.

List assignment/activities:

We will use Generative AI to understand the financial and sustainability report of a company, chosen by the students

Group project: Explain Tech strategy.

Article: GenAI's World-Changing Power Is Putting Knowledge To Work (Forrester)

SESSION 7 (LIVE IN-PERSON)

Generative AI: Disruptive Models (II)

Continuing from the exploration of disruptive generative AI models from Session 6.

List assignment/activities:

We will work with a simulation tool or interactive case study where students can experiment with basic AI tools related to business analytics or customer service enhancements.

Group project: Showcase.

SESSION 8 (LIVE IN-PERSON)

Prompt Engineering

This session introduces students to the concept of prompt engineering, a crucial skill for effectively interacting with and leveraging generative AI systems. Prompt engineering involves crafting inputs (or "prompts") that guide AI models, particularly generative ones, to produce desired outputs. Students will explore the art and science behind effective prompt design, including strategies for eliciting high-quality responses from AI. The practice component will involve hands-on exercises in prompt engineering for various AI platforms, enabling students to apply their learning in real-time.

Learning Objectives for the Session:

1. Understand the concept of prompt engineering and its importance in the context of generative AI.
2. Learn strategies and best practices for designing prompts that lead to high-quality, relevant AI-generated content.
3. Develop skills in prompt engineering through hands-on practice, enhancing the ability to interact with AI systems effectively.
4. Foster creativity and problem-solving abilities by applying prompt engineering techniques to various scenarios and AI applications.

List of Concepts Covered in the Session:

- Overview of prompt engineering, including why it is crucial for maximizing the utility of AI models.
- Strategies for Effective Prompts: Best practices for creating prompts that are clear, concise, and likely to produce the desired outcome.
- Prompt Design and Testing: Techniques for iteratively designing, testing, and refining prompts to improve AI interactions.
- Hands-on Prompt Engineering Exercises: Practical sessions where students apply prompt engineering concepts to real AI platforms, learning how to tailor prompts for specific objectives and contexts.
- Creative and Technical Applications: Exploration of how prompt engineering can be used creatively in content generation and technically in data analysis and automation.

List assignment/activities:

Prompt iteration

Group project: Showcase.

SESSION 9 (ASYNCHRONOUS)

AI and Sustainability

This session focuses on the intersection of Artificial Intelligence (AI) and sustainability, examining how AI technologies can be harnessed to tackle ESG challenges. We will explore case studies where AI has been instrumental in improving energy efficiency, reducing waste, and enhancing resource management, highlighting AI's role in contributing to sustainable development goals. The session will also address the environmental implications of AI itself, including the energy consumption of training complex models, and discuss strategies to mitigate these impacts.

Learning Objectives for the Session:

1. Understand the application of AI technologies in promoting environmental sustainability across various sectors.
2. Recognize the environmental impact of AI operations and explore strategies to minimize these effects.
3. Develop innovative approaches to integrating AI in solving global environmental challenges.
4. Foster a critical mindset towards the ethical deployment of AI in sustainability efforts.

List of Concepts Covered in the Session:

- Relevance of the Sustainable Development Goals (SDGs)
- AI for Environmental Good: Case studies showcasing AI's contributions to energy efficiency, waste reduction, and resource management.
- Mitigating AI's Environmental Impact: Discussion on the carbon footprint of AI and approaches to develop more energy-efficient AI systems.
- Ethical Considerations: Navigating the balance between leveraging AI for sustainability and ensuring ethical, responsible use of technology.

List assignment/activities:

Individual work on 50 Breakthroughs

Other / Complementary Documentation: 50 Breakthroughs (Institute for Transformative Technologies)

Other / Complementary Documentation: ICT4SDG videos (Institute for Transformative Technologies)

Other / Complementary Documentation: Do you know all 17 SDGs? (UN; Youtube)

SESSION 10 (LIVE IN-PERSON)

Ethics, Cybersecurity, and Regulation in AI

As AI technologies become increasingly integrated into our daily lives and business operations, understanding the ethical implications, and ensuring the security of AI systems are paramount. This lecture will cover the foundational ethical considerations in AI development and use, such as bias, privacy, IP, and accountability. Additionally, we'll explore the cybersecurity challenges specific to AI, including data protection, system vulnerabilities, and mitigation strategies.

Learning Objectives for the Session:

1. Identify key ethical issues in AI, including bias, privacy, IP, and accountability, and understand the regulatory responses to these challenges.
2. Recognize cybersecurity risks specific to AI, the significance of data protection, and the impact of regulations on securing AI technologies.
3. Examine how different countries, with a focus on the EU, are leading the way in AI regulation, setting standards for ethical development and cybersecurity.

List of Concepts Covered in the Session:

- Ethical Considerations in AI: including algorithmic bias and data privacy concerns.
- Cybersecurity Challenges in AI
- AI Regulation: EU's role as a frontrunner in establishing legal frameworks to govern AI development and use.

List assignment/activities:

In-class exercise that helps students identify major cyber risks.

Group project: Showcase.

SESSION 11 (LIVE IN-PERSON)

AI and the Reshaping of the Entrepreneurial World

In this session, students will explore how Artificial Intelligence (AI) is fundamentally changing the landscape of entrepreneurship. They will dive into how AI enables new business models, disrupts traditional industries, and equips entrepreneurs with powerful tools for innovation.

Learning Objectives for the Session:

1. Understand the transformative impact of AI on entrepreneurship and industry disruption.
2. Identify opportunities for leveraging AI to solve complex problems and create innovative business solutions.
3. Analyze the challenges and considerations involved in integrating AI into new ventures.
4. Develop the ability to articulate a compelling business concept that utilizes AI, through the creation of a pitch deck.

List of Concepts Covered in the Session:

- AI-Driven Business Models: Exploration of how AI technologies enable new types of business models and disrupt existing ones.
- Innovation through AI: Insight into the role of AI in fostering innovation, including examples of startups that have successfully used AI to gain a competitive edge.
- Market Disruption: Understanding how AI is reshaping traditional industries by introducing efficiency, personalization, and automation.
- Challenges in AI Entrepreneurship: Discussion on the technical, ethical, and market-related challenges faced by AI-driven startups.

List assignment/activities:

- Use GenAI to create a Pitch.

Group project: Showcase.

SESSION 12 (LIVE IN-PERSON)

Leadership in AI times

In this session, we explore the pivotal role of leadership in the transformative era of Artificial Intelligence (AI). We will understand how leaders can navigate the complexities of AI, inspire innovation, and foster agility in response to change. The session will highlight the importance of an organizational culture that values learning from failures and encourages innovation, creating a fertile ground for the effective use of advanced technologies. We'll also touch upon the concept of intellectual capital, discussing diverse metrics for measuring progress, such as employee engagement, innovation rates, and customer satisfaction.

Learning Objectives for the Session:

1. Understand the essential qualities of leadership that drive AI transformation and innovation within organizations.
2. Appreciate the dynamic interplay between technological advancement and a culture of continuous learning and adaptation.
3. Explore various metrics for assessing intellectual capital growth in the context of AI integration.
4. Develop strategies for effective knowledge implementation, including the establishment of continuous feedback loops and open communication channels.
5. Recognize the importance of agile methodologies in enabling rapid adaptation and evolution in response to AI-driven changes and opportunities.

List of Concepts Covered in the Session:

- Visionary Leadership in the AI Era: Characteristics of leaders who can effectively steer their organizations through the complexities of AI transformation.
- Technology-Culture Synergy: The critical role of a learning-focused organizational culture in leveraging AI for innovation and success.
- Measuring Intellectual Capital: Exploring diverse metrics to assess progress in organizations embracing AI.
- Knowledge Implementation: Strategies for ensuring that insights gained from AI are effectively applied to achieve tangible outcomes.
- Agile Methodologies: The significance of agility in fostering continuous innovation and preparing for future challenges and opportunities in the AI landscape.

List assignment/activities:

AI leaders: Discussion about who they are, what they have in common, how they lead their teams.

Group project: Showcase.

Multimedia Material: This might be the last hard thing I ever do (Unconfuse Me with Bill Gates; Youtube)

Other / Complementary Documentation: Satya Nadella (LinkedIn)

SESSION 13 (LIVE IN-PERSON)

CONTENT QUIZ

List assignment/activities:

- Exploratory session using simple AI tools or apps to understand AI applications.

Group project: Showcase.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Group Presentations and wrap up

Group Presentations

Course Wrap up

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Class Participation	15 %		10% 5% graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance)
Individual presentation	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Presentation	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- -Ismail, Salim; Diamandis, Peter H. (2023). *Exponential Organizations 2.0: The New Playbook for 10x Growth and Impact*. 2023. Ethos Collective. ISBN B0C6YGMDVW (Digital)

In a world of accelerating technologies, three visionary pioneers—Salim Ismail, Peter H. Diamandis, MD, and Michael S. Malone—bring you a playbook to ride on top of the exponential curve. This is a compelling sequel to *Exponential Organizations*, which quickly became one of the most successful business books globally, being used by leaders, organizations, and even countries to create transformation across nearly every industry and geography.

- Rodney Zemmel, Eric Lamarre. *Rewired: The McKinsey Guide to Outcompeting in the Age of Digital and AI..* 2023. Editorial Wiley John + Sons. ISBN 1394207115 (Digital)

In *Rewired*, the world's most influential management consulting firm, McKinsey & Company, delivers a road-tested, how-to manual their own consultants use to help companies build the capabilities to outcompete in the age of digital and AI.

BEHAVIOR RULES

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.T.IoTs

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **BORJA GÓMEZ ZARCENO**

E-mail: bgomezz@faculty.ie.edu

Borja studied telecommunications engineering at the UPM Madrid and a Master of Science in Information Technology at the University of Stuttgart.

He has a strong professional experience in technology, telecommunications and consultancy companies, where he has carried out a diverse set of projects, always combining technology levers, innovative approaches and customer focus Borja is currently caring for IoT solutions of Telefónica globally, and in this role he aims to leverage Internet of Things, Blockchain and AI technologies in order to build disruptive solutions for enterprise customers, enabling emergence of new business models, as well as bringing more sustainable and efficient operating models.

Borja believes in science and technology disruption as the key tools for the human being to leave a better world to future generations.

Office Hours

Office hours will be on request. Please contact at:

bgomezz@faculty.ie.edu

SUBJECT DESCRIPTION

Empowering Innovation: Exploring IoT's Practical Applications

Embark on an immersive journey into the Internet of Things (IoT) in our engaging course tailored for learners of all backgrounds. Explore the real-world applications and transformative potential of IoT across diverse industries, from healthcare to smart cities. Through captivating case studies, interactive discussions and hands-on projects, discover how IoT solutions are revolutionizing business operations, enhancing customer experiences, and addressing pressing societal challenges like sustainability.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

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Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course, with appropriate acknowledgement, except for the Reflections assignments and exam (QUIZ on Session 13). If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with the professor.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of *[AI systems link]* to *[specify how you used generative AI]*. The prompts used include *[list of prompts]*. The output of these prompts was used to *[explain how you used the outputs in your work]*

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with “pillar courses” in three of IE’s core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

- humanistic approaches to interpersonal relations, decision-making and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

The IE Challenge is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE’s core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN’s 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world’s most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

SESSION 1 (LIVE IN-PERSON)

Introduction to IoT course, SDGs and Innovation Engineering Project

Description: This session provides an overview of the Internet of Things (IoT), its core concepts, significance in modern society, synergies with Sustainability Development Goals (SDGs), and the course structure.

Learning Objectives:

Understand the course structure, assignments, grading criteria, and Innovation Engineering Project. Define the Internet of Things (IoT).

Explain the impact and significance of IoT in modern society and SDGs.

Content

- IoT and SDGS
- IoT assignments and gradings

Assignment: Semester reflection

Technical note & tutorials: Internet of Things (IST020081-U-ENG-HTM)

SESSION 2 (LIVE IN-PERSON)

Couse Methodology, Tools & groups formation

Description:

This session provides an overview of the Innovation Engineering Project (IEP) methodology, to guide the group projects, as well as introduces the Arduino Explore Kit Platform that will be used along the semester.

Learning Objectives:

Learn Course Project Methodology
Understand the Arduino Explore IoT Platform

Content:

- IoT Group Project description
- Introduction of Arduino Explore IoT Platform
- Methodology and expectations. IoT Lab access.

Group Formation

Technical note: Explorer IoT Kit Rev 2 Onboarding-guide (Arduino)

SESSION 3 (LIVE IN-PERSON)

IoT devices and sensors

Description: This session focuses on different types of IoT devices (based on function and form factor) and explores various sensors used in IoT applications

Learning Objectives:

Identify different types of IoT devices based on function and form factor.

Learn about various sensors used in IoT and their data acquisition methods.

Analyze how sensors and devices work together to collect and transmit data.

Content:

- Introduction to IoT stack: devices, communications, platforms and applications
- Key characteristics of devices in different use cases

IoT Group Project

IoT Arduino Kit in class practice

Assignment: IoT project NABC

Article: What are IoT devices (Medium.com)

SESSION 4 (LIVE IN-PERSON)

IoT communication protocols

Description: This session explores different communication protocols used in IoT applications, their strengths, weaknesses, and impact on data transmission.

Learning Objectives:

Explain the role of communication protocols in IoT data transmission

Compare and contrast different communication protocols (e.g., RFID, Bluetooth, LoRaWAN, Narrow Band IoT).

Understand the impact of communication protocols on data transfer speed, range, and security.

Content:

- Network topologies
- Communication protocols
- Key factors: (range, activity, power consumption, security)
- Short range examples: Wifi vs. RFID vs. Bluetooth
- Long range examples: LoraWan vs Narrow Band IoT

IoT Group Project

- Assignment: low tech demo
- Assignment: lab work (1/3)

SESSION 5 (LIVE IN-PERSON)

Internet of Things (IoT) platforms

Description: This session explores the world of Internet of Things (IoT) platforms, comparing different options, getting insight into the functionalities and differentiators

Learning Objectives:

Understand the core functionalities of IoT platforms (device management, data handling, analytics, security, application enablement).

Analyze the key features and deployment models of cloud-based and on-premise IoT platforms.

Evaluate the trade-offs between cloud and on-premise deployments considering factors like cost, scalability, security, and control.

Identify the appropriate platform type (cloud, on-premise, or hybrid) based on specific project needs.

Content:

Device management, Data processing, App enablement

Cloud vs. on-premise

Arduino IoT platform showcase

SESSION 6 (LIVE IN-PERSON)

IoT in the consumer domain. Real world use cases

Description: This session explores smart home technologies and their benefits for comfort and security, and wearable sensors and devices used for health monitoring and remote patient care.

Learning Objectives:

Understand the concept and benefits of IoT applications in smart homes.

Analyze real-world examples of IoT solutions in smart homes (e.g., smart lighting, automated thermostats, security systems).

Learn about wearable sensors and devices used for health monitoring (e.g., fitness trackers, smartwatches) and remote patient care.

Identify potential applications of IoT in smart homes or healthcare relevant to the group project.

Content:

Smart home uses cases
IoT health applications. Remote patient monitoring.

SESSION 7 (LIVE IN-PERSON)

IoT in the b2b domain. Real world use cases

Description: This session explores the concept of smart cities and how IoT enables efficient infrastructure management. It also covers connected vehicle technologies and their impact on transportation safety and efficiency, and explores IoT applications in smart agriculture for optimizing resource usage and crop yield.

Learning Objectives:

Understand the concept of smart cities and how IoT enables efficient infrastructure management (e.g., traffic control, waste management, energy use).

Learn about connected vehicle technologies (e.g., vehicle-to-everything communication) and their impact on transportation.

Explore IoT applications in smart agriculture (e.g., precision irrigation, soil monitoring, remote field management).

Identify potential applications of IoT in smart cities, connected vehicles, or smart agriculture relevant to the group project.

Content:

IoT in the primary sector. Smart agriculture.

Connected vehicles. V2X models. Telematics.

Smart Cities. Sustainable living.

SESSION 8 (LIVE IN-PERSON)

Industrial IoT (IIoT), energy management, retail. Real world use cases.

Description: This session defines Industrial IoT (IIoT) and explores its key applications in manufacturing and automation. It also covers how IoT can optimize energy use and improve sustainability in various sectors, and explores IoT applications in retail for inventory management, customer experience personalization, and supply chain optimization.

Learning Objectives:

Define Industrial IoT (IIoT) and understand its key applications in manufacturing and automation (e.g., predictive maintenance, process optimization).

Learn about IoT applications for energy management and improving sustainability (e.g., smart grids, building automation).

Explore how IoT is used in retail for inventory management, customer experience personalization, and supply chain optimization.

Identify potential applications of IoT in IIoT, energy management, or retail relevant to the group project.

Understand a detailed Case study in water management: IoT to better manage the water cycle, from water collection to water sewage.

Content:

Predictive maintenance, process optimization, quality assurance

Smart grids; Building automation.

Retail applications: Inventory, supply chain, customer experience

Case study: IoT to better manage the water cycle

IoT Group Project

Assignment Lab work (2/3)

Assignments:

Critical thinking exercise.

Mid semester reflection: IoT real-world problem and solution proposed

Other / Complementary Documentation: How IoT works and manufacturing (Bing)

SESSION 9 (LIVE IN-PERSON)

AI integration in the Internet of Things

Description: This session explores how Artificial Intelligence (AI) can be integrated with IoT for data analysis and decision-making. Students will learn about the benefits of using AI in IoT applications.

Learning Objectives:

Understand how AI can be integrated with IoT for data analysis and decision-making.

Explore the benefits of using AI in IoT applications (e.g., anomaly detection, predictive maintenance).

Learn about different AI techniques (e.g., machine learning) used in conjunction with IoT data.

Content:

Intro to AI and Machine Learning

Benefits of combining AI and IoT

Anomaly detection. Predictive maintenance

AI Risks and Challenges

Other / Complementary Documentation: Supervised vs. Unsupervised Learning (Youtube)

SESSION 10 (LIVE IN-PERSON)

Emerging trends: Blockchain, edge computing

Description: This session explores emerging trends in IoT, including blockchain technology and its potential applications in IoT security and data ownership, and edge computing for processing data closer to devices.

Learning Objectives:

Understand the concept of blockchain technology and its potential applications in IoT security and data ownership. Describe blockchain and web 3.0 disruptions

Explore the benefits of edge computing in processing data closer to IoT devices.

Analyze the impact of emerging trends on the future of IoT development and applications.

Content:

Intro to Web 3.0 and blockchain

Potential application of blockchain in the IoT domain

Benefits of edge computing in processing data closer to IoT devices.

Other IoT trends

Assignment:

Critical thinking exercise

SESSION 11 (ASYNCHRONOUS)

Ethical considerations in IoT

Description: This session explores the ethical implications of widespread IoT adoption, focusing on data privacy and user consent. Students will discuss the importance of responsible development and deployment of IoT solutions.

Learning Objectives:

Analyze the ethical implications of widespread IoT adoption (e.g., data privacy, user consent, algorithmic bias).

Discuss the importance of responsible development and deployment of IoT solutions.

Explore potential ethical challenges related to security vulnerabilities and biases in AI algorithms used with IoT.

Content:

Data privacy; User consent; Algorithm Bias
Responsible development practices

Asynchronous activity: Discuss the ethical implications of IoT

Other / Complementary Documentation: Ethical Aspects of the Internet of things (Youtube)

SESSION 12 (LIVE IN-PERSON)**Security, data privacy and regulations in IoT**

Description: This session focuses on security vulnerabilities and risks associated with IoT devices and networks, and relevant regulation considerations to make when designing and deploying IoT solutions. Students will learn about best practices for securing IoT deployments.

Learning Objectives:

Understand the regulatory framework that governs data collection and ownership (with a focus on GDPR).

Identify potential security vulnerabilities and risks in IoT systems (e.g., device hacking, data breaches).

Understand best practices for securing IoT deployments (e.g., data encryption, network authentication, device management).

Learn about security protocols and frameworks designed for secure communication in IoT environments.

Content:

Regulatory framework that governs data collection and ownership

Security vulnerabilities in IoT

Best practices for securing IoT deployments

Data protection in general and impact of IoT

GDPR regulation review

Group project

Assignment: Lab work (3/3)

Article: IoT Security Issues in 2022: A Business Perspective (Thales)

SESSION 13 (LIVE IN-PERSON)

Quiz (30 min) – Sessions 1-12

Insights to Group Presentations and gradings.

SESSIONS 14 - 15 (LIVE IN-PERSON)**Teams final project presentations**

Teams 1 to 10 Final project presentations

Course wrap up**EVALUATION CRITERIA**

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

UNIVERSITY

TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.U.WastRes

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **EDUARDO FERNÁNDEZ CASTRO**

E-mail: eduardof@faculty.ie.edu

Eduardo, an industrial process engineer from the University Carlos III of Madrid and the Norwegian University of Science and Technology, has been immersed in the energy sector since his academic years. Presently, he works as a Circular Economy Scientist specialized in renewable fuels.

His current research is focused on transforming waste and bio-feedstocks into new energy resources, including waste cooking oil, renewable oils derived from waste materials like plastic or tires, and various vegetable oils.

Eduardo's notable accomplishments include leading multiple continuous improvement projects aimed at enhancing energy efficiency and reducing waste, leveraging continuous improvement tools and advanced analytics to drive these initiatives. Recently, he contributed to activities scaling up renewable feedstock processing in existing refineries, transitioning from mineral oil to sustainable sources.

Beyond his professional role, Eduardo has been recognized as a Future Energy Leader by the World Energy Council, contributing to the transformation of the global energy landscape. Additionally, he is a member of QVIXOTE, a leadership and geopolitics organization fostering young professionals' development through mentorship, seminars, and networking.

Office Hours

Office hours will be on request. Please contact at:

eduardof@faculty.ie.edu

SUBJECT DESCRIPTION

Step into the world of sustainable innovation with the IE Impact Technology course - Waste to Resources. You will experience a hands-on course which will take you beyond the basics of circular economy. Whether you are a techie or not, this course is intended for anyone eager to learn, innovate, and make a difference. Discover the pivotal shift from a 'take-make-dispose' model to a regenerative circular system, where nothing is wasted and everything is valued.

You'll deepen into the core of sustainability, exploring how sectors like food, agriculture, fashion, plastics energy or e-waste are reinventing themselves. Through case studies, you'll see how circular economy can succeed (and fail). Finally, you will dive into a project which will challenge your knowledge, not only from the technical point of view but from a holistic one, from ideation to implementation.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following.

This course consists of 15 sessions divided in three components: lectures (9 sessions), a challenge to be solved (2 sessions) and game simulations (2 sessions) plus 1 session for evaluation. All sessions for this course will be live-in sessions. The 10 sessions of theory will be complemented with a game simulation to understand waste management in the context of space trash, together with global governance, and political decisions.

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Critical GenAI use is encouraged

In this course, the use of generative artificial intelligence (GenAI) is encouraged, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

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familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and

entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the **IE Challenge** where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Introduction to the course and to circular economy

- Ice breaker
- Overview of linear vs. circular economy
- Importance of transitioning to a circular model/introduction to circular principles

Lecture: Introduction to the course

- Environmental, social, and economic impacts of the linear model
- Overview of linear vs. circular economy
- Importance of transitioning to a circular model/introduction to circular principles
- The new vision of waste in the circular economy

Explanation of Reflection 1

SESSION 2 (LIVE IN-PERSON)

Lecture: Waste Characterization and Assessment.

- Types and composition of different waste streams and consequent environmental impacts.
- Life cycle analysis (LCA) of waste products
- Assessing environmental impact and resource potential

Deadline of Reflection 1

Explanation of assignment 1

SESSION 3 (LIVE IN-PERSON)

Lecture: R strategies I

- Consumption and Waste in today's World.
- R strategies in circular economy.
- Manufacturing Process Map
- Postconsumption Map.

SESSION 4 (LIVE IN-PERSON)

Lecture: R strategies II

- Principles of recycling
- Materials for recycling
- Overview of recycling processes (mechanical, chemical, biological)
- Challenges and innovations in recycling technologies
- Explanation of peer-feedback to assignment 1 through FeedbackFruits or similar software (a session-time deadline)

Deadline Assignment 1

Explanation of the peer feedback to Assignment 1

SESSION 5 (LIVE IN-PERSON)

Lecture: Food and agricultural Waste

- Introduction of the platform for sharing the common feedback.
- Food and agricultural waste management.
- Resource Recovery and Recycling.
- Innovations and future trends

Deadline Feedback Assignment 1

Explanation of Reflection 2

SESSION 6 (LIVE IN-PERSON)**Lecture: Fashion and Plastic Waste**

- Fashion waste. Typology and processes overview.
- Plastic waste. Typology and processes overview.
- Circularity Trends in Fashion and Plastic Sectors.

Deadline Reflection 2

SESSION 7 (LIVE IN-PERSON)**Lecture: Waste-to-Energy Technologies**

- Waste materials and products.
- Waste-to-Energy processes overview. Impact measurement. Circular credits and carbon footprint.
- The role of R&D in Energy sector decarbonization.

Questions for assignment 2 on the challenge

SESSION 8 (LIVE IN-PERSON)**Lecture: e-Waste Management**

- Challenges of electronic waste
- Recycling and resource recovery from electronic devices
- Responsible disposal of e-waste

SESSION 9 (LIVE IN-PERSON)**Lecture: Circular Economy Business Models**

- Transitioning from linear to circular business models
- Economic benefits of circular economy practices
- Case studies on companies successfully implementing circular principles.
- Challenges: regional and national policy and regulations, circular Supply Chain Management, geopolitics.

Deadline Assignment 2

Explanation peer-review of Assignment 2

SESSION 10 (ASYNCHRONOUS)**Lecture: Governance (I)**

- Preparation for the SpaceGov activity

SESSION 11 (LIVE IN-PERSON)

Lecture: Governance (II)

Global Governance and International Relations through SpaceGov

- Management of waste as a collective problem
- Importance of Technology for societies
- Cooperative/competitive nature of complex social processes

Deadline Feedback of Assignment 2

Games & Simulations: Facing New Challenges in Space & Cyber Affairs: SpaceGov (IRE090056-U-ENG-HTM)

SESSION 12 (LIVE IN-PERSON)

Lecture: Final Project Workshop and Feedback Poster Visualization.

- Poster Visualization.
- Presentation workshop.
- Q&A.

SESSION 13 (LIVE IN-PERSON)

Exam

In paper, MCQ and 1 to develop

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final Project Presentations

- Group presentations of refined circular business proposals
- Q&A session with panel of experts and peers
- Evaluation and feedback on presentations

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		10% reflections + 20% assignments
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BIBLIOGRAPHY

Recommended

- Edited by Terry Tudor, Cleber JC. Dutra. *The Routledge Handbook of Waste Resources and the Circular Economy*. Routledge International Handbooks. ISBN 9780367637590 (Printed)
- Siming You. *Waste-to-Resource System Design for Low-Carbon Circular Economy*. Elsevier. ISBN 9780128226 (Digital)

BEHAVIOR RULES

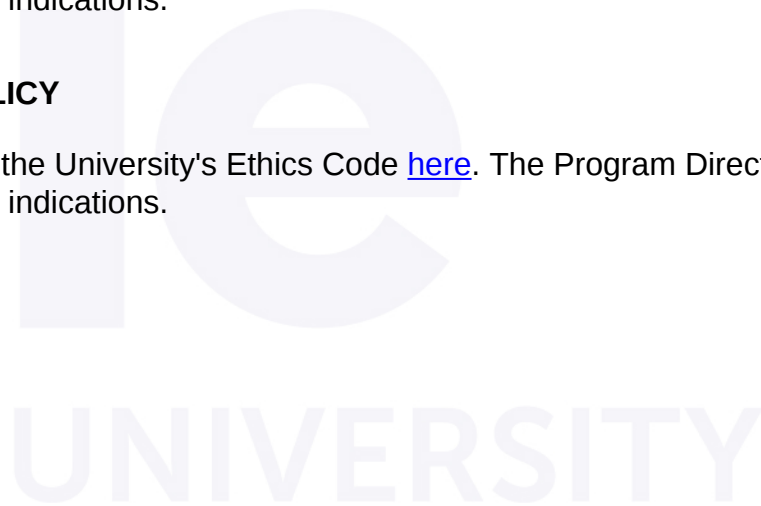
Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.



TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.V.WatTech

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1^o

Category: COMPULSORY

Language: English

Professor: **GONZALO DELACAMARA ANDRES**

E-mail: gdelacamara@faculty.ie.edu

Director of the IE Centre of Water & Climate Adaptation, Gonzalo is a senior economist (25+ years of experience) who works worldwide (in 90+ countries: European Union, the USA, Latin America and the Caribbean, the Middle East, other countries in Africa, Central and South Asia, Australia).

He is specialized in the economic management of natural resources: water, climate, energy, atmospheric pollution, oceans, biological diversity and ecosystem services, etc., with emphasis on their complex linkages to economic and social development. In 2023, he was appointed by the European Commission as member of the EU Platform of Sustainable Finance.

Gonzalo has worked for over two decades for multilateral organizations such as the European Commission, of which he is a 'water policy advisor' (through its DG Environment, Clean Water Unit), the European Parliament (which he also advises on climate change policy), a number of UN agencies and programs (UN Water, UNESCO, FAO, WHO-PAHO, UNDP, etc.), the World Bank Group (including its 2030 Water Resources Group initiative but also the World Bank itself or the International Finance Corporation, IFC) or the Inter-American Development Bank (IDB). He is also a Senior Advisor and member of the OECD Water Governance Initiative.

Gonzalo is also the First Vice-President of Water Europe (up to June 2024), the former EU Water & Sanitation Technology Platform (WssTP), and an elected member of the Board of Directors of the International Desalination & Reuse Association (IDRA). He is also the first non-Dutch member of the External Scientific Advisory Council (ESAC) of KWR, a renowned research centre on the water cycle in the Netherlands.

Gonzalo is also a mentor in international support programs for female researchers in Germany (Association of Leibniz Institutes) or the United States of America (Techwomen), and author of numerous books and scientific articles as well as a keynote speaker in global events.

Office Hours

Office hours will be on request. Please contact at:

gdelacamara@faculty.ie.edu

SUBJECT DESCRIPTION

WATER TECHNOLOGY FOR CLIMATE RESILIENCE

Climate change has dramatic consequences on the water cycle of our planet, which affects both the water quantity and quality of freshwater, brackish water and seawater. As a matter of fact, climate change, regardless of changes in the chemical composition of the atmosphere that trigger complex phenomena (such as global warming), can actually be seen as a change in the water cycle as such. The human population and its environment have to deal with an increasing long-term insecurity: freshwater scarcity and drought risk, floods, an overall lowered quality of the current freshwater sources and the loss of biological diversity in aquatic ecosystems at higher rates than in terrestrial ecosystems, which may lead to the collapse of ecosystems, both terrestrial and aquatic. The need for sustainable water resources management and novel technologies has therefore increased over the last years. In this water technology course, students will be introduced to several aspects of water management and technologies, with specific emphasis on water quantity and quality issues and with some references to hydro-morphological alterations, that is changes to the physical habitat, and/or a water body' natural functioning. It explores the three key concepts of climate solutions for water management and technologies: retention, recharge and reuse of water. These are the drivers for climate resilient freshwater management and technology, together with the search for alternative water sources.

Water management and technologies that address water scarcity and water quality have rapidly evolved over the last decade and are applied as we speak. Water technologies for water treatment have always followed a linear approach to treat water, but are currently exploring the implementation of circular approaches that emulate nature. Moreover, alternative water supply sources are being explored for drinking water production and other uses. The application of these new technologies, circular approaches and alternative water sources not only have consequences on water quality and quantity, but also on society as a whole. The application of these new technologies therefore also involves socio-economic aspects such as awareness, behaviour, mindsets, incentives, institutional innovation, governance at large, legislation, etc.

This course aims to educate students on the technologies that are making an impact on solving some of the world's most pressing societal challenges, that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-grounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will also specifically address how society, organizations and people apply technology. A practical, human-centred approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals. However, we will also focus on social-ecological systems, as dynamic, complex and adaptive systems in which complex interactions happen and where siloed and fragmented approaches (scientific, political, economic) would fail to deliver.

During this course, you will obtain knowledge on the current status of water technology and management, but you will also co-create hands-on experience by working on real-world case studies where novel technologies are to be implemented. You will gain the ability to critically assess how the technology should be implemented, but also what would be the effect on society and industry. You will also collaborate with peers in a challenge where you will be inspired to create an impactful and innovative solution to a water challenge. You will gain understanding on the need to go beyond technological progress (i.e., governance) to understand why and how some of these technologies deliver and why others do not. In other words, you will understand the enabling factors for technology to play its part in ensuring long-term water security in a context of climate change mitigation and adaptation.

This IE Impact course is designed for all IEU students, from all schools and all bachelor programs and no technical knowledge is necessary. Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Specific use cases of GenAI are encouraged

Generative artificial intelligence (GenAI) tools may be used in this course for the case studies and group work (for example for ideation, generating an outline, proofreading, grammar check, coding, image generation) with appropriate acknowledgement. GenAI may not be used for assignments where it is specifically mentioned and the exam. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

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No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Introduction to course

- Course summary: contents description
- IE and students' expectations
- Assignments and grading
- Explanation of individual case studies and group project

Specific materials for each session and the chapters to read from the compulsory book will be distributed during the course

Book Chapters: Water Science and technology, an introduction

SESSION 2 (LIVE IN-PERSON)

Climate change effects on the water cycle

- Understand the effect of climate change on the water cycle
- Identify challenges for sustainable water resources management and the difference between water resources and water services
- Define conceptual solutions in the three R's (retention, recharge and reuse) and alternative water sources

Specific materials for each session and the chapters to read from the compulsory book will be distributed during the course

SESSION 3 (LIVE IN-PERSON)

Sustainable water management: retention and recharge

- Understand the importance of sustainable water management at a basin level
- Explore sustainable water technologies for retention and recharge, and how these can be connected
- Analyse the impact of sustainable water management on society, such as on the economy, culture, or the environment
- Recharge and rainwater use
- Understanding rainwater and its potential uses
- Design and implementation of rainwater harvesting and recharging systems
- Group project: discuss initial ideas for the group assignment

SESSION 4 (LIVE IN-PERSON)

Sustainable Water Treatment Technologies

- Traditional vs. modern water treatment methods
- Overview of current water purification technologies
- Water quality regulations for discharge on surface waters
- Examples of successful water treatment projects

Specific materials for each session and the chapters to read from the compulsory book will be distributed during the course

SESSION 5 (LIVE IN-PERSON)

Membrane technologies for water reclamation and reuse

- Overview of membrane technologies for water purification
- Desalination processes and alternative water sources
- Advantages and challenges of desalination
- Sustainable approaches to desalination
- Analyse effects on society of alternative water sources and drawbacks for their penetration

Group project: teams pitch their chosen project for the group assignment

SESSION 6 (LIVE IN-PERSON)

Sustainable water management: reclamation and reuse or regenerated water as well as materials and energy

- Understanding the principles and benefits of water reuse
- Identify water sources qualified for reuse
- Explore greywater and its potential uses
- Reuse in practice: design and implementation of water recycling systems
- Analyse societal and governance aspects of water reuse
- Examples on water recycling in different settings
- Deliver individual work; Case study 1: design of a water catchment and highlight implications of application

SESSION 7 (LIVE IN-PERSON)

Water-Energy Nexus

- Interconnection between water and energy; going beyond the sectoral bias
- Energy-efficient water technologies and water efficiency for energy
- Hydrogen and water technology
- Thermal energy storage
- Residual heat from industry
- Examples of integrated water-energy projects
- Deliver group project intermediate 1: teams deliver presentation slides for the group assignment on the technological part

SESSION 8 (LIVE IN-PERSON)

Smart Water Management

- Role of technology and IT in water management
- IoT and sensors for water monitoring
- Hydroinformatics and digital twins
- Opportunities in the tangency between digitization of the economy and sustainability

SESSION 9 (LIVE IN-PERSON)

Sustainable Agriculture and Water

- Importance of water in agriculture
- Precision agriculture for water efficiency
- Smart irrigation systems and water conservation and water quality
- Deliver group project intermediate 2: teams deliver presentation slides for the group assignment on the implications of the technology

SESSION 10 (ASYNCHRONOUS)

Group assignment: development of presentation (group work)

- Apply knowledge from the course to a groupwork assignment
- Prepare presentation of the assignment as a short pitch and report

SESSION 11 (LIVE IN-PERSON)

'Eye in the Storm' VR session + guided role-play in a multimedia environment

Games & Simulations: Eye in the Storm VR (CSR090011-U-ENG-VXR)

SESSION 12 (LIVE IN-PERSON)

'Eye in the storm' serious gaming session + class discussion on mitigation and adaptation policies

- Deliver individual work; Case study 2: possible solutions for sustainable management of concentrate streams and highlight implications of application

Practical Case : Eye in the storm: your role in climate change action (EEN010191-U-ENG-HTM)

SESSION 13 (LIVE IN-PERSON)

Final exam

- 19 question-multiple choice
- 1 open, critical-thinking/analytical question with max 400 word response

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final presentations of group assignment

- Each group presents their assignment case (7-10 min)
- Q&A and class feedback will be given by professor and students
- All team members must participate in presentation and Q&A

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Final Exam	25 %		

Individual work	30 %		Includes 2 reflections (10%), 2 individual assignments (20%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

- Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.
- In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Compulsory

- Nick Gray. (2017). *Water Science and technology*. 4th edition. CRC Press. ISBN 9781498753456 (Digital)

Physical book and eBook available

BEHAVIOR RULES

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TECHNOLOGY

**IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-
IMPACT.2.M.W.Sustain**

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **MANUEL PÉREZ ROMERO**

E-mail: mpr@faculty.ie.edu

Ph.D. in Architecture - Chair of the Center for Sustainable Cities

Manuel Pérez Romero has an interdisciplinary background as an architect, urban designer, entrepreneur and inventor. Pérez Romero interests focus on two different but complementary areas: co-evolutionary urbanism and lightweight sustainable structures. Co-evolutionary urbanism is an interdisciplinary approach for city-making based on time, co-evolution and ecology. In terms of lightweight structures, he has developed more than ten patents for timber structures, for mid-rise and high-rise buildings.

Currently, Pérez Romero serves as the Chair of the Center for Sustainable Cities at IE University, an applied research center dedicated to promoting sustainable city-making through collaboration with key stakeholders in the urban environment

He has extensive teaching experience at various institutions, including IE University, Alcalá de Henares School of Architecture, and Madrid School of Architecture. From 2018 to 2020, he served as a Board Member of the International Practice Committee of the American Institute of Architects.

Perez Romero is the co-founder of Phylem Structures, a pioneering R&D company in the field of timber structural systems. At Phylem Structures we have developed and patented a unique timber structural system designed for mid-rise and high-rise building construction. Phylem utilizes half of the wood than any other structural system.

Pérez Romero is founding member of nodo17 group, a Madrid based group of architects, urban designers and ecologists operating within the fields of urbanism, landscape, architecture, engineering, information and ecology. Projects undertaken by nodo17 group have received more than 20 awards in national and international competitions, as 2009 AR for Emerging Architecture, RE-THINK Award, Smart Island Award or 2018 AZ Award. As result of winning competition entries, nodo17 has developed the Master Plan for Klekovaca Tourist Centre in Bosnia Herzegovina or Abalos Sustainable Resort in La Gomera Island.

His work has been published in journals and monographs, such as "nodo17 version 2.08" (Damdi Publishing Co, South Korea, 2009) and he is author of "Timetecture" (Diseño, 2017).

Office Hours

Office hours will be on request. Please contact at:

mpr@faculty.ie.edu

SUBJECT DESCRIPTION

"Sustainable Cities," part of the IE Impact Technology track, offers an immersive exploration into the essence and evolution of urban environments. This course demystifies the complex networks that define a city, focusing on the transformative power of technology in urban development. From historical underpinnings to futuristic visions, students will traverse the terrain of urban ecosystems, examining water, energy, mobility, biodiversity, food, matter, and the digitized realms through sensorization and data analytics.

The curriculum is crafted to share a nuanced understanding of the multifaceted flows within cities and the technological innovations that drive their growth and future sustainable evolution. Through a blend of theoretical knowledge, exemplary practices, and in-depth case studies, students can cultivate a profound appreciation for the intricacies of sustainable urban planning and the technological levers that can propel cities toward a more resilient future.

In addition to the core curriculum, "Sustainable Cities" places a significant emphasis on the potential of technology as a catalyst for positive change, particularly in addressing the climate crisis and critical social issues. The course explores how innovative technological solutions can mitigate environmental impact, promote sustainability, and foster social equity within urban settings. Students will examine case studies where technology has been leveraged to reduce carbon footprints, enhance resource efficiency, improve public health, and increase access to essential services for underserved populations. This segment aims to inspire students to envision and develop technological interventions that advance urban sustainability and contribute to building more inclusive and resilient communities. Through this lens, contemporary technology is presented as a tool for urban development and a vital component in the global effort to create more equitable and environmentally conscious cities.

Objectives:

1. Historical Insights and Urban Evolution: Gain insights into the historical development of cities and the multifaceted impact of technology, social dynamics, and environmental considerations on their growth and metamorphosis.
2. Comprehensive Analysis of Urban Systems: Acquire a holistic view of urban flows (including water, energy, mobility, biodiversity, food, and matter) and the role of technology in optimizing these systems for sustainability.
3. Innovation and Practical Solutions: Develop the ability to critically evaluate and implement

sustainable urban practices and technologies, drawing inspiration from real- world scenarios and forward-thinking smart city initiatives.

Competencies:

1. Critical Analysis and Strategic Thinking: Enhance the capacity to critically assess urban systems and technology integration in city planning, fostering a strategic approach to identifying urban challenges and opportunities.
2. Creative Problem-Solving: Cultivate a creative and solution-oriented mindset, empowering students to devise innovative and sustainable solutions to contemporary urban issues, leveraging technological advancements.
3. Collaborative Innovation: Promote interdisciplinary teamwork, emphasizing the importance of combining insights from technology, environmental science, urban planning, and social sciences to craft multifaceted solutions for sustainable urban development.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed.

The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology.

A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.

Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.

Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).

Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Specific use cases of GenAI are encouraged.

Generative artificial intelligence (GenAI) tools may be used in this course for research, ideation, generating an outline, proofreading, grammar check, coding, image generation, etc. with appropriate acknowledgement. GenAI may not be used for drawing conclusions, creating proposals for the capstone projects or individual works. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

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I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

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PROGRAM

SESSION 1 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Introduction to Course and The History of Urban Development

Content: This session introduces the course framework, objectives, and methodologies. Following the introduction, the course delves into the history of urban development from ancient settlements to modern cities. This historical perspective includes the evolution of urban forms, major technological innovations, and the socio-economic forces that have shaped urban environments.

Objectives: Establish course expectations, understand the historical context of urban development, and connect past innovations to present urban challenges.

SESSION 2 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Future Cities: Challenges and Opportunities

Content: Examination of contemporary and future challenges facing urban environments. Topics include climate change impacts, resource scarcity, urban sprawl, informal settlements, rapid urbanization, housing shortage, homelessness, and socio-economic disparities. The session also explores potential future scenarios and the role of resilience and adaptability in urban planning.

Objectives: Identify key future challenges and discuss the role of technology and policy in addressing these issues.

SESSION 3 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Strategies for Shaping Urban Landscapes.

Content: Focus on current urban strategies and practical solutions as placemaking, 15-min city, superblocks, evolutionary urbanism, or tactical urbanism. The session also establishes a critical comparison with traditional and historical urban strategies as master planning or zoning.

Objectives: Understand the ideas and political ideologies behind contemporary urban strategies, for fostering sustainable and inclusive cities.

SESSION 4 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Technology's Role in Shaping Urban Landscapes

Content: Overview of pivotal technological advancements that have influenced urban development, such as transportation systems, infrastructure, building components, security and communication technologies. Discussion on how these technologies have reshaped cities and their socio-economic landscapes.

Objectives: Link historical technological shifts to changes in urban form and function, fostering an understanding of technology as a driver of urban evolution.

SESSION 5 (ASYNCHRONOUS)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Technology in Modern Urban Management

Content: Focus on current technologies like IoT, AI, and big data analytics that support urban operations including traffic management, waste disposal, and energy distribution. Examination of cybersecurity and privacy issues related to urban sensor networks.

Objectives: Understand the technological backbone of contemporary smart cities and discuss the ethical implications of surveillance and data collection.

SESSION 6 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Case Studies in Urban Strategy and Technology Implementation

Content: Analysis of three distinct case studies in each session that demonstrate the implementation, effects, and challenges of strategies and technologies in urban settings. These case studies will cover different continents and scales, providing a global perspective on urban strategies and tech solutions.

Objectives: Apply theoretical knowledge to real-world scenarios, critically evaluate the effectiveness of technological interventions in urban settings.

Information and reading material regarding the three case studies provided in class will be provided via blackboard to the students via Blackboard.

SESSION 7 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Case Studies in Urban Technology Implementation.

Content: Analysis of three distinct case studies in each session that demonstrate the implementation, effects, and challenges of strategies and technologies in urban settings. These case studies will cover different continents and scales, providing a global perspective on urban strategies and tech solutions.

Objectives: Apply theoretical knowledge to real-world scenarios, critically evaluate the effectiveness of technological interventions in urban settings.

Information and reading material regarding the three case studies provided in class will be provided via blackboard to the students via Blackboard.

SESSION 8 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Regenerative Urban Practices and Technologies

Content: Exploration of large-scale urban sustainability projects that focus on regeneration and repair, such as green infrastructure, zero-waste cities, and water reclamation projects. Includes three case studies that highlight successful implementation of these practices.

Objectives: Learn from existing sustainable urban projects, understanding the impact and scalability of regenerative practices.

Information and reading material regarding the three case studies provided in class will be provided via blackboard to the students via Blackboard.

SESSION 9 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Research and Innovation in Urban Sustainability

Content: Insight into ongoing research projects at the IE Center for Sustainable Cities and similar institutions worldwide. Focus on how academic and field research is translated into practical urban solutions.

Objectives: Expose students to current research methodologies and their practical applications in urban environments, emphasizing the connection between academia and urban policy-making.

SESSION 10 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Capstone Project Introduction and Hackathon

Content: Introduction to the capstone project, formation of teams, and initial brainstorming. This session sets the stage for a project that challenges students to rethink and repurpose existing urban infrastructures and technologies for greater sustainability and societal benefit.

Objectives: Foster collaborative innovation, critical thinking, and creative problem-solving in developing sustainable urban technologies.

This exercise encourages students to "hack" existing urban technologies and infrastructures, uncovering opportunities to repurpose or enhance them for more significant communal and environmental benefit. Teams will critically assess the potential of these technologies, speculating on their future impact, proposing minor yet impactful modifications, and envisioning new connections to bolster existing services. This capstone project synthesizes the course's learning outcomes and offers a platform for students to contribute innovative ideas toward the sustainable evolution of urban environments.

A detailed Brief for the exercise will be provided via Blackboard, explaining the exercises, deadlines and project deliverables.

SESSION 11 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Project Development and Critiques

Content: Ongoing project development with periodic critiques from the professor and peers, providing feedback and guidance. These sessions are interactive and allow for iterative refinement of project ideas and methodologies.

Objectives: Develop a strategic approach to sustainable urban technology solutions, refine project proposals through continuous feedback.

SESSION 12 (LIVE IN-PERSON)**Sustainability Topics:**

- Environment
- Governance
- Social Challenge

Project Development and Critiques

Content: Ongoing project development with periodic critiques from the professor and peers, providing feedback and guidance. These sessions are interactive and allow for iterative refinement of project ideas and methodologies.

Objectives: Develop a strategic approach to sustainable urban technology solutions, refine project proposals through continuous feedback.

SESSION 13 (LIVE IN-PERSON)**Sustainability Topics:**

- Environment
- Governance
- Social Challenge

Project Development and Critiques

Content: Ongoing project development with periodic critiques from the professor and peers, providing feedback and guidance. These sessions are interactive and allow for iterative refinement of project ideas and methodologies.

Objectives: Develop a strategic approach to sustainable urban technology solutions, refine project proposals through continuous feedback.

SESSIONS 14 - 15 (LIVE IN-PERSON)**Sustainability Topics:**

- Environment
- Governance
- Social Challenge

Final Presentations Groups

Content: Groups present their final projects in two sessions, allowing for comprehensive feedback from classmates and instructors. These presentations showcase the culmination of the course's learning objectives and practical applications.

Objectives: Enhance communication skills, demonstrate mastery of course content, and present innovative solutions to urban challenges.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		Breakdown: 10% 2 reflections (400-700 words) 1. Start of semester: Reflection on why you chose this topic and expectations. Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.). 2. Mid semester: Reflection on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society) 20% At least 2 individual assignments specific to the course topic, involving critical thinking, technical aspects, case studies and/or problem-solving skills. 25% Final exam (session 13): 19 question-multiple

Group Work	30 %		Presentation content: 20% Continuous Evaluation + Presentation + Submitted slides: Problem Area (knowledge) + Technology Applied (knowledge) + What specific problem it was applied to resolve (use case) + Implications (Critical Thinking/Analysis) Final presentation of 7-10 minutes (no less than 7 minutes, no longer than 10) and Q&A (professor and classmates). All team members must participate (in presentation and/or Q&A). All group projects must include at least 2 intermediate deliverables prior to the final presentations (continuous evaluation). Details regarding the rubric for Continuous Evaluation + Presentation & Slides will be posted in the blackboard during the course. 10% Self and Peer Review (numeric and with commentaries).
Class Participation	15 %		Breakdown: 10%: 5 graded pre-class work reading or video preparation: readings/videos for feedback fruits Q&A and comment threads. 5%: Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call. - Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- JANE JACOBS. *THE DEATH AND LIFE OF GREAT AMERICAN CITIES*. ISBN 067974195X (Digital)

- BEN WILSON. *METROPOLIS. A HISTORY OF THE CITY HUMANKIND'S GREATEST INVENTION*. ISBN 178470752X (Digital)

- RICHARD FLORIDA. *THE NEW URBAN CRISIS: HOW OUR CITIES ARE INCREASING INEQUALITY, DEEPENING SEGREGATION, AND FAILING*. ISBN 0465079741 (Digital)
- EDWARD GLAESER. *TRIUMPH OF THE CITY*. ISBN 0143120549 (Digital)
- CAROLYN STEEL. *HUNGRY CITY: HOW FOOD SHAPES OUR LIVES*. ISBN B00AMI6L3U (Digital)
- Carlo Ratti. *The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life*. ISBN 0300204809 (Digital)

BEHAVIOR RULES

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ETHICAL POLICY

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UNIVERSITY

TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.M.X.DecodAI

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **PABLO SANGUINETTI FERNÁNDEZ-ORDÓÑEZ**

E-mail: psanguinetti@faculty.ie.edu

Pablo Sanguinetti is a PhD researcher and writer specializing in a humanistic approach to technology. He holds a BA in Literary Theory with postgraduate studies in Artificial Intelligence and Programming, and is currently pursuing a PhD in artificial intelligence narratives. He operated the Google innovation program for the media industry in Spain and Portugal, delivering over a hundred lectures and workshops at leading universities and media companies in both countries. He has also served as a correspondent for the German agency DPA in Berlin and Madrid during his journalism career. He is the author of the essay book *Tecnohumanismo: Por un diseño narrativo y estético de la inteligencia artificial* (Technohumanism: Towards a narrative and aesthetic design of artificial intelligence) and two collections of short stories. He is a member of the Observatory on the Ethical and Social Impact of Artificial Intelligence in Spain (OdiselA).

Office Hours

Office hours will be on request. Please contact at:

psanguinetti@faculty.ie.edu

SUBJECT DESCRIPTION

Artificial intelligence (AI) may be one of the most disruptive technologies in human history. It is also a complex reality, distorted by exaggerated expectations and fears. How can we truly understand this technology in order to exploit its opportunities, avoid its risks and discuss its implications? This course is an attempt to 'decode' AI in three distinct but intertwined ways. First, by helping non-technical students understand the key components of an AI model and how its main algorithms work. Second, by applying these concepts to real-world problems using practical tools in a final project at the end of the course. Third, by using this technical and practical knowledge to better understand and engage with key debates surrounding AI and its social and ethical implications. By the end of the course, students will have a clear idea of concepts such as deep learning, transformers, natural language processing (NLP), generative AI or world model. They will have tested tools and techniques such as NLP tasks, Hugging Face, Python, Colab and Flourish. And they will be counting on better arguments to explain sociotechnical problems, such as why a neural network operates as a "black box" and the implications for transparency and accountability, how the architecture of a large language model makes it unreliable as a source of information, or the impact on public debate of including "likes" on social media platforms.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

In this course, the use of generative artificial intelligence (GenAI) is permitted, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE's core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world's greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

SESSIONS

It culminates with the **IE Challenge** where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

IE IMPACT TECHNOLOGY SYLLABUS

SESSION 1 (LIVE IN-PERSON)

The course begins with a high-level introduction to artificial intelligence. We will review the main historical milestones that explain where this technology comes from and where it is now. We will understand some of the main concepts behind the current boom. And we'll start to clarify key terms and differences, such as symbolic AI vs machine learning or strong vs weak AI. To do this, we will build an AI model in class, test it and discuss its results.

Concepts covered: Artificial intelligence, symbolic AI, machine learning, strong AI or AGI, weak or narrow AI, AI winter.

Reading for next class:

Book Chapters: Coeckelbergh, M. (2020), "The Technology", in AI Ethics. The MIT Press (63-81) (See Bibliography)

SESSION 2 (LIVE IN-PERSON)

We will recap the core ideas of our first session and keep expanding our vocabulary with new concepts. We will explore the distinction between supervised, unsupervised and reinforcement learning. To close these two first sessions focused on core ideas, we will visualize a neural network, the basis of deep learning, to understand how it works.

Concepts covered: Supervised, unsupervised, and reinforcement learning. Deep learning, neural network, algorithm.

Initial reflection for next class: Write a short reflection (400-700 words) on why you chose this topic and expectations. Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.)

SESSION 3 (LIVE IN-PERSON)

The phases that we have studied in an AI project shed light on the various ethical challenges of this technology. Every decision in every design phase has a direct impact on society. What are those decisions? What frameworks can we apply to evaluate the impact of the model and guide us towards ethical technology?

Concepts covered: Black box, transparency, privacy, bias, ethical and design frameworks.

Watch:

Other / Complementary Documentation: The Wisdom We Need to Design Humane Technology (the Center for Human Technology; Youtube)

SESSION 4 (LIVE IN-PERSON)

After understanding the common basis of all AI models, we will see what particular forms it can take depending on the format in which it is applied: numbers, audio, image and language. This distinction will help us delve deeper into generative AI and begin to understand the algorithms behind models such as ChatGPT or Dall-e.

Concepts covered: AI tasks (classification, regression, anomaly detection, clustering, recommendation). Computer vision, natural language processing. Generative AI.

Reading:

Article: Generative AI Exists Because of Transformers (The Financial Times)

SESSION 5 (LIVE IN-PERSON)

In this class we will focus on one of the areas studied in the previous one: language. Natural language processing (NLP) is one of the most powerful and useful branches of AI today. We will review the various tasks (from sentiment analysis to entity extraction or classification). And we will ask ourselves if the current state of the art is enough to believe that AI "understands" the world... or can ever do so.

Concepts covered: NLP tasks (NER, sentiment analysis, classification, topic modeling, Q&A). World model, knowledge graph.

SESSION 6 (ASYNCHRONOUS)

You will work on your own to complete a framework that allows you to organize and propose an AI project, known as ML Canvas.

Concepts covered: ML Canvas.

SESSION 7 (LIVE IN-PERSON)

In this hands-on class, we'll look at some basics of one of today's most popular programming languages, Python. We'll do it on a platform that's especially useful for testing code, sharing it, and presenting it to others: Google Colab.

Concepts covered: Python (and its main components), coding notebooks, Google Colab.

Assignment for next class: Coding exercises in Google Colab.

SESSION 8 (LIVE IN-PERSON)

Programmers don't work alone. In their daily lives they rely on numerous resources, most of which are free and open. While we continue with programming tests in Colab, we will see how we can use those resources for our own work.

Concepts covered: Github, stack overflow, chatgpt coding, documentation, libraries, advanced search.

SESSION 9 (LIVE IN-PERSON)

Thanks to that open and collaborative spirit of an important part of the technology community, we have a platform like Hugging Face, a large collection of open source AI models for various tasks. We will see what it is, how it is organized and how we can use its models in Colab. Finally, we will briefly discuss why open source models are controversial and who opposes them.

Concepts covered: Hugging Face, open source models.

Midterm reflection for next class: Write a short reflection (400-700 words) on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.

SESSION 10 (LIVE IN-PERSON)

Can we "program" something as unpredictable as creativity? In this session, we will look at some algorithms and models especially suitable for making "art" and discuss some famous examples of their application.

Concepts covered: GANs, DeepDream, diffusion models.

Optional reading for next class: Du Sautoy, M. (2019), "Why We Create: A Meeting of Minds". In The Creativity Code. How AI is Learning to Write, Paint and Think. 4th Estate (298-306).

SESSION 11 (LIVE IN-PERSON)

We have already explored the ethical implications of the way we design a technology. In this class, we will now ask ourselves about the very possibilities of AI. How far can it go? Where is the limit? What arguments can help us find the answer? Is the current AI boom justified?

Concepts covered: Limits of AI. Value alignment. Generalization. Turing Test. Singularity.

Reading for next class:

Book Chapters: Russell, S. & Norvig, P. (2022), "The Limits of AI". In Artificial Intelligence. A Modern Approach. (paragraphs 28.1-28.2) (See Bibliography)

SESSION 12 (LIVE IN-PERSON)

There is a long distance between having data and using it effectively and eloquently. In this session we will review the seven phases of a data project and the tools and resources that can help us in each one: from obtaining data to its visualization, from cleaning datasets to its verification.

Concepts covered: Datasets, data processing, data visualization, Flourish.

SESSION 13 (LIVE IN-PERSON)

Final exam: multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final presentation of 7-10 minutes and Q&A (professor and classmates).

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%), Self and Peer Review (10%)

Class participation	15 %		5 graded pre-class work. Reading or video preparation (10%). Overall in-class participation (does not include attendance) (5%)
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RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
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- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

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In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Melanie Mitchell. *Artificial Intelligence. A Guide for Thinking Humans*. ISBN 9780241404836 (Digital)
- Stuart Russell and Peter Norvig. *Artificial Intelligence. A Modern Approach*. ISBN 9781292401133 (Digital)
- Mark Coeckelbergh. *AI Ethics*. ISBN 9780262538190 (Digital)
- Stuart Russell. *Human Compatible. AI and the Problem of Control*. ISBN 9780241335246 (Digital)

BEHAVIOR RULES

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.A.Society

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1^o

Category: COMPULSORY

Language: English

Professor: **ANNA JABLONER**

E-mail: ajabloner@faculty.ie.edu

Dr. Anna Jabloner is an assistant professor of anthropology at IE University. She holds a Mag.Phil. from the University of Vienna (2004) and Ph.D. from the University of Chicago (2015). Between 2019-2023, Jabloner taught anthropology and Science & Technology Studies (STS) at Harvard University, where her teaching excellence was recognized each semester. She previously held postdoctoral fellowships at the Stanford and Columbia Medical Schools and at Goethe University Frankfurt. Jabloner's field of research is the anthropology of science and technology, with a regional specialization on California. Her work centers on the social and cultural dimensions of science, technology, medicine, and data, on biopolitics and bioethics, futurism, feminist epistemologies, gender and race, and on ethnographies of the US. Jabloner's research has been supported by the US National Institutes of Health, the Wenner-Gren Foundation, Social Science Research Council, and the Austrian Federal Ministry of Education, Science and Research, and she has authored recent articles in such journals as *Social Analysis*, *Science as Culture*, *Catalyst: Feminism, Theory, Technoscience*, *Anthropology Now*, and *Nature Biotechnology*.

Office Hours

Office hours will be on request. Please contact at:

ajabloner@faculty.ie.edu

SUBJECT DESCRIPTION

Technologies always develop in specific contexts. Groups of people think of and create technologies to solve problems and work together to build something new. In this process, society and culture make up the conditions in which technologies emerge and are thus an essential aspect of all technological progress. This course will draw on instances from a range of sectors where technologies are used and being developed – market industries, medicine, education, military, law, etc. – to learn about their social and cultural dimensions. For example, human suffering during the COVID-19 pandemic created intense pressure to quickly develop a vaccine. Within a year, lives around the globe were saved through a new bio-technology. A dark case in history is of course the atom bomb; here, war-time pressures led to rapid advances in a specific technological area. Once they are being developed or exist, technologies also impact society and culture, changing conditions in turn. For example, we are witnessing how information technologies influence political processes, such as in social media's role in organizing people into new movements, or create ethical puzzles, as we see in the debate around AI in college education. Another example is the use of genetic technologies in medicine, which is impacting how doctors practice their profession.

These ongoing dynamics – the conditions in which technologies develop, how technologies impact conditions – make it impossible to separate technology from society. Thus in this course, you will learn to put technologies into context. Doing so is essential to understanding where investment and development are needed and where technologies might actually cause new problems. In addition, studying the social contexts in which technologies develop is crucial for our ability to critically assess and manage technologies' impacts on society. At the end of the course, you will understand the entwined dynamics of technological and social change. Overall, in this basic introductory course, you will be introduced to theories and conceptualizations of technology & society. You will also have a chance to investigate specific cases and thereby apply the theories and concepts you learn about during the semester.

CASES WE WILL INVESTIGATE:

- Social media, Digital rights, and Global freedoms: What even becomes data? And what should become data but doesn't?
- Designing for inclusion and equality/Algorithmic discrimination; e.g., is facial recognition software racist? If so, can we change that?
- AI in Education: Does anyone still need to learn how to write if technology can do it for us?
- Nuclear technologies: If rapid technological development causes terrible social conditions, should we still invest in them? Or in turn, how do we weigh risks vis-a-vis sustainability, environment, and human lives?
- Reproductive technologies: Prenatal genetic testing can predict the gender of a fetus, but should such technologies be developed?

*****NOTE: There are only two books you need for class -- you can borrow them from the IE library or buy them (they should be available used for a low price):**

- Ludwik Fleck, 1979 [1935] *Genesis and Development of a Scientific Fact*. University of Chicago Press.
- Thomas Kuhn, 1996. *The Structure of Scientific Revolutions*, 3rd Edition. University of Chicago Press (please make sure you get the 3rd edition)

All other session materials will be provided on Blackboard (required and recommended readings).

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

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- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

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Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

PROGRAM

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

PLEASE NOTE THAT THE SCHEDULE BELOW IS SUBJECT TO CHANGE BASED ON THE INTERESTS AND NEEDS OF THE STUDENTS. THE MOST UPDATED INFORMATION ABOUT WHAT YOU NEED TO DO FOR EACH SESSION WILL ALWAYS BE FOUND IN THE ANNOUNCEMENTS SECTION OF BLACKBOARD.

Topic: *INTRODUCTION TO TECHNOLOGY & SOCIETY*. Discuss the course and the syllabus.

Pre-class: No readings due.

SESSION 2 (LIVE IN-PERSON)

Topic: *WHAT HAS CAUSED AND IS CAUSING THE TECHNOLOGICAL CHANGES WHOSE IMPACT WE ARE EXPERIENCING?*

Concepts covered: society, causation, technological determinism, social determinism

Learning objectives: To understand how the relationship between technology & society can be analyzed – and without getting stuck in a binary.

Pre-class: read Mackenzie & Wajcman: “Introductory Essay” in *The Social Shaping of Technology: How the Refrigerator Got Its Hum*.

Book Chapters: Mackenzie & Wajcman: “Introductory Essay” in The Social Shaping of Technology: How the Refrigerator Got Its Hum (CED)

SESSION 3 (LIVE IN-PERSON)

Topic: **DATA & JUSTICE WORKSHOP* or: “Technologies always reflect the culture that produces them...”*

Concepts covered: data, justice, social conditions & implications, approaches to ethics

Learning objectives: to understand how issues of justice exist “before” & “after” technology (e.g., national priority setting, values that shape design processes, ethical implications)

Pre-class: no readings due.

Reflection 1 due today (Details will be provided in advance).

SESSION 4 (LIVE IN-PERSON)

Topic: *THINKING AND REASONING*

Concepts covered: Thought collectives, approaches to technology & society

Learning objectives: to understand what happens in the practice of thinking and reasoning

Pre-class: read Ludwik Fleck, *Genesis and Development of a Scientific Fact*. Excerpt TBD.

Book Chapters: Ludwik Fleck, Genesis and Development of a Scientific Fact. Excerpt TBD (See Bibliography)

SESSION 5 (LIVE IN-PERSON)

Topic: *ARE TECHNOLOGIES THEMSELVES POLITICAL?*

Concepts covered: classic approaches in social studies of technology

Learning objectives: To understand how political processes shape technological design and how technological developments shape politics.

Pre-class: read Langdon Winner, *Do Artifacts Have Politics?* Excerpts TBD.

Article: Langdon Winner, Do Artifacts Have Politics? (Daedalus, Vol. 109, No. 1 (Winter. 1980), 121-36) (CED)

SESSION 6 (LIVE IN-PERSON)

Topic: **ALGORITHMIC DISCRIMINATION WORKSHOP** -- Is facial recognition software racist?, or, designing technology for equality

Concepts covered: new approaches to algorithmic oppression in the digital age

Learning objectives: to deepen the understanding of where issues of data and justice arise

Pre-class: read Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. Introduction. Excerpt TBD.

First deliverable due for final presentations. Details TBD.

Book Chapters: Safiya Umoja Noble, Algorithms of Oppression: How Search Engines Reinforce Racism. Introduction (CED)

SESSION 7 (LIVE IN-PERSON)

Topic: *WHAT MAKES A FACT A FACT?*

Concepts covered: facts, truths, authoritative knowledge

Learning objectives: to understand elemental conceptualizations of facts

Pre-class: read Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*. Chapters 1, 2 and 4 (See also Bibliography).

Book Chapters: Bruno Latour, Laboratory Life: The Construction of Scientific Facts. Princeton University Press, 2013. Chapter 1 (CED)

SESSION 8 (LIVE IN-PERSON)

FIRST 45 MINUTES: MIDTERM (multiple choice & reflection 2 on the course, 400 words)

Topic: In-class Workshop on Social Dimensions of Nuclear Technologies / Reproductive Technologies

We will divide into two groups that work on these topics respectively. I will have a list of questions to guide you in your research on these topics. You will learn some basics of these two fields of technological development (e.g. what scientific disciplines do they draw on? What machinery do they use? Are they digital technologies / how has the digital revolution changed these fields?) Given our class topic and to approach such technologies' societal embedding, you will generate a list of steps to take in a research project, centered on historical emergence, risks and benefits, sustainability, ethical implications, etc. For example, we might ask what problems in society lead to the development of these sectors in the first place, where you would need to look/go to answer questions about what cell free fetal DNA is, or what kind of expert you would need to interview to understand the risks of nuclear technologies.

Pre-class: no reading due.

SESSION 9 (LIVE IN-PERSON)

Topic: HOW DOES SCIENCE CHANGE? PART I

Concepts covered: paradigms, scientific process & progress, scientific revolutions

Learning objectives: To become familiar with a seminal text in philosophy of science and understand its core concept of the scientific paradigm.

Pre-class: read Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, Excerpt TBD & Barry Barnes, 3-page section on "Similarity Relations" in *T.S. Kuhn and Social Science*.

Book Chapters: Thomas Kuhn, The Structure of Scientific Revolutions, 3rd edition, Excerpt TBD (See Bibliography)

Book Chapters: Barry Barnes, 3-page section on "Similarity Relations" in T.S. Kuhn and Social Science (CED)

SESSION 10 (ASYNCHRONOUS)

Topic: HOW DOES SCIENCE CHANGE? PART II

In this asynchronous session, you will finish reading Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, and an excerpt from Emily Martin's article, "The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles."

We will have a short assignment on Blackboard due the same week as (but after) Session 9: on Wednesday for Segovia students and on Friday for Madrid students.

Article: Emily Martin, The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles (Signs, Vol. 16, No. 3 (Spring, 1991), pp. 485-501) (CED)

SESSION 11 (LIVE IN-PERSON)

Topic: HOW CAN WE STUDY CURRENT SCIENTIFIC AND TECHNOLOGICAL PRACTICE?

Concepts covered: epistemic culture, how humans relate to machines

Learning objectives: to understand the basics of empirical social science research on technology, understanding social analysis of technology

Pre-class: read Karin Knorr Cetina, *Epistemic Cultures: How the Sciences Make Knowledge*. Excerpt TBD.

Second deliverable due for final presentations. Details TBD.

Book Chapters: Karin Knorr Cetina, Epistemic Cultures: How the Sciences Make Knowledge. Chapters 1 and 5 (CED)

SESSION 12 (LIVE IN-PERSON)

Topic: *WHAT IS OBJECTIVITY AND WHO DO WE TRUST TO BE OBJECTIVE?*

Concepts covered: objectivity, subjectivity, authority, positionality, trust, expertise

Learning objectives: to understand how the contemporary idea of objectivity developed in history (objectivity used to mean the opposite of what it does now!)

Pre-class: read Daston, Lorraine & Galison, Peter, *Objectivity* Ch 1 and Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin* (or Donna Haraway, *Situated Knowledge*). Excerpts TBD.

Book Chapters: Daston, Lorraine & Galison, Peter, *Objectivity*. Ch 1 (CED)

Book Chapters: Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin*. Chapter 7 (CED)

Article: *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective* (*Feminist Studies*, Vol. 14, No. 3 (Autumn, 1988), pp. 575-599) (CED)

SESSION 13 (LIVE IN-PERSON)

Final Exam (25%)

Details on the final exam will be provided in advance.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Student Presentations (7-10minutes for each group, Q&A, 20%)

Self and Peer Review of Presentations (numeric and with commentaries) due TBD (10%)

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		5% Reflection 1, 25% Midterm (incl Reflection 2), 25% Final Exam
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) • Self and Peer Review (10%)
Class Participation	15 %		10% graded pre-class work Reading or video preparation. • 5% Overall in-class participation (does not include attendance)

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Compulsory

- Ludwik Fleck. (1979). *Genesis and Development of a Scientific Fact*. The University of Chicago Press. ISBN 0226253252 (Printed)
- Thomas Kuhn. (1996). *The Structure of Scientific Revolutions*. 3rd Edition. The University of Chicago Press. ISBN 0226458083 (Digital)

Recommended

- Bruno Latour. *Laboratory Life: The Construction of Scientific Facts*. Princeton Paperbacks. ISBN 9780691028323 (Digital)

BEHAVIOR RULES

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ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

**IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-
IMPACT.2.S.B.DecodAI**

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **PABLO SANGUINETTI FERNÁNDEZ-ORDÓÑEZ**

E-mail: psanguinetti@faculty.ie.edu

Pablo Sanguinetti is a PhD researcher and writer specializing in a humanistic approach to technology. He holds a BA in Literary Theory with postgraduate studies in Artificial Intelligence and Programming, and is currently pursuing a PhD in artificial intelligence narratives. He operated the Google innovation program for the media industry in Spain and Portugal, delivering over a hundred lectures and workshops at leading universities and media companies in both countries. He has also served as a correspondent for the German agency DPA in Berlin and Madrid during his journalism career. He is the author of the essay book *Tecnohumanismo: Por un diseño narrativo y estético de la inteligencia artificial* (Technohumanism: Towards a narrative and aesthetic design of artificial intelligence) and two collections of short stories. He is a member of the Observatory on the Ethical and Social Impact of Artificial Intelligence in Spain (OdiselA).

Office Hours

Office hours will be on request. Please contact at:

psanguinetti@faculty.ie.edu

SUBJECT DESCRIPTION

Artificial intelligence (AI) may be one of the most disruptive technologies in human history. It is also a complex reality, distorted by exaggerated expectations and fears. How can we truly understand this technology in order to exploit its opportunities, avoid its risks and discuss its implications? This course is an attempt to 'decode' AI in three distinct but intertwined ways. First, by helping non-technical students understand the key components of an AI model and how its main algorithms work. Second, by applying these concepts to real-world problems using practical tools in a final project at the end of the course. Third, by using this technical and practical knowledge to better understand and engage with key debates surrounding AI and its social and ethical implications. By the end of the course, students will have a clear idea of concepts such as deep learning, transformers, natural language processing (NLP), generative AI or world model. They will have tested tools and techniques such as NLP tasks, Hugging Face, Python, Colab and Flourish. And they will be counting on better arguments to explain sociotechnical problems, such as why a neural network operates as a "black box" and the implications for transparency and accountability, how the architecture of a large language model makes it unreliable as a source of information, or the impact on public debate of including "likes" on social media platforms.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

In this course, the use of generative artificial intelligence (GenAI) is permitted, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE's core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world's greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

SESSIONS

It culminates with the **IE Challenge** where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

IE IMPACT TECHNOLOGY SYLLABUS

SESSION 1 (LIVE IN-PERSON)

The course begins with a high-level introduction to artificial intelligence. We will review the main historical milestones that explain where this technology comes from and where it is now. We will understand some of the main concepts behind the current boom. And we'll start to clarify key terms and differences, such as symbolic AI vs machine learning or strong vs weak AI. To do this, we will build an AI model in class, test it and discuss its results.

Concepts covered: Artificial intelligence, symbolic AI, machine learning, strong AI or AGI, weak or narrow AI, AI winter.

Reading for next class:

Book Chapters: Coeckelbergh, M. (2020), "The Technology", in AI Ethics. The MIT Press (63-81)
(See Bibliography)

SESSION 2 (LIVE IN-PERSON)

We will recap the core ideas of our first session and keep expanding our vocabulary with new concepts. We will explore the distinction between supervised, unsupervised and reinforcement learning. To close these two first sessions focused on core ideas, we will visualize a neural network, the basis of deep learning, to understand how it works.

Concepts covered: Supervised, unsupervised, and reinforcement learning. Deep learning, neural network, algorithm.

Initial reflection for next class: Write a short reflection (400-700 words) on why you chose this topic and expectations. Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.)

SESSION 3 (LIVE IN-PERSON)

The phases that we have studied in an AI project shed light on the various ethical challenges of this technology. Every decision in every design phase has a direct impact on society. What are those decisions? What frameworks can we apply to evaluate the impact of the model and guide us towards ethical technology?

Concepts covered: Black box, transparency, privacy, bias, ethical and design frameworks.

Watch:

Other / Complementary Documentation: The Wisdom We Need to Design Humane Technology (the Center for Human Technology; Youtube)

SESSION 4 (LIVE IN-PERSON)

After understanding the common basis of all AI models, we will see what particular forms it can take depending on the format in which it is applied: numbers, audio, image and language. This distinction will help us delve deeper into generative AI and begin to understand the algorithms behind models such as ChatGPT or Dall-e.

Concepts covered: AI tasks (classification, regression, anomaly detection, clustering, recommendation). Computer vision, natural language processing. Generative AI.

Reading for next class:

Article: Generative AI Exists Because of Transformers (The Financial Times)

SESSION 5 (LIVE IN-PERSON)

In this class we will focus on one of the areas studied in the previous one: language. Natural language processing (NLP) is one of the most powerful and useful branches of AI today. We will review the various tasks (from sentiment analysis to entity extraction or classification). And we will ask ourselves if the current state of the art is enough to believe that AI "understands" the world... or can ever do so.

Concepts covered: NLP tasks (NER, sentiment analysis, classification, topic modeling, Q&A). World model, knowledge graph.

SESSION 6 (ASYNCHRONOUS)

You will work on your own to complete a framework that allows you to organize and propose an AI project, known as ML Canvas.

Concepts covered: ML Canvas.

SESSION 7 (LIVE IN-PERSON)

In this hands-on class, we'll look at some basics of one of today's most popular programming languages, Python. We'll do it on a platform that's especially useful for testing code, sharing it, and presenting it to others: Google Colab.

Concepts covered: Python (and its main components), coding notebooks, Google Colab.

Assignment for next class: Coding exercises in Google Colab.

SESSION 8 (LIVE IN-PERSON)

Programmers don't work alone. In their daily lives they rely on numerous resources, most of which are free and open. While we continue with programming tests in Colab, we will see how we can use those resources for our own work.

Concepts covered: Github, stack overflow, chatgpt coding, documentation, libraries, advanced search.

SESSION 9 (LIVE IN-PERSON)

Thanks to that open and collaborative spirit of an important part of the technology community, we have a platform like Hugging Face, a large collection of open source AI models for various tasks. We will see what it is, how it is organized and how we can use its models in Colab. Finally, we will briefly discuss why open source models are controversial and who opposes them.

Concepts covered: Hugging Face, open source models.

Midterm reflection for next class: Write a short reflection (400-700 words) on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.

SESSION 10 (LIVE IN-PERSON)

Can we "program" something as unpredictable as creativity? In this session, we will look at some algorithms and models especially suitable for making "art" and discuss some famous examples of their application.

Concepts covered: GANs, DeepDream, diffusion models.

Optional reading for next class: Du Sautoy, M. (2019), "Why We Create: A Meeting of Minds". In *The Creativity Code. How AI is Learning to Write, Paint and Think*. 4th Estate (298-306).

SESSION 11 (LIVE IN-PERSON)

We have already explored the ethical implications of the way we design a technology. In this class, we will now ask ourselves about the very possibilities of AI. How far can it go? Where is the limit? What arguments can help us find the answer? Is the current AI boom justified?

Concepts covered:

Book Chapters: Russell, S. & Norvig, P. (2022), "The Limits of AI". In Artificial Intelligence. A Modern Approach. (paragraphs 28.1-28.2) (See Bibliography)

SESSION 12 (LIVE IN-PERSON)

There is a long distance between having data and using it effectively and eloquently. In this session we will review the seven phases of a data project and the tools and resources that can help us in each one: from obtaining data to its visualization, from cleaning datasets to its verification.

Concepts covered: Datasets, data processing, data visualization, Flourish.

SESSION 13 (LIVE IN-PERSON)

Final exam: multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final presentation of 7-10 minutes and Q&A (professor and classmates).

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%), Self and Peer Review (10%)
Class participation	15 %		5 graded pre-class work. Reading or video preparation (10%). Overall in-class participation (does not include attendance) (5%)

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
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- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

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Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Melanie Mitchell. *Artificial Intelligence. A Guide for Thinking Humans*. ISBN 9780241404836 (Digital)

- Stuart Russell and Peter Norvig. *Artificial Intelligence. A Modern Approach*. ISBN

9781292401133 (Digital)

- Mark Coeckelbergh. *AI Ethics*. ISBN 9780262538190 (Digital)

- Stuart Russell. *Human Compatible. AI and the Problem of Control*. ISBN 9780241335246 (Digital)

BEHAVIOR RULES

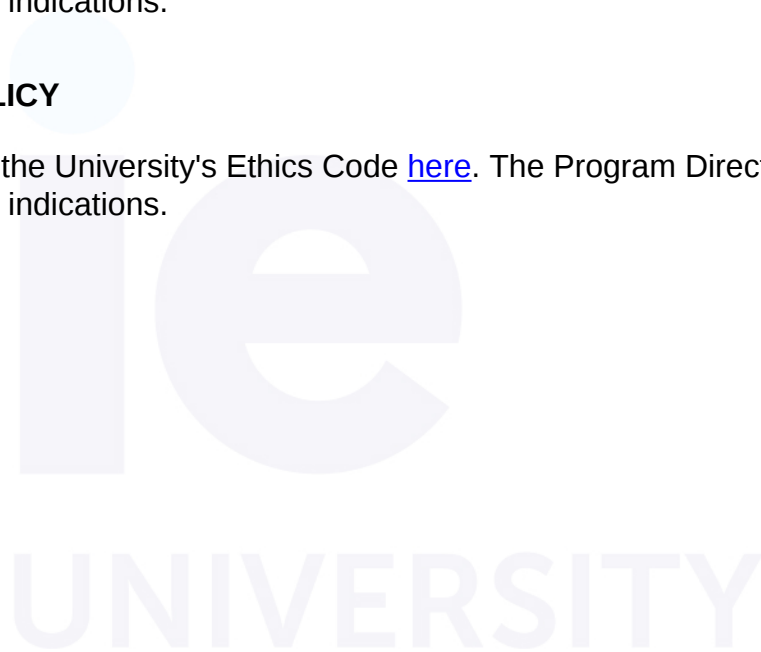
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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.C.WatTech

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1^o

Category: COMPULSORY

Language: English

Professor: **PEER HENDRIK ANTON TIMMERS**

E-mail: ptimmers@faculty.ie.edu

Dr. Peer Timmers is a trained microbiologist that focusses on water treatment. During his doctoral research at Wageningen University & Research (Wageningen, the Netherlands) and his post-doc work at Wetsus (Leeuwarden, the Netherlands), he studied how to use microorganisms for the degradation of undesirable substances in wastewater or for the production of valuable resources from waste streams ? preferably for both simultaneously. Afterwards, he worked at KWR water research (Nieuwegein, the Netherlands) where he investigated current and novel drinking water water treatment and management processes with a specific focus on microbiology and nature-based solutions, that possibly lead to new applications for climate-resilient water treatment and management

Office Hours

Office hours will be on request. Please contact at:

ptimmers@faculty.ie.edu

SUBJECT DESCRIPTION

WATER TECHNOLOGY FOR CLIMATE RESILIENCE

Climate change has dramatic consequences on the water cycle of our planet, which affects both the water quantity and quality of freshwater, brackish water and seawater. As a matter of fact, climate change, regardless of changes in the chemical composition of the atmosphere that trigger complex phenomena (such as global warming), can actually be seen as a change in the water cycle as such. The human population and its environment have to deal with an increasing long-term insecurity: freshwater scarcity and drought risk, floods, an overall lowered quality of the current freshwater sources and the loss of biological diversity in aquatic ecosystems at higher rates than in terrestrial ecosystems, which may lead to the collapse of ecosystems, both terrestrial and aquatic. The need for sustainable water resources management and novel technologies has therefore increased over the last years. In this water technology course, students will be introduced to several aspects of water management and technologies, with specific emphasis on water quantity and quality issues and with some references to hydro-morphological alterations, that is changes to the physical habitat, and/or a water body' natural functioning. It explores the three key concepts of climate solutions for water management and technologies: retention, recharge and reuse of water. These are the drivers for climate resilient freshwater management and technology, together with the search for alternative water sources.

Water management and technologies that address water scarcity and water quality have rapidly evolved over the last decade and are applied as we speak. Water technologies for water treatment have always followed a linear approach to treat water, but are currently exploring the implementation of circular approaches that emulate nature. Moreover, alternative water supply sources are being explored for drinking water production and other uses. The application of these new technologies, circular approaches and alternative water sources not only have consequences on water quality and quantity, but also on society as a whole. The application of these new technologies therefore also involves socio-economic aspects such as awareness, behaviour, mindsets, incentives, institutional innovation, governance at large, legislation, etc.

This course aims to educate students on the technologies that are making an impact on solving some of the world's most pressing societal challenges, that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-grounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will also specifically address how society, organizations and people apply technology. A practical, human-centred approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals. However, we will also focus on social-ecological systems, as dynamic, complex and adaptive systems in which complex interactions happen and where siloed and fragmented approaches (scientific, political, economic) would fail to deliver.

During this course, you will obtain knowledge on the current status of water technology and management, but you will also co-create hands-on experience by working on real-world case studies where novel technologies are to be implemented. You will gain the ability to critically assess how the technology should be implemented, but also what would be the effect on society and industry. You will also collaborate with peers in a challenge where you will be inspired to create an impactful and innovative solution to a water challenge. You will gain understanding on the need to go beyond technological progress (i.e., governance) to understand why and how some of these technologies deliver and why others do not. In other words, you will understand the enabling factors for technology to play its part in ensuring long-term water security in a context of climate change mitigation and adaptation.

This IE Impact course is designed for all IEU students, from all schools and all bachelor programs and no technical knowledge is necessary. Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Specific use cases of GenAI are encouraged

Generative artificial intelligence (GenAI) tools may be used in this course for the case studies and group work (for example for ideation, generating an outline, proofreading, grammar check, coding, image generation) with appropriate acknowledgement. GenAI may not be used for assignments where it is specifically mentioned and the exam. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Introduction to course

- Course summary: contents description
- IE and students' expectations
- Assignments and grading
- Explanation of individual case studies and group project

Specific materials for each session and the chapters to read from the compulsory book will be distributed during the course

Book Chapters: Water Science and technology, an introduction

SESSION 2 (LIVE IN-PERSON)

Climate change effects on the water cycle

- Understand the effect of climate change on the water cycle
- Identify challenges for sustainable water resources management and the difference between water resources and water services
- Define conceptual solutions in the three R's (retention, recharge and reuse) and alternative water sources

Specific materials for each session and the chapters to read from the compulsory book will be distributed during the course

SESSION 3 (LIVE IN-PERSON)

Sustainable water management: retention and recharge

- Understand the importance of sustainable water management at a basin level
- Explore sustainable water technologies for retention and recharge, and how these can be connected
- Analyse the impact of sustainable water management on society, such as on the economy, culture, or the environment
- Recharge and rainwater use
- Understanding rainwater and its potential uses
- Design and implementation of rainwater harvesting and recharging systems
- Group project: discuss initial ideas for the group assignment

SESSION 4 (LIVE IN-PERSON)

Sustainable Water Treatment Technologies

- Traditional vs. modern water treatment methods
- Overview of current water purification technologies
- Water quality regulations for discharge on surface watersExamples of successful water treatment projects

Specific materials for each session and the chapters to read from the compulsory book will be distributed during the course

SESSION 5 (LIVE IN-PERSON)

Membrane technologies for water reclamation and reuse

- Overview of membrane technologies for water purification
- Desalination processes and alternative water sources
- Advantages and challenges of desalination
- Sustainable approaches to desalination
- Analyse effects on society of alternative water sources and drawbacks for their penetration

Group project: teams pitch their chosen project for the group assignment

SESSION 6 (LIVE IN-PERSON)

Sustainable water management: reclamation and reuse or regenerated water as well as materials and energy

- Understanding the principles and benefits of water reuse
- Identify water sources qualified for reuse
- Explore greywater and its potential uses
- Reuse in practice: design and implementation of water recycling systems
- Analyse societal and governance aspects of water reuse
- Examples on water recycling in different settings
- Deliver individual work; Case study 1: design of a water catchment and highlight implications of application

SESSION 7 (LIVE IN-PERSON)

Water-Energy Nexus

- Interconnection between water and energy; going beyond the sectoral bias
- Energy-efficient water technologies and water efficiency for energy
- Hydrogen and water technology
- Thermal energy storage
- Residual heat from industry
- Examples of integrated water-energy projects
- Deliver group project intermediate 1: teams deliver presentation slides for the group assignment on the technological part

SESSION 8 (LIVE IN-PERSON)

Smart Water Management

- Role of technology and IT in water management
- IoT and sensors for water monitoring
- Hydroinformatics and digital twins
- Opportunities in the tangency between digitization of the economy and sustainability

SESSION 9 (LIVE IN-PERSON)

Sustainable Agriculture and Water

- Importance of water in agriculture
- Precision agriculture for water efficiency
- Smart irrigation systems and water conservation and water quality
- Deliver group project intermediate 2: teams deliver presentation slides for the group assignment on the implications of the technology

SESSION 10 (ASYNCHRONOUS)

Group assignment: development of presentation (group work)

- Apply knowledge from the course to a groupwork assignment
- Prepare presentation of the assignment as a short pitch and report

SESSION 11 (LIVE IN-PERSON)

'Eye in the Storm' VR session + guided role-play in a multimedia environment

Games & Simulations: Eye in the Storm VR (CSR090011-U-ENG-VXR)

SESSION 12 (LIVE IN-PERSON)

'Eye in the storm' serious gaming session + class discussion on mitigation and adaptation policies

- Deliver individual work; Case study 2: possible solutions for sustainable management of concentrate streams and highlight implications of application

Practical Case : Eye in the storm: your role in climate change action (EEN010191-U-ENG-HTM)

SESSION 13 (LIVE IN-PERSON)

Final exam

- 19 question-multiple choice
- 1 open, critical-thinking/analytical question with max 400 word response

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final presentations of group assignment

- Each group presents their assignment case (7-10 min)
- Q&A and class feedback will be given by professor and students
- All team members must participate in presentation and Q&A

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Final Exam	25 %		

Individual work	30 %		Includes 2 reflections (10%), 2 individual assignments (20%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

- Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.
- In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Compulsory

- Nick Gray. (2017). *Water Science and technology*. 4th edition. CRC Press. ISBN 9781498753456 (Digital)

Physical book and eBook available

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.D.ClimTec

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **MARIA DEL CARME HUGUET MICHEO**

E-mail: mhuguet@faculty.ie.edu

Carme Huguet is a seasoned researcher with over two decades of experience across six countries. Her work focuses on addressing globally significant issues through scientific research, with a particular emphasis on understanding the impacts of climate change and other human activities on life on Earth. She employs a multidisciplinary approach and specializes in the development and application of organic geochemical tools to study past and present terrestrial and marine processes. A recognized leader in biogeochemistry, she serves on the board of the Geochemical Society. Huguet is also passionate about teaching and has founded a research group dedicated to active STEM learning, developing innovative materials and activities. She is actively involved in the scientific community, participating in outreach activities, organizing workshops, and serving as a session chair among other roles.

More details:

- <https://www.ie.edu/university/about/faculty/carme-huguet/#:~:text=Carme%20Huguet%20is%20a%20well,can%20be%20addressed%20through%20science.>
- <https://scholar.google.com.co/citations?user=Fd4oT24AAAAJ&hl=en>

Office Hours

Office hours will be on request. Please contact at:

mhuguet@faculty.ie.edu

SUBJECT DESCRIPTION

Embark on a transformative journey with our Climate Technology course, designed to empower you with a deep understanding of climate change and its profound impact on our daily lives. This course is not just about learning; it's about becoming a part of the solution.

Our holistic, transdisciplinary, and integrative approach will guide you through the complexities of global change. We believe that to tackle such a multifaceted issue, an interdisciplinary perspective is essential. Our first step is to comprehend the climate system itself, to grasp the changes it's undergoing, and to understand the far-reaching consequences at all levels.

We will then move into mitigation and adaptation strategies and technological solutions. It's in our hands to act within our areas of expertise to build the solutions of the future. Through adaptation and mitigation actions, we can build a more resilient society. Join us and be a part of this crucial journey towards a sustainable future.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
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Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Technology course – Climate Solutions

- o Explain course dynamics.
- o Start of the course challenge, group configuration and countries
- o What do you know: exploratory quiz.

SESSION 2 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to the Climate system and its dynamics

- o Know the components of the climatic system: spheres, sinks, flows.
- o Learn how the climate system works: heat budget and flow, atmospheric circulation, ocean circulation, feedback.
- o Biogeochemical Cycles-link carbon and water cycle.

Supporting material:

Book Chapters: The Climate System: an Overview (IPCC)

SESSION 3 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Climate Change

- o Understanding the basics of climate change
- o The science behind global warming and greenhouse gases

Supporting material:

Article: What Is Climate Change? (UN)

Article: What Is Climate Change? (NASA)

SESSION 4 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Impact of Climate Change

- o Discussing the environmental, economic, and social impacts of climate change
- o Case studies on the effects of climate change, primary and secondary, students will research and present.

Supporting material:

Article: Consequences of climate change (European Commission)

Article: The Basics of Climate Change (The Royal Society)

SESSION 5 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Climate Change Mitigation and adaptation

- o Understanding the concept of climate change mitigation and adaptation, resistance, and resilience.
- o Exploring various strategies for reducing greenhouse gas emissions.
- o What are we adapting to?

Supporting materials:

Article: Responding to Climate Change (NASA)

Book Chapters: Inter-relationships between adaptation and mitigation (IPCC)

SESSION 6 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Industrial)

- o Understanding the technology behind carbon capture and storage: Where and how.
- o Geoengineering
- o Discussing the potential and limitations of this technology-approach.

Supporting materials: articles will be provided.

Article: Negative emissions technologies and practices: the way forward (European Commission)

SESSION 7 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Nature Based)

- o Exploration of various nature-based NETs such as afforestation, reforestation, blue carbon (carbon captured by oceans and coastal ecosystems), and soil carbon sequestration.
- o Examination of real-world applications and case studies of nature-based NETs.

Supporting materials: articles will be provided.

Article: Could negative emissions actually help curb climate change? (European Commission)

SESSION 8 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Regenerative agroecology and land management, going beyond sustainable agriculture.

- Exploring the connection between agriculture, farming, and climate change
- Techniques for promoting real sustainable food production systems agriculture.

Supporting materials:

Other / Complementary Documentation: Movie: Ganado o Desierto

Other / Complementary Documentation: Movie: Kiss the Ground (Netflix)

SESSION 9 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Green Cities

- Understanding the concept of green cities
- Role of green cities in reducing greenhouse gas emissions and improving water use.
- Madrid Deep Demonstration project, EIT Climate KIC
- Towns in Transition

Supporting materials:

Other / Complementary Documentation: Towns in Transition (transitionnetwork.org)

Article: Supporting municipalities to develop collaboration capability to facilitate urban transitions and sustainability: Role of transition intermediaries in Madrid (Journal of Cleaner Production Journal of Cleaner Production 426:138964, 2023) (ResearchGate)

SESSION 10 (ASYNCHRONOUS)

Sustainability Topics:

- Environment
- Governance

Climate Change Policy

- o Discussing the role of policy in climate change mitigation and adaptation
- o Review of international climate agreements and policies

Supporting materials: COP meetings

Other / Complementary Documentation: COP meetings (UN)

SESSION 11 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Social Challenge

Climate Change and Society

- o Understanding the social dimensions of climate change
- o Role of individual and collective action in climate change mitigation

Supporting materials: articles will be provided, other sources:

- <https://www.worldbank.org/en/topic/social-dimensions-of-climate-change#1>
- <https://www.ipcc.ch/report/ar6/wg2/>

SESSION 12 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Climate Change Communication

- o Importance of effective communication in climate change mitigation
- o Techniques for communicating about climate change to diverse audiences.
- o Discussing the role of innovation in climate change mitigation

Supporting materials: articles, booklets will be provided. Additional:
<https://www.un.org/en/climatechange/communicating-climate-change>

SESSION 13 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Final EXAM

SESSIONS 14 - 15 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Climate Change Innovation

Students present their work.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		Class participation should be active, engaged and always respectful with the professor and fellow students.

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

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Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Puay Yok Tan (Editor), Chi Yung Jim (Editor). *Greening Cities: Forms and Functions (Advances in 21st Century Human Settlements)*. ISBN 9811350515 (Digital)
- Jose Carlos Magalhaes Pires (Redactor), Ana Luisa da Cunha Goncalves

(Redactor). *Bioenergy with Carbon Capture and Storage: Using Natural Resources for Sustainable Development*. Academic press. ISBN 0128162295 (Digital)

BEHAVIOR RULES

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ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.E.Leisure

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **MARIANO ALVAREZ DIENTE**

E-mail: mad2@faculty.ie.edu

Mariano Álvarez has extensive professional experience as a professor at IE University and IE Business School and has been a regular instructor at IBM for more than 20 years.

He complements his teaching activity at IE University with responsibilities in telecommunications projects for the public and private sectors and has lectured for institutions such as the CNP (National Police Corps) and the University of Valladolid.

His current focus is on initiatives in the areas of digital transformation, Internet of Things, Big Data and advanced analytics and AI. This allows him to acquire, also from a practical approach, the depth and breadth of knowledge necessary to be permanently updated in the complex IT world.

In addition to his education as a telecommunications engineer, he also has an education in Humanities (holds a bachelor's degree in literary theory and comparative literature and a master's degree in applied philological studies.) and often, in his lectures, stresses how important it is to put the focus on technology as an enabler of human evolution. In his opinion, technology is only useful if the human species can thrive through it.

Professor Alvarez always encourages students to explore the uses of technology in the development and expansion of niche markets for entrepreneurship; while upholding the welfare of our modern society and the right to our individual freedom.

Office Hours

Office hours will be on request. Please contact at:

Contact details: e-mail: mad2@faculty.ie.edu

Office hours: Live tutorials available by previous appointment.

SUBJECT DESCRIPTION

The present course addresses the evolving landscape of leisure and entertainment in the context of modern, fast-paced lifestyles and technological advancements. It explores how these changes meet the growing demand for new leisure experiences, influenced by demographic shifts and changing societal preferences. The course delves into the significant impact of technology on making leisure and entertainment experiences more accessible, thereby enhancing mental, emotional, and physical health. It also considers the role of technology-driven leisure in promoting work-life balance, environmental sustainability, social equity, and cultural preservation.

Students will examine how these experiences not only provide personal enjoyment and relaxation but also serve broader societal and global objectives, such as fostering social interaction, breaking down cultural barriers, and promoting economic diversification. The curriculum is designed to provide a comprehensive understanding of the interplay between technology, leisure, and social change, encouraging students to critically analyze and creatively engage with the future of leisure and entertainment. Through this course, participants will gain insights into how technology can transform leisure experiences into opportunities for personal growth, social impact, sustainable economic development, job creation and global connectivity.

In addition, students will also have the opportunity to potentially contribute to society by thinking critically about solutions or projects in this sector that, who knows, may become a reality.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in

Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Nowadays, the great development of Generative Artificial Intelligence (GenAI) is rapidly changing the way we work, study and, in general, the way we do things.

However, for the context of this course, we believe that an improper use of AI tools would mean reducing the learning possibilities of the interesting contents covered. Therefore, it will be up to the instructor to indicate when the use of AI tools is appropriate and it will be considered academic misconduct to use them without the instructor's supervision. Such misconduct will result in the failure of the corresponding assignment and even the entire course.

PROGRAM

IE IMPACT OVERVIEW

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop: humanistic approaches to interpersonal relations, decision-making, and critical thinking; familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Introduction to Technology and Leisure. Digital Transformation in Travel and other leisure experiences

- Introduction to the course objectives and structure (Assignments, exams, presentations, evaluation).
- Overview of key concepts, including leisure technology, digital transformation, and experiential design.
- Historical evolution and current trends in technology adoption in leisure sectors

Concepts covered: leisure technology, digital transformation, experiential design

Supporting materials: slides and additional materials provided by the professor

SESSION 2 (LIVE IN-PERSON)

Social Media, Online Communities and identities in Leisure. E-commerce and the Future of Leisure Retail

- The role of social media, online communities in shaping contemporary leisure experiences and building online communities.
- User-generated content, influencer marketing, and community-driven leisure activities
- Successful social media campaigns in promoting leisure experiences and destinations
- Privacy, authenticity, and digital well-being.
- Exploration of social media strategies for leisure brands and organizations, including content creation, influencer marketing, and community engagement.
- The intersection of e-commerce and leisure retail, exploring how online shopping platforms and digital marketplaces are reshaping the way consumers access and engage with leisure products and services.
- Streaming platforms and their impact on entertainment consumption
- Trends in original content production and distribution
- Cultural implications of binge-watching and on-demand viewing habits

Assignments/activities: Students will examine how platforms like Facebook, Instagram, TikTok and others have transformed the way individuals socialize, consume media, and participate in leisure activities. Other cases studies and further discussion.

Concepts covered: Social Media, E-commerce, Digital Platforms and Retail industry in Leisure sector.

Supporting materials: slides and additional materials provided by the professor

SESSION 3 (LIVE IN-PERSON)

Data Analytics for Leisure Decision-Making and personalization. Use of Blockchain in leisure industries

- The role of data analytics in informing decision-making and optimizing leisure experiences.
- Overview of data analytics techniques for analyzing user behavior and preferences in leisure technology.
- Understanding recommendation algorithms and their influence on leisure choices
- Exploring issues of algorithmic bias and diversity in content recommendation
- Introduction to blockchain technology and its applications in leisure
- Potential for blockchain to revolutionize leisure industries
- Personalized Recommendations and Curation

Assignments/activities: Analysis of real-world datasets related to leisure consumption patterns. Statistical analyses to identify trends and correlations, and creating data visualizations to communicate insights effectively. Use cases of blockchain in ticketing, authentication, and digital rights management

Concepts covered: Data analytics, bias, diversity, Blockchain, Curation

Supporting materials: slides and additional materials provided by the professor

SESSION 4 (LIVE IN-PERSON)

Virtual Reality and Immersive Technologies, immersive Experiences in Entertainment. Artificial Intelligence in personalization

- The transformative potential of virtual reality (VR) and other immersive technologies in redefining leisure experiences. How technology such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) is revolutionizing storytelling, gaming, and live events
- Applications of AR and VR technologies in transforming leisure experiences: virtual travel, immersive cultural experiences, and interactive entertainment
- Designing AR/VR experiences for personalized leisure activities
- AI-driven personalization strategies for tailoring leisure experiences based on user preferences and behavior
- AI-powered virtual assistants, chatbots, and recommendation systems

Assignments/activities: Analysis of VR demos, interactive experiences, and discussions of real-world applications of VR in leisure domains such as gaming, entertainment, tourism.

Case studies: immersive museum exhibits, virtual destination tours, online games...

Case studies: AI-driven personalization in travel, cultural exploration, and entertainment

Concepts covered: AR, VR, MR, AI-powered solutions.

Supporting materials: slides and additional materials provided by the professor

SESSION 5 (LIVE IN-PERSON)

Digital Health and Wellness Technologies. Personalized Well-being

- The intersection of technology and wellness, focusing on the role of digital health technologies in promoting physical and mental well-being: telehealth services.
- Exploration of emerging technologies for well-being, including wearable devices and biofeedback systems.
- Fitness Trackers & Wearables: smartwatches and health apps for monitoring activity and well-being.
- Mental Health Apps: Exploring guided meditations, mindfulness apps, and mental health resources available through technology.

Assignments/activities: Discussion in small groups and conclusions sharing

Concepts covered: Wellnes, Digital health, mental well-being, apps, wearable devices

Supporting materials: slides and additional materials provided by the professor

SESSION 6 (LIVE IN-PERSON)

Smart Cities and Urban Leisure Experiences, Sustainable Tourism and Hospitality. Ecotourism Practices.

- This session will explore the concept of smart cities and their potential to enhance leisure experiences in urban environments.
- Focus on sustainable tourism and ecotourism practices, exploring how technology can be used to minimize environmental impact and promote responsible travel behavior.
- Case studies on eco-friendly leisure technologies and sustainable tourism initiatives. Virtual Tourism and Immersive Experiences. Smart Hotel Technologies: IoT and Automation.
- AI in Travel Planning and Customer Service. Sustainable Destination Management. Case studies: eco-friendly travel apps, carbon offset initiatives

Assignments/activities: Analysis of case studies of sustainable tourism initiatives around the world, exploring tools and technologies for monitoring and mitigating environmental impact, and discussing strategies for engaging travelers in sustainability efforts.

Concepts covered: Sustainable tourism and hospitality, Ecotourism, eco-friendly leisure.

Supporting materials: slides and additional materials provided by the professor

SESSION 7 (LIVE IN-PERSON)

Digital Arts and Creative Expression, cultural exploration, cultural Heritage Preservation and digital archives.

- This session will explore the intersection of technology and creativity, focusing on the ways in which digital tools and platforms are democratizing artistic expression and transforming the creative process. Creative coding and interactive media,
- Students will also explore the intersection of technology and cultural heritage preservation, focusing on the role of digital archives, virtual reality, and augmented reality in safeguarding and promoting cultural heritage assets.
- Examination of digital tools for cultural exploration, including virtual museum tours, language learning apps, and online cultural exchanges.
- Leveraging location-based technologies for personalized cultural exploration and heritage preservation
- Digital mapping, geo-tagging, and interactive guides for cultural sites and landmarks
- Language Learning Apps: Examining language learning apps and online resources for enhanced cultural immersion.
- Technology in the film sector

Assignments/activities: Analysis of how technology is transforming museums, historical sites, and cultural experiences

Concepts covered: Heritage, museums, creativity, cultural exploration, location-based technologies

Supporting materials: slides and additional materials provided by the professor

SESSION 8 (LIVE IN-PERSON)

Gaming Culture and esports. Streaming platforms

- Gaming has evolved into a mainstream form of entertainment, with millions of players worldwide participating in online multiplayer games, Esports competitions, and virtual reality experiences. Gaming communities provide social interaction and opportunities for collaboration and competition.
- Gaming Culture and Esports Phenomenon. Evolution of gaming as a leisure activity. Rise of esports and competitive gaming
- Social and cultural aspects of gaming communities
- Augmented Reality (AR) and Virtual Reality (VR) Experiences in Esports and Gaming Platforms.
- Social Media Marketing and Fan Engagement. Data Analytics and Personalization. Interactive Stadium Experiences. Broadcasting and Content Distribution. Immersive Fan Experiences. Sponsorship Activation and Brand Integration.
- Streaming Services and On-Demand Entertainment. Streaming platforms continue to dominate

the entertainment landscape, offering a vast library of movies, TV shows, documentaries, and live events. Subscription-based models provide users with on-demand access to a wide range of content anytime, anywhere.

Assignments/activities: Analysis of how technology is transforming the gaming industry. Case studies based on new platforms, the rise of Esports

Concepts covered: Gaming, Esports, digital platforms,

Supporting materials: slides and additional materials provided by the professor

SESSION 9 (LIVE IN-PERSON)

Travel technology. Digital Transformation in Travel

- Smart Travel Assistants and AI-powered travel assistants help travelers plan and organize their trips more efficiently. These assistants use machine learning algorithms to suggest personalized travel itineraries, recommend activities based on preferences, and provide real-time travel updates and assistance.
- Virtual Reality (VR) Travel: VR technology enables users to virtually explore destinations from the comfort of their homes. Companies are offering immersive travel experiences, allowing users to "visit" destinations, landmarks, and cultural sites around the world without physically traveling.
- Personalized Travel and Leisure Planning. AI-driven travel planning tools and personalized itinerary recommendations
- Planning & Booking, Immersive Experiences and Travel Safety & Security
- Mobile apps for travel planning, navigation, and booking

Assignments/activities: Exploration of digital innovations in the travel industry, such as online booking platforms, virtual reality tours, and smart destination management systems.

Examples of successful implementations of digital technologies in travel experiences

Concepts covered: Travel, VR and AI in the travel industry, personalization, immersive experiences

Supporting materials: slides and additional materials provided by the professor

SESSION 10 (LIVE IN-PERSON)

Design Thinking for Leisure Innovation. Digital Storytelling and Immersive Narratives. Entrepreneurship in Leisure Technology

- Principles and methodologies of design thinking, with a focus on applying design thinking to leisure innovation.
- The art of digital storytelling and its role in creating immersive leisure experiences.
- Prototyping immersive leisure and tourism experiences. Students will learn about the process of launching and scaling a leisure technology startup, from ideation and validation to product development and market entry.
- The role of immersive media technologies (360-degree video, spatial audio) in storytelling and cultural exploration
- Immersive museum experiences, virtual heritage tours, and interactive storytelling platforms
- User experience (UX) design principles for leisure attractions and tourism destinations
- Introduction to user experience (UX) design principles and methodologies, including user research, prototyping, and usability testing.

Assignments/activities: Analysis of examples of digital storytelling across different media formats, such as video games, virtual reality experiences, and interactive websites, and experimenting with storytelling techniques and tools.

Concepts covered: Design thinking, narratives and storytelling, entrepreneurship

Supporting materials: slides and additional materials provided by the professor

SESSION 11 (LIVE IN-PERSON)

Gamification and Experiential Design, Interactive Experiences in Leisure.

- Gamification and experiential design as strategies for enhancing leisure experiences through technology. Application in leisure contexts to enhance engagement and motivation.

Gamification techniques for engaging leisure activities

- Interactive media installations in theme parks and entertainment venues
- Designing interactive leisure experiences: escape rooms, AR scavenger hunts.

Assignments/activities: Analysis of examples of digital storytelling across different media formats, such as video games, virtual reality experiences, and interactive websites, and experimenting with storytelling techniques and tools.

Concepts covered: Gamification, motivation, interactive media.

Supporting materials: slides and additional materials provided by the professor

SESSION 12 (ASYNCHRONOUS)

Ethical and Privacy Considerations in Leisure Technology

- This session will delve into the ethical implications of technology use in leisure contexts, with a focus on data privacy, surveillance, digital addiction, and algorithmic bias.
- Ethical considerations in content creation and distribution
- Addressing issues of digital piracy, copyright infringement, and content moderation
- Role of media literacy in promoting responsible consumption of digital entertainment

Understanding Leisure Behavior in the Digital Age

- The dynamics of leisure behavior in the digital age. Exploring how technology has transformed the ways in which individuals engage in leisure activities.
- Examples including the rise of digital media consumption, online gaming, and social networking.
- Accessibility and Inclusive Design in Leisure Technology

Assignments/activities:

Exploration of the concept of "technological leisure" and its implications for individual well-being, social relationships, and community participation

Students will explore the ethical dimensions of technology-enabled leisure experiences, considering questions of consent, equity, and cultural representation.

Concepts covered: Data Privacy and protection, surveillance, digital addiction, algorithmic bias, ethics, user behavior in Digital Leisure

Supporting materials: slides and additional materials provided by the professor

SESSION 13 (LIVE IN-PERSON)

The Future of Leisure Technology

- Students will explore emerging trends and predictions in leisure technology, considering how advances in fields such as artificial intelligence, virtual reality, immersive storytelling, wearable technology, and the Internet of Things are shaping the future of leisure experiences.
- The impact of robotics and automation on leisure experiences, from theme parks and attractions to hospitality and service industries.
- Exploring the metaverse: virtual worlds, digital twins
- Challenges and Opportunities in the future of technology applied to the leisure industry

Assignments/activities: Students will try to envision what the future of the entertainment industry will look like.

Concepts covered: The metaverse, IoT, future AI, new narratives

In this session the Final exam will take place

Supporting materials: slides and additional materials provided by the professor

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final presentation and reflection

- In this session, students will have the opportunity to showcase their learning and knowledge of the course by presenting the teamwork they have developed throughout the course.
- Students will also have the opportunity to receive feedback from peers and instructors, fostering a culture of constructive criticism and continuous improvement

Supporting materials: slides and additional materials provided by the professor

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year).

The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may

provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.



TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.F.Securit

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **JUAN GRAU GÓMEZ**

E-mail: jgraug@faculty.ie.edu

Juan Grau is an IT consultant and educator with broad experience working with customers across western Europe. Understanding their needs and positioning the best solutions for their companies to succeed. He works with customers to improve their security posture and their business applications performance. He currently teaches Cloud Computing, Cybersecurity, Artificial Intelligence, ICT Governance, Computing Structures and Microsoft Azure as an adjunct professor at IE University and others international universities.

Holding a Master in Electronics and Telecom Engineer BS from UPM (Universidad Politécnica de Madrid) and Master Business Program from IESE Business School (Spain). Juan has been holding positions as Southern Europe Director or Country Manager in several Systems, Networks, Telecom and CyberSecurity companies as Aerohive, BlueCoat, Bitdefender, Brocade, CA, Cabletron Systems, CrossBeam, Enterasys, Huawei, Radware, Riverstone Networks, Ruckus Networks, Zerofox. He has 30 years of experience in Sales and Business Development introducing last innovation technics into the market. He holds several certifications in Microsoft and Azure, Google and Tech Selling Programs

More details about his profile can be found at <https://es.linkedin.com/jgrau>

Office Hours

Office hours will be on request. Please contact at:

jgraug@faculty.ie.edu

SUBJECT DESCRIPTION

Insights into Modern Intelligence: Exploring Technology's Role in National Security

Join us for an illuminating journey into the world of modern intelligence operations and the pivotal role technology plays in safeguarding national security. In "Insights into Modern Intelligence," we delve into the fascinating realm of espionage, surveillance, and intelligence gathering, offering a comprehensive overview accessible to all audiences.

Through engaging discussions and captivating case studies, we explore how governments leverage technology to enhance their intelligence capabilities, ensuring the safety and security of their citizens in an ever-evolving geopolitical landscape. From traditional methods of information gathering to cutting-edge cyber tactics, we unravel the intricacies of intelligence operations and shed light on the ethical considerations and societal implications of these practices.

By participating in this course, students will gain a deeper understanding of:

1. The evolution of intelligence gathering techniques and the role of technology in shaping modern geopolitics.
2. The utilization of advanced surveillance systems, data analytics, and artificial intelligence in intelligence operations.
3. The ethical dilemmas and legal frameworks surrounding intelligence gathering and surveillance practices.
4. The impact of cyber threats and digital vulnerabilities on national security and the strategies employed to mitigate these risks.
5. The importance of interdisciplinary collaboration and information sharing in fostering effective intelligence operations.
6. The emerging field of cyber intelligence and its significance in addressing contemporary security challenges.
7. The principles of resilience and adaptive governance in building resilient cities and communities in the face of threats and disruptions.

By mastering these concepts and acquiring hands-on experience with cutting-edge technologies, students will develop invaluable skills in critical thinking, problem-solving, data analysis, and strategic decision-making. Join us in unraveling the complexities of modern intelligence and shaping the future of national security.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

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Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
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Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course for research, ideation, generating an outline, proofreading, grammar check, coding, image generation with appropriate acknowledgement. GenAI may not be used for exams. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with "pillar courses" in three of IE's core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

- humanistic approaches to interpersonal relations, decision-making and critical thinking;
- familiarity with the technologies that are applied to solve some of the world's greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

The **IE Challenge** is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE's core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN's 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

SESSION 1 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Social Challenge

Description (Theory): Introduction to the course

Learning Objectives: Familiarising with subject matter, Clear understanding of course requirements.

Concepts to be covered in Course: Biological/Cultural Anthropology

Introduction to Modern Intelligence and National Security

Course overview and discussion of basic intelligence and national security concepts. We will see the different sessions, objectives and expected work to be done along the sessions.

Intro to the Course

Course summary: contents description.

IE and Students expectations.

Assignments and Grading.

SESSION 2 (LIVE IN-PERSON)

Sustainability Topics:

- Social Challenge
- Economic Development

Description (Theory): Human behaviour evolved as an adaptation to the physical and social environment of the archaic past. Since the technical environment is changing too fast for human adaption, traits that were once features are now bugs.

Learning Objectives: Understanding of Human Predicament

Concepts to be covered in Course: Evolutionary Psychology, Evolutionary Mismatch, Signaling Theory,

Big Data

Description of the session

In this session, we will explore the world of Big Data, focusing on how it is collected, stored and used in the intelligence domain. We will also examine data regulation, including the laws and regulations governing the collection, storage and use of big data.

Learning objectives for the session

- Understand the fundamental concepts of Big Data and its application in the field of intelligence.
- Become familiar with the methods and technologies used to collect and store large volumes of data.
- Explore the ethical and legal challenges related to the collection and use of Big Data.
- Understand the regulations and standards that affect the management of big data.

List concepts covered in this session

- Definition and characteristics of Big Data.
- Methods of large-scale data collection.
- Applications of Big Data in the field of intelligence and security.
- Ethical and legal aspects of Big Data use.
- Relevant regulations and standards, such as GDPR, CCPA

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: How to find out what Google knows about you and limit the data it collects (CNBC)

Other / Complementary Documentation: The Dangers of Video Surveillance and A.I. (Youtube)

Other / Complementary Documentation: Big Data: A Revolution That Will Transform How We Live, Work, and Think (Youtube)

Assignments: Reading

Reading: The new fable of the bees: multilevel selection, adaptive societies, and the concept of self interest (Evolutionary Psychology and Economic Theory (pp. 201-220). Emerald Group Publishing Limite. 2005

SESSION 3 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): We are the Symbolic Species. The Power of Stories.

Learning Objectives: Clear understanding of stories and models of Homo Sapiens

Concepts to be covered in Course: Myths, Memes, Symbotypes

IoT and Smart Technologies

Description of the session

In this session we will explore the fascinating world of smart technology and the Internet of Things (IoT), examining how these advances are transforming our daily lives and their relevance to national security.

We will look at how internet-connected smart devices are collecting real-time data, from sensors in smart cities to home devices, and how this information can be used to improve decision-making in intelligence and security operations.

Learning objectives for the session

- Understand what the Internet of Things is and how it works.
- Explore the practical applications of IoT in different sectors, such as health, agriculture, industry, etc.
- Analyse smart technologies, such as sensors, actuators, and control systems, and their role in building smart environments.
- Discuss the security and privacy challenges associated with the mass deployment of IoT devices.
- Consider the opportunities and risks presented by smart cities and the Internet of Things in general.

List concepts covered in this session

- Definition and characteristics of the Internet of Things.
- Typical architecture of an IoT solution.
- IoT applications in different sectors, such as health, agriculture, industry, etc.
- Key technologies used in smart systems, such as sensors, actuators and control systems.
- IoT security and privacy: threats, vulnerabilities and best practices for protection.
- The role of IoT in the development of smart cities and the improvement of urban quality of life.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Security and Privacy Challenges in the Internet of Things (IEEE)

Article: Smart City Architecture and its Applications Based on IoT (Procedia Computer Science Volume 52, 2015, Pages 1089-1094) (Elsevier)

SESSION 4 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): There are many widely known, yet faulty models of the Human Being.

Learning Objectives: Clear understanding of models (Game Theory).

Concepts to be covered in Course: Homo Economicus, Tragedy of the Commons, Prisoners Dilemma, Egoism/ Altruism.

Artificial Intelligence

Description of the session

In this session, we will dive into the exciting field of Artificial Intelligence (AI), exploring how this advanced technology is fundamentally transforming the way intelligence and national security services operate. We will look at how machine learning algorithms and artificial neural networks are being applied in a variety of scenarios, from detecting patterns in large datasets to automating complex intelligence analysis tasks.

Learning objectives for the session

- Understand the basic concepts of Artificial Intelligence and its subfields.
- Explore applications of AI in sectors such as health, education, commerce and industry.
- Discuss the ethical and social implications of AI, including issues such as privacy, algorithmic discrimination and employment automation.

List concepts covered in this session

- Definition and types of Artificial Intelligence.
- Practical applications of AI in everyday life and in various sectors.
- AI algorithms and techniques, such as machine learning, neural networks, etc.
- AI ethics and social considerations. Future challenges and opportunities in the field of AI.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Other / Complementary Documentation: Machine Learning vs Deep Learning (Youtube)

Other / Complementary Documentation: Supervised vs. Unsupervised Learning (Youtube)

Technical note & tutorials: Types of Algorithms (ENT020208-U-ENG-VID)

SESSION 5 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): The Anthropocene and Innovation

Learning Objectives: Clear understanding of what it means to design something.

Concepts to be covered in Course: Artefact, The Built Environment, Design and Design Thinking

Robotics and Aerial Surveillance

Description of the session

In this session, we will delve into the impact of robotics and aerial surveillance on data collection and target surveillance, exploring how these technologies are revolutionising traditional methods of intelligence gathering and providing an unprecedented perspective on homeland security. We will look in detail at how drones and other robotic systems are being used to conduct surveillance, reconnaissance and data collection missions in remote or hard-to-reach environments, as well as in urban and critical areas.

Learning objectives for the session

- Understand the role of robotics and aerial surveillance in data collection and target surveillance.
- Explore the applications of drones and other robotic systems in intelligence and security missions.
- Analyse the challenges and opportunities associated with the use of aerial surveillance technologies.

- Discuss the ethical and legal implications of aerial surveillance in society.

List concepts covered in this session

- Introduction to robotics and aerial surveillance.
- Types of drones and robotic systems used in surveillance.
- Applications of aerial surveillance in civilian and military environments.
- Technical and operational challenges of aerial surveillance.
- Impact of aerial surveillance on privacy and civil rights.
- Strategies to mitigate risks associated with aerial surveillance.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Unmanned Aerial Vehicles for Civil Applications: A Review (MDPI)

Article: Robotic Vision for Human-Robot Interaction and Collaboration: A Survey and Systematic Review (Transactions on Human-Robot Interaction, Vol. 12, No. 1, Article 12, 2023) (ACM)

Article: Societal acceptance of urban drones: A scoping literature review (Technology in Society 75, 2023) (Elsevier)

SESSION 6 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): Design, Animism, Magic, and the Cargo Cults

Learning Objectives: Familiarising with subject matter, Clear understanding of course requirements

Concepts to be covered in Course: Animism, Magical Thinking, Cargo Cults, Fetichism

Generative AI and Content Automation

Description of the session

In this session, we will see what is Generative AI, the main tools, etc We will explore how generative AI is transforming the production of information and content and how can be used in the national intelligence.

Learning objectives for the session

- Understand the basic concepts of Generative Artificial Intelligence (AI) and Content Automation.
- Explore the practical applications of generative AI in the creation of visual, auditory and textual content.
- Analyse examples of the use of generative AI in the national intelligence.
- Discuss the ethical and social implications of content automation and generative AI.

List concepts covered in this session

- Definition and principles of Generative Artificial Intelligence.
- Techniques and algorithms used in content generation by AI, such as GANs, recurrent neural networks, among others.
- Practical applications of generative AI in the creation of audiovisual content, generative text,

etc. and the use by national intelligence.

- Outstanding examples of generative AI projects and applications.
- Discussion of ethical challenges and concerns related to content automation and generative AI.

PRACTICE

Using prompts to get useful insights in national security.

Article: Generative AI: A New Frontier in Artificial Intelligence (Deloitte)

Other / Complementary Documentation: Introduction to Generative AI (Google; Youtube)

Other / Complementary Documentation: Algorithmic Bias and Fairness (Crash Course; Youtube)

SESSION 7 (LIVE IN-PERSON)

Description (Theory): The Grip of Marketing, the “Holy Trinity of Design”

Learning Objectives: Clear understanding of Supply and Demand and how Marketing can skew them

Concepts to be covered in Course: Marketing, Satisfactoriness, Need and Want, Novelty, Beauty, and Convenience

XR. Extended Reality

Description of the session

Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR): Exploring how AR, VR and MR are being used in intelligence and security applications, enabling visualisation of complex data, simulation of security scenarios, training of personnel, remote surveillance and collaboration in virtual environments.

Learning objectives for the session

- Understand the concepts of augmented reality, virtual reality and mixed reality.
- Explore the applications of AR, VR and MR in the field of intelligence and security.
- Become familiar with the technologies and devices used in AR, VR and MR by immersing in this virtual ecosystem.
- Analyse how these technologies can enhance data visualisation and simulation of security scenarios.
- Discuss the challenges and ethical considerations in the use of AR, VR and RM in security applications.

List concepts covered in this session

- Definition and differences between augmented reality, virtual reality and mixed reality.
- Applications of AR, VR and MR in intelligence and security, such as remote surveillance, scenario simulation, personnel training, etc.
- Technologies and devices used in AR, VR and MR, such as virtual reality glasses, augmented reality viewers, etc.
- Examples of XR use cases in security and defence applications.
- Challenges and ethical considerations in the use of these technologies.

PRACTICE

We will use the IE Metaverse platform to take an important decision in our role inside this virtual environment with an immersive experience.

Article: Use of virtual reality simulators for training programs in the areas of security and defense: a systematic review (Multimedia Tools and Applications (2020) 79: 3495–3515) (CED)

Article: No pain, no gain? The effects of adding a pain stimulus in virtual training for police officers

(Taylor&Francis)

SESSION 8 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): Systemic Thinking, The Circular Economy, Applied Ethics

Learning Objectives: Clear understanding of what needs to change in our production and consumption.

Concepts to be covered in Course: Sustainability, The Doughnut Economy, Circular Design

Blockchain

Description of the session

In this session, we will discuss on blockchain technology and its impact on information security, along with cryptocurrencies and their role in financial transactions.

Learning objectives for the session

- Understand the fundamental concepts of blockchain technology and how it works.
- Analyse the impact of blockchain technology on information security and data management.
- Explore the applications of blockchain in different sectors.
- Study the characteristics and operation of cryptocurrencies, such as Bitcoin and Ethereum.
- Assess the risks and challenges associated with the use of cryptocurrencies in financial transactions.

List concepts covered in this session

- Blockchain technology: definition, characteristics and operation.
- Types of blockchains: public, private and consortium.
- Applications of blockchain in information security and data management.
- Cryptocurrencies: characteristics, operation and types.
- Blockchain use cases in different industries.
- Security and privacy in financial transactions with cryptocurrencies.

PRACTICE

In this session, we will create our own crypto wallet to understand better how a Blockchain is.

Technical note & tutorials: Moving Forward: The Blockchain Opportunity (IST020192-U-ENG-VID)

Technical note & tutorials: Cryptocurrencies and Bitcoin (IST020387-U-ENG-VID)

SESSION 9 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Research): Quantitative and Qualitative User Research, Secondary Literature

Learning Objectives: Clear understanding of how to collect data

Concepts to be covered in Course: Desktop Research, Ethnography

Cybersecurity

Description of the session

In the session dedicated to Cyber Security, we will delve into the analysis of the growing cyber threats facing governments and organisations today, from ransomware and phishing attacks to sophisticated intrusions backed by state actors and hacker groups. We will explore in detail the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and information systems, as well as the motivations behind these attacks, ranging from data theft and extortion to sabotage and interference in government operations.

Learning objectives for the session

- Understand the current cyber threats facing governments and organisations.
- Become familiar with the different forms of cyber attacks, such as ransomware, phishing and intrusions.
- Understand the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and systems.
- Analyse the motivations behind cyber attacks and their potential impacts.
- Explore strategies and best practices to mitigate and prevent cyber attacks.

List concepts covered in this session

- Types of cyber threats: ransomware, phishing, state-sponsored intruders, etc.
- Tactics, techniques and procedures (TTPs) used by cybercriminals.
- Motivations behind cyber attacks.
- Impact of cyber attacks on the security and functioning of organisations.
- Strategies for mitigating and preventing cyber attacks.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Technical note & tutorials: Cybersecurity: Protecting your Digital Self (IST020120-U-ENG-VID)

Technical note & tutorials: Cybersecurity: The risk of Data and Algorithms (IST020268-U-ENG-VID)

SESSION 10 (ASYNCHRONOUS)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Research): Deciding on real research matter. Application of different Research methods

Learning Objectives: Clear understanding of the employment of research

Concepts to be covered in Course: Interviews, Focus Groups, Cultural Probes

Biometrics and Facial Recognition

In this session, we will explore biometric techniques and their use in the identification of individuals, with a special focus on facial recognition. Students will learn about the principles behind biometrics, how biometric data is collected and used, and the current and potential uses of facial recognition technology in various fields.

Description of the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

Learning objectives for the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

List concepts covered in this session

- Definition and principles of biometrics.
- Types of biometric features: facial, fingerprint, iris, voice, etc.
- Processes for capturing and analysing biometric data.
- Algorithms and techniques used in facial recognition.
- Current and potential uses of facial recognition in society.
- Ethical and privacy considerations in the use of biometric technology.

PRACTICE

Analysis of the accuracy of face recognition using an online tool.

Article: Facial Recognition Technology: A Survey of Policy and Implementation Issues (Center for Catastrophe Preparedness and Response, New York University, 2009) (CED)

Article: The ethical application of biometric facial recognition technology (AI & SOCIETY (2022) 37:167–175) (Springer)

SESSION 11 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Application): Introduction to Design Thinking

Learning Objectives: Clear understanding of “Double Diamond Design Process”

Concepts to be covered in Course: Induction/Deduction/Abduction, Divergence/Convergence

Open Source Intelligence

Description of the session

In this session, we will explore the importance of Open Source Information in Intelligence (OSINT), looking at how it is used in intelligence and security information gathering. We will delve into the key concepts of OSINT and examine how it can be effectively applied in the collection, analysis and use of information to support intelligence and security operations.

Learning objectives for the session

- Understand the concept of Open Source Information in Intelligence (OSINT) and its importance in intelligence gathering.
- Become familiar with the different types of open sources available and how to access them.
- Explore the techniques and tools used in OSINT collection.
- Analyse OSINT use cases in intelligence and security operations.

List concepts covered in this session

- Definition and scope of Open Source Information in Intelligence (OSINT).
- Types of open sources, including social media, public databases, government websites, etc.
- OSINT search and collection techniques, such as advanced search engine searching, web scraping, social network analysis, etc.
- Common tools used in OSINT collection and analysis.
- OSINT use cases in intelligence and security, including threat detection, risk assessment, incident investigation, etc.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Open source intelligence (crowdstrike.com)

Article: A quantitative study of the law enforcement in using open source intelligence techniques through undergraduate practical training (Forensic Science International: Digital Investigation 47 (2023) (CED)

SESSION 12 (LIVE IN-PERSON)

Description (Application): Consulting with Students on their projects

Learning Objectives: Clear understanding of empathetic research

Concepts to be covered in Course: Empathy, Closed/Open Questions, Empathy Maps, Content Analysis

Emerging Technologies and National Security

Description of the session

In this session, we will explore emerging technologies and their impact on national security. We will discuss future trends in technology and how they may affect a country's security. We will analyse how innovations in areas such as artificial intelligence, quantum computing, biotechnology, cybersecurity and robotics can transform national security and geopolitical landscapes.

Learning objectives for the session

- Identify the most relevant emerging technologies and their potential impact on national security.
- Understand how technological trends can influence national security policy-making.
- Analyse the challenges and opportunities posed by new technologies for national security.
- Explore case studies and concrete examples that illustrate the use of emerging technologies in the field of homeland security.

List concepts covered in this session

- Future trends in technology and their relevance to national security.
- Potential of quantum computing for cryptography and cyber security.
- Biotechnology applications in defence and health security.
- Ethical and legal challenges associated with the use of emerging technologies in national security.

- Mitigation and response strategies to address emerging threats.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Quantum technologies in defence & security (NATO)

SESSION 13 (LIVE IN-PERSON)

Description (Final Exam): 19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

Resilience and Adaptive Governance

Description of the session

In this session, we will explore the principles of resilience and adaptive governance in homeland security. We will look at how organisations and governments can develop resilient capacities to cope with and recover from crises and threats in the national security domain. We will also examine adaptive governance approaches, which involve the ability to adapt and respond effectively to complex and changing environments.

Learning objectives for the session

- Understand the concept of resilience in the context of national security.
- Explore the key principles and components of organisational and governmental resilience.
- Analyse case studies and examples of crises and threats in homeland security and how they were addressed through resilient approaches.
- Become familiar with the principles of adaptive governance and their application in homeland security environments.
- Reflect on the importance of collaboration and coordination between different actors in building resilience and adaptive governance.

List concepts covered in this session

- Definition of resilience and its components.
- Examples of crises and threats in national security.
- Principles of organisational and governmental resilience.
- Adaptive governance approaches and their application in homeland security. Importance of collaboration and coordination in building resilience.

FINAL EXAM (25%)

19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

Article: Governance for Resilience: How Can States Prepare for the Next Crisis? (Carnegie)

SESSIONS 14 - 15 (LIVE IN-PERSON)

Description: Presentation of Project

Learning Objectives: Clear explanation and presentation of projects

Group Work Presentation

Simulation of a national security scenario in which students take on specific roles, such as intelligence analysts, cyber security officers, political leaders, etc. We will use the Space and Cyber Affairs Game (SpaceGov). During the game, students will face collective action problems related to two very important challenges: space governance and cyber warfare.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

BIBLIOGRAPHY

Recommended

- Bruce Sterling. (2005). *Shaping Things*. MIT. ISBN 9781322501659 (Digital)
- Conny Bakker, Marcel den Hollander. (2015). *Products that last : product design for circular business models*. TU Delft Libra. ISBN 9789461863867 (Digital)
- Kate Crawford. (2021). *The atlas of AI: Power, politics, and the planetary costs of artificial intelligence*. Yale University Press. ISBN 978030020957 (Digital)
- Donald A Norman. (2007). *Emotional design : why we love (or hate) everyday things*. Basic Books. ISBN 9781280598562 (Digital)
- Donald A Norman. *The design of everyday things*. Basic Books. ISBN 9780465072996 (Digital)
- Loshini Naidoo. (2012). *Ethnography: An Introduction to Definition and Method*. INtech Open. ISBN 1154165287 (Digital)
- McDonough, W., & Braungart, M. (2013). *The upcycle: Beyond sustainability-- designing for abundance*. Macmillian. ISBN 9780865477483 (Digital)
- Michael Leube. (2024). *The Future Designer. Anthropology meets Innovation in Search of Sustainable Design*. Routledge. ISBN 9781003464 (Digital)
- Ridley, M. (2020). *How innovation works: And why it flourishes in freedom*. Harper. ISBN 9780008334840 (Digital)

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may

provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.



TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.G.WastRes

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **IRENE SÁNCHEZ ANDREA**

E-mail: isancheza@faculty.ie.edu

An enthusiast of resource recovery

Dr. Sanchez-Andrea holds a PhD in Microbiology from the Autonomous University of Madrid (Spain), defended with honours (cum laude and awarded with the Extraordinary Doctorate Prize of the Faculty of Sciences) in 2012. After working in Spain, Germany, and USA, she became tenured professor in Wageningen University in 2017 and moved to Ie university in 2023. Her research focuses on the discovery of novel microorganisms, pathways and applications for resource recovery and biomolecules production reducing the anthropogenic impact on ecosystems.

Office Hours

Office hours will be on request. Please contact at:

irene.sanchez@ie.edu from 9:30 to 2.

SUBJECT DESCRIPTION

Step into the world of sustainable innovation with the IE Impact Technology course - Waste to Resources. You will experience a hands-on course which will take you beyond the basics of circular economy. Whether you are a techie or not, this course is intended for anyone eager to learn, innovate, and make a difference. Discover the pivotal shift from a 'take-make-dispose' model to a regenerative circular system, where nothing is wasted and everything is valued.

You'll deepen into the core of sustainability, exploring how sectors like food, agriculture, fashion, plastics energy or e-waste are reinventing themselves. Through case studies, you'll see how circular economy can succeed (and fail). Finally, you will dive into a project which will challenge your knowledge, not only from the technical point of view but from a holistic one, from ideation to implementation.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals. At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following.

This course consists of 15 sessions divided in three components: lectures (9 sessions), a challenge to be solved (2 sessions) and game simulations (2 sessions) plus 1 session for evaluation. All sessions for this course will be live-in sessions. The 10 sessions of theory will be complemented with a game simulation to understand waste management in the context of space trash, together with global governance, and political decisions.

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours

Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Critical GenAI use is encouraged

In this course, the use of generative artificial intelligence (GenAI) is encouraged, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools: I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended: No content generated by AI technologies has been used in this assignment.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Introduction to the course and to circular economy

- Ice breaker
- Overview of linear vs. circular economy
- Importance of transitioning to a circular model/introduction to circular principles

Lecture: Introduction to the course

- Environmental, social, and economic impacts of the linear model
- Overview of linear vs. circular economy
- Importance of transitioning to a circular model/introduction to circular principles
- The new vision of waste in the circular economy

Explanation of Reflection 1

SESSION 2 (LIVE IN-PERSON)

Lecture: Waste Characterization and Assessment.

- Types and composition of different waste streams and consequent environmental impacts.
- Life cycle analysis (LCA) of waste products

- Assessing environmental impact and resource potential

Deadline of Reflecion 1

Explanation of assignment 1

SESSION 3 (LIVE IN-PERSON)

Lecture: R strategies I

- Consumption and Waste in today's World.
- R strategies in circular economy.
- Manufacturing Process Map
- Postconsumption Map.

SESSION 4 (LIVE IN-PERSON)

Lecture: R strategies II

- Principles of recycling
- Materials for recycling
- Overview of recycling processes (mechanical, chemical, biological)
- Challenges and innovations in recycling technologies
- Explanation of peer-feedback to assignment 1 through FeedbackFruits or similar software (a session-time deadline)

Deadline Assignment 1

Explanation of the peer feedback to Assignment 1

SESSION 5 (LIVE IN-PERSON)

Lecture: Food and agricultural Waste

- Introduction of the platform for sharing the common feedback.
- Food and agricultural waste management.
- Resource Recovery and Recycling.
- Innovations and future trends

Deadline Feedback Assignment 1

Explanation of Reflection 2

SESSION 6 (LIVE IN-PERSON)

Lecture: Fashion and Plastic Waste

- Fashion waste. Typology and processes overview.
- Plastic waste. Typology and processes overview.
- Circularity Trends in Fashion and Plastic Sectors.

Deadline Reflection 2

SESSION 7 (LIVE IN-PERSON)

Lecture: Waste-to-Energy Technologies

- Waste materials and products.

- Waste-to-Energy processes overview. Impact measurement. Circular credits and carbon footprint.
- The role of R&D in Energy sector decarbonization.

Questions for assignment 2 on the challenge

SESSION 8 (LIVE IN-PERSON)

Lecture: e-Waste Management

- Challenges of electronic waste
- Recycling and resource recovery from electronic devices
- Responsible disposal of e-waste

SESSION 9 (LIVE IN-PERSON)

Lecture: Circular Economy Business Models

- Transitioning from linear to circular business models
- Economic benefits of circular economy practices
- Case studies on companies successfully implementing circular principles.
- Challenges: regional and national policy and regulations, circular Supply Chain Management, geopolitics.

Deadline Assignment 2

Explanation peer-review of Assignment 2

SESSION 10 (ASYNCHRONOUS)

Lecture: Governance (I)

- Preparatio for the SpaceGov activity

Games & Simulations: Facing New Challenges in Space & Cyber Affairs: SpaceGov (IRE090056-U-ENG-HTM)

SESSION 11 (LIVE IN-PERSON)

Lecture: Governance (II)

Global Governance and International Relations through SpaceGov

- Management of waste as a collective problem
- Importance of Technology for societies
- Cooperative/competitive nature of complex social processes

Deadline Feedback of Assignment 2

Games & Simulations: Facing New Challenges in Space & Cyber Affairs: SpaceGov (IRE090056-U-ENG-HTM)

SESSION 12 (LIVE IN-PERSON)

Lecture: Final Project Workshop and Feedback Poster Visualization.

- Poster Visualization.
- Presentation workshop.
- Q&A.

SESSION 13 (LIVE IN-PERSON)

Exam

In paper, MCQ and 1 to develop

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final Presentations

- Group presentations of refined circular business proposals
- Q&A session with panel of experts and peers
- Evaluation and feedback on presentations

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		10% reflections + 20% assignments
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous

evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.

- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Edited by Terry Tudor, Cleber JC. Dutra. *The Routledge Handbook of Waste Resources and the Circular Economy*. Routledge International Handbooks. ISBN 9780367637590 (Printed)
- Siming You. *Waste-to-Resource System Design for Low-Carbon Circular Economy*. Elsevier. ISBN 9780128226 (Digital)

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.H.Society

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1^o

Category: COMPULSORY

Language: English

Professor: **ANNA JABLONER**

E-mail: ajabloner@faculty.ie.edu

Dr. Anna Jabloner is an assistant professor of anthropology at IE University. She holds a Mag.Phil. from the University of Vienna (2004) and Ph.D. from the University of Chicago (2015). Between 2019-2023, Jabloner taught anthropology and Science & Technology Studies (STS) at Harvard University, where her teaching excellence was recognized each semester. She previously held postdoctoral fellowships at the Stanford and Columbia Medical Schools and at Goethe University Frankfurt. Jabloner's field of research is the anthropology of science and technology, with a regional specialization on California. Her work centers on the social and cultural dimensions of science, technology, medicine, and data, on biopolitics and bioethics, futurism, feminist epistemologies, gender and race, and on ethnographies of the US. Jabloner's research has been supported by the US National Institutes of Health, the Wenner-Gren Foundation, Social Science Research Council, and the Austrian Federal Ministry of Education, Science and Research, and she has authored recent articles in such journals as Social Analysis, Science as Culture, Catalyst: Feminism, Theory, Technoscience, Anthropology Now, and Nature Biotechnology.

Office Hours

Office hours will be on request. Please contact at:

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SUBJECT DESCRIPTION

Technologies always develop in specific contexts. Groups of people think of and create technologies to solve problems and work together to build something new. In this process, society and culture make up the conditions in which technologies emerge and are thus an essential aspect of all technological progress. This course will draw on instances from a range of sectors where technologies are used and being developed – market industries, medicine, education, military, law, etc. – to learn about their social and cultural dimensions. For example, human suffering during the COVID-19 pandemic created intense pressure to quickly develop a vaccine. Within a year, lives around the globe were saved through a new bio-technology. A dark case in history is of course the atom bomb; here, war-time pressures led to rapid advances in a specific technological area. Once they are being developed or exist, technologies also impact society and culture, changing conditions in turn. For example, we are witnessing how information technologies influence political processes, such as in social media's role in organizing people into new movements, or create ethical puzzles, as we see in the debate around AI in college education. Another example is the use of genetic technologies in medicine, which is impacting how doctors practice their profession.

These ongoing dynamics – the conditions in which technologies develop, how technologies impact conditions – make it impossible to separate technology from society. Thus in this course, you will learn to put technologies into context. Doing so is essential to understanding where investment and development are needed and where technologies might actually cause new problems. In addition, studying the social contexts in which technologies develop is crucial for our ability to critically assess and manage technologies' impacts on society. At the end of the course, you will understand the entwined dynamics of technological and social change. Overall, in this basic introductory course, you will be introduced to theories and conceptualizations of technology & society. You will also have a chance to investigate specific cases and thereby apply the theories and concepts you learn about during the semester.

CASES WE WILL INVESTIGATE:

- Social media, Digital rights, and Global freedoms: What even becomes data? And what should become data but doesn't?
- Designing for inclusion and equality/Algorithmic discrimination; e.g., is facial recognition software racist? If so, can we change that?
- AI in Education: Does anyone still need to learn how to write if technology can do it for us?
- Nuclear technologies: If rapid technological development causes terrible social conditions, should we still invest in them? Or in turn, how do we weigh risks vis-a-vis sustainability, environment, and human lives?
- Reproductive technologies: Prenatal genetic testing can predict the gender of a fetus, but should such technologies be developed?

*****NOTE: There are only two books you need for class -- you can borrow them from the IE library or buy them (they should be available used for a low price):**

- Ludwik Fleck, 1979 [1935] *Genesis and Development of a Scientific Fact*. University of Chicago Press.
- Thomas Kuhn, 1996. *The Structure of Scientific Revolutions*, 3rd Edition. University of Chicago Press (please make sure you get the 3rd edition)

All other session materials will be provided on Blackboard (required and recommended readings).

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

PROGRAM

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

PLEASE NOTE THAT THE SCHEDULE BELOW IS SUBJECT TO CHANGE BASED ON THE INTERESTS AND NEEDS OF THE STUDENTS. THE MOST UPDATED INFORMATION ABOUT WHAT YOU NEED TO DO FOR EACH SESSION WILL ALWAYS BE FOUND IN THE ANNOUNCEMENTS SECTION OF BLACKBOARD.

Topic: *INTRODUCTION TO TECHNOLOGY & SOCIETY*. Discuss the course and the syllabus.

Pre-class: No readings due.

SESSION 2 (LIVE IN-PERSON)

Topic: *WHAT HAS CAUSED AND IS CAUSING THE TECHNOLOGICAL CHANGES WHOSE IMPACT WE ARE EXPERIENCING?*

Concepts covered: society, causation, technological determinism, social determinism

Learning objectives: To understand how the relationship between technology & society can be analyzed – and without getting stuck in a binary.

Pre-class: read Mackenzie & Wajcman: “Introductory Essay” in *The Social Shaping of Technology: How the Refrigerator Got Its Hum*.

Book Chapters: Mackenzie & Wajcman: “Introductory Essay” in The Social Shaping of Technology: How the Refrigerator Got Its Hum (CED)

SESSION 3 (LIVE IN-PERSON)

Topic: **DATA & JUSTICE WORKSHOP* or: “Technologies always reflect the culture that produces them...”*

Concepts covered: data, justice, social conditions & implications, approaches to ethics

Learning objectives: to understand how issues of justice exist “before” & “after” technology (e.g., national priority setting, values that shape design processes, ethical implications)

Pre-class: no readings due.

Reflection 1 due today (Details will be provided in advance).

SESSION 4 (LIVE IN-PERSON)

Topic: *THINKING AND REASONING*

Concepts covered: Thought collectives, approaches to technology & society

Learning objectives: to understand what happens in the practice of thinking and reasoning

Pre-class: read Ludwik Fleck, *Genesis and Development of a Scientific Fact*. Excerpt TBD.

Book Chapters: Ludwik Fleck, *Genesis and Development of a Scientific Fact*. Excerpt TBD (See Bibliography)

SESSION 5 (LIVE IN-PERSON)

Topic: *ARE TECHNOLOGIES THEMSELVES POLITICAL?*

Concepts covered: classic approaches in social studies of technology

Learning objectives: To understand how political processes shape technological design and how technological developments shape politics.

Pre-class: read Langdon Winner, *Do Artifacts Have Politics?* Excerpts TBD.

Article: Langdon Winner, *Do Artifacts Have Politics?* (*Daedalus*, Vol. 109, No. 1 (Winter. 1980), 121-36) (CED)

SESSION 6 (LIVE IN-PERSON)

Topic: **ALGORITHMIC DISCRIMINATION WORKSHOP** -- Is facial recognition software racist?, or, designing technology for equality

Concepts covered: new approaches to algorithmic oppression in the digital age

Learning objectives: to deepen the understanding of where issues of data and justice arise

Pre-class: read Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. Introduction. Excerpt TBD.

First deliverable due for final presentations. Details TBD.

Book Chapters: Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. Introduction (CED)

SESSION 7 (LIVE IN-PERSON)

Topic: *WHAT MAKES A FACT A FACT?*

Concepts covered: facts, truths, authoritative knowledge

Learning objectives: to understand elemental conceptualizations of facts

Pre-class: read Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*. Chapters 1, 2 and 4 (See also Bibliography).

Book Chapters: Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*. Princeton University Press, 2013. Chapter 1 (CED)

SESSION 8 (LIVE IN-PERSON)

FIRST 45 MINUTES: MIDTERM (multiple choice & reflection 2 on the course, 400 words)

Topic: In-class Workshop on Social Dimensions of Nuclear Technologies / Reproductive Technologies

We will divide into two groups that work on these topics respectively. I will have a list of questions to guide you in your research on these topics. You will learn some basics of these two fields of technological development (e.g. what scientific disciplines do they draw on? What machinery do they use? Are they digital technologies / how has the digital revolution changed these fields?) Given our class topic and to approach such technologies' societal embedding, you will generate a list of steps to take in a research project, centered on historical emergence, risks and benefits, sustainability, ethical implications, etc. For example, we might ask what problems in society lead to the development of these sectors in the first place, where you would need to look/go to answer questions about what cell free fetal DNA is, or what kind of expert you would need to interview to understand the risks of nuclear technologies.

Pre-class: no reading due.

SESSION 9 (LIVE IN-PERSON)

Topic: HOW DOES SCIENCE CHANGE? PART I

Concepts covered: paradigms, scientific process & progress, scientific revolutions

Learning objectives: To become familiar with a seminal text in philosophy of science and understand its core concept of the scientific paradigm.

Pre-class: read Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, Excerpt TBD & Barry Barnes, 3-page section on "Similarity Relations" in *T.S. Kuhn and Social Science*.

Book Chapters: Thomas Kuhn, The Structure of Scientific Revolutions, 3rd edition, Excerpt TBD (See Bibliography)

Book Chapters: Barry Barnes, 3-page section on "Similarity Relations" in T.S. Kuhn and Social Science (CED)

SESSION 10 (ASYNCHRONOUS)

Topic: HOW DOES SCIENCE CHANGE? PART II

In this asynchronous session, you will finish reading Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd edition, and an excerpt from Emily Martin's article, "The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles."

We will have a short assignment on Blackboard due the same week as (but after) Session 9: on Wednesday for Segovia students and on Friday for Madrid students.

Article: Emily Martin, The Egg and the Sperm: How Science Constructed a Romance Based on Stereotypical Male-Female Roles (Signs, Vol. 16, No. 3 (Spring, 1991), pp. 485-501) (CED)

SESSION 11 (LIVE IN-PERSON)

Topic: HOW CAN WE STUDY CURRENT SCIENTIFIC AND TECHNOLOGICAL PRACTICE?

Concepts covered: epistemic culture, how humans relate to machines

Learning objectives: to understand the basics of empirical social science research on technology, understanding social analysis of technology

Pre-class: read Karin Knorr Cetina, *Epistemic Cultures: How the Sciences Make Knowledge*. Excerpt TBD.

Second deliverable due for final presentations. Details TBD.

Book Chapters: Karin Knorr Cetina, Epistemic Cultures: How the Sciences Make Knowledge. Chapters 1 and 5 (CED)

SESSION 12 (LIVE IN-PERSON)

Topic: *WHAT IS OBJECTIVITY AND WHO DO WE TRUST TO BE OBJECTIVE?*

Concepts covered: objectivity, subjectivity, authority, positionality, trust, expertise

Learning objectives: to understand how the contemporary idea of objectivity developed in history (objectivity used to mean the opposite of what it does now!)

Pre-class: read Daston, Lorraine & Galison, Peter, *Objectivity* Ch 1 and Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin* (or Donna Haraway, *Situated Knowledge*). Excerpts TBD.

Book Chapters: Daston, Lorraine & Galison, Peter, *Objectivity*. Ch 1 (CED)

Book Chapters: Banu Subramaniam, "Objectivity" in *Ghost Stories for Darwin*. Chapter 7 (CED)

Article: *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective* (*Feminist Studies*, Vol. 14, No. 3 (Autumn, 1988), pp. 575-599) (CED)

SESSION 13 (LIVE IN-PERSON)

Final Exam (25%)

Details on the final exam will be provided in advance.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Student Presentations (7-10minutes for each group, Q&A, 20%)

Self and Peer Review of Presentations (numeric and with commentaries) due TBD (10%)

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		5% Reflection 1, 25% Midterm (incl Reflection 2), 25% Final Exam
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) • Self and Peer Review (10%)
Class Participation	15 %		10% graded pre-class work Reading or video preparation. • 5% Overall in-class participation (does not include attendance)

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

- Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.
- In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Compulsory

- Thomas Kuhn. (1996). *The Structure of Scientific Revolutions*. 3rd Edition. The University of Chicago Press. ISBN 0226458083 (Digital)
- Ludwik Fleck. (1979). *Genesis and Development of a Scientific Fact*. The University of Chicago Press. ISBN 0226253252 (Printed)

Recommended

- Bruno Latour. *Laboratory Life: The Construction of Scientific Facts*. Princeton Paperbacks. ISBN 9780691028323 (Digital)

BEHAVIOR RULES

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.I.DecodAI

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **PABLO SANGUINETTI FERNÁNDEZ-ORDÓÑEZ**

E-mail: psanguinetti@faculty.ie.edu

Pablo Sanguinetti

Pablo Sanguinetti is a PhD researcher and writer specializing in a humanistic approach to technology. He holds a BA in Literary Theory with postgraduate studies in Artificial Intelligence and Programming, and is currently pursuing a PhD in artificial intelligence narratives. He operated the Google innovation program for the media industry in Spain and Portugal, delivering over a hundred lectures and workshops at leading universities and media companies in both countries. He has also served as a correspondent for the German agency DPA in Berlin and Madrid during his journalism career. He is the author of the essay book *Tecnohumanismo: Por un diseño narrativo y estético de la inteligencia artificial* (Technohumanism: Towards a narrative and aesthetic design of artificial intelligence) and two collections of short stories. He is a member of the Observatory on the Ethical and Social Impact of Artificial Intelligence in Spain (OdiselA).

Office Hours

Office hours will be on request. Please contact at:

psanguinetti@faculty.ie.edu

SUBJECT DESCRIPTION

Artificial intelligence (AI) may be one of the most disruptive technologies in human history. It is also a complex reality, distorted by exaggerated expectations and fears. How can we truly understand this technology in order to exploit its opportunities, avoid its risks and discuss its implications? This course is an attempt to 'decode' AI in three distinct but intertwined ways. First, by helping non-technical students understand the key components of an AI model and how its main algorithms work. Second, by applying these concepts to real-world problems using practical tools in a final project at the end of the course. Third, by using this technical and practical knowledge to better understand and engage with key debates surrounding AI and its social and ethical implications. By the end of the course, students will have a clear idea of concepts such as deep learning, transformers, natural language processing (NLP), generative AI or world model. They will have tested tools and techniques such as NLP tasks, Hugging Face, Python, Colab and Flourish. And they will be counting on better arguments to explain sociotechnical problems, such as why a neural network operates as a "black box" and the implications for transparency and accountability, how the architecture of a large language model makes it unreliable as a source of information, or the impact on public debate of including "likes" on social media platforms.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

In this course, the use of generative artificial intelligence (GenAI) is permitted, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

·If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.

·Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.

·AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools:

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

IE IMPACT OVERVIEW

It culminates with the **IE Challenge** where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

SESSIONS

IE IMPACT TECHNOLOGY SYLLABUS

SESSION 1 (LIVE IN-PERSON)

The course begins with a high-level introduction to artificial intelligence. We will review the main historical milestones that explain where this technology comes from and where it is now. We will understand some of the main concepts behind the current boom. And we'll start to clarify key terms and differences, such as symbolic AI vs machine learning or strong vs weak AI. To do this, we will build an AI model in class, test it and discuss its results.

Concepts covered: Artificial intelligence, symbolic AI, machine learning, strong AI or AGI, weak or narrow AI, AI winter.

Reading for next class: Coeckelbergh, M. (2020), "The Technology", in *AI Ethics*. The MIT Press (63-81).

SESSION 2 (LIVE IN-PERSON)

We will recap the core ideas of our first session and keep expanding our vocabulary with new concepts. We will explore the distinction between supervised, unsupervised and reinforcement learning. To close these two first sessions focused on core ideas, we will visualize a neural network, the basis of deep learning, to understand how it works.

Concepts covered: Supervised, unsupervised, and reinforcement learning. Deep learning, neural network, algorithm.

Initial reflection for next class: Write a short reflection (400-700 words) on why you chose this topic and expectations. Reflect on how you think the technologies that will be addressed in this course topic may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.)

SESSION 3 (LIVE IN-PERSON)

The phases that we have studied in an AI project shed light on the various ethical challenges of this technology. Every decision in every design phase has a direct impact on society. What are those decisions? What frameworks can we apply to evaluate the impact of the model and guide us towards ethical technology?

Concepts covered: Black box, transparency, privacy, bias, ethical and design frameworks.

Watch the video "[The Wisdom We Need to Design Humane Technology](#)", by the Center for Human Technology

SESSION 4 (LIVE IN-PERSON)

After understanding the common basis of all AI models, we will see what particular forms it can take depending on the format in which it is applied: numbers, audio, image and language. This distinction will help us delve deeper into generative AI and begin to understand the algorithms behind models such as ChatGPT or Dall-e.

Concepts covered: AI tasks (classification, regression, anomaly detection, clustering, recommendation). Computer vision, natural language processing. Generative AI.

Reading for next class: "[Generative AI Exists Because of Transformers](#)" (The Financial Times)

SESSION 5 (LIVE IN-PERSON)

In this class we will focus on one of the areas studied in the previous one: language. Natural language processing (NLP) is one of the most powerful and useful branches of AI today. We will review the various tasks (from sentiment analysis to entity extraction or classification). And we will ask ourselves if the current state of the art is enough to believe that AI "understands" the world... or can ever do so.

Concepts covered: NLP tasks (NER, sentiment analysis, classification, topic modeling, Q&A). World model, knowledge graph.

SESSION 6 (ASYNCHRONOUS)

You will work on your own to complete a framework that allows you to organize and propose an AI project, known as ML Canvas.

Concepts covered: ML Canvas.

SESSION 7 (LIVE IN-PERSON)

In this hands-on class, we'll look at some basics of one of today's most popular programming languages, Python. We'll do it on a platform that's especially useful for testing code, sharing it, and presenting it to others: Google Colab.

Concepts covered: Python (and its main components), coding notebooks, Google Colab.

Assignment for next class: Coding exercises in Google Colab.

SESSION 8 (LIVE IN-PERSON)

Programmers don't work alone. In their daily lives they rely on numerous resources, most of which are free and open. While we continue with programming tests in Colab, we will see how we can use those resources for our own work.

Concepts covered: Github, stack overflow, chatgpt coding, documentation, libraries, advanced search.

SESSION 9 (LIVE IN-PERSON)

Thanks to that open and collaborative spirit of an important part of the technology community, we have a platform like Hugging Face, a large collection of open source AI models for various tasks. We will see what it is, how it is organized and how we can use its models in Colab. Finally, we will briefly discuss why open source models are controversial and who opposes them.

Concepts covered: Hugging Face, open source models.

Midterm reflection for next class: Write a short reflection (400-700 words) on student's development in class. Surprises. New discoveries. Questions. New thoughts on how the technologies discussed in class may or may not affect and/or influence the lifestyles, behavior or outlooks of different segments of society.

SESSION 10 (LIVE IN-PERSON)

Can we "program" something as unpredictable as creativity? In this session, we will look at some algorithms and models especially suitable for making "art" and discuss some famous examples of their application.

Concepts covered: GANs, DeepDream, diffusion models.

Optional reading for next class: Du Sautoy, M. (2019), "Why We Create: A Meeting of Minds". In The Creativity Code. How AI is Learning to Write, Paint and Think. 4th Estate (298-306).

SESSION 11 (LIVE IN-PERSON)

We have already explored the ethical implications of the way we design a technology. In this class, we will now ask ourselves about the very possibilities of AI. How far can it go? Where is the limit? What arguments can help us find the answer? Is the current AI boom justified?

Concepts covered: Limits of AI. Value alignment. Generalization. Turing Test. Singularity.
Reading for next class: Russell, S. & Norvig, P. (2022), "The Limits of AI". In Artificial Intelligence. A Modern Approach. (paragraphs 28.1-28.2)

SESSION 12 (LIVE IN-PERSON)

There is a long distance between having data and using it effectively and eloquently. In this session we will review the seven phases of a data project and the tools and resources that can help us in each one: from obtaining data to its visualization, from cleaning datasets to its verification.

Concepts covered: Datasets, data processing, data visualization, Flourish.

SESSION 13 (LIVE IN-PERSON)

Final exam: multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final presentation of 7-10 minutes and Q&A (professor and classmates).

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%), Self and Peer Review (10%)

Class participation	15 %		5 graded pre-class work. Reading or video preparation (10%). Overall in-class participation (does not include attendance) (5%)
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RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year)
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Melanie Mitchell. *Artificial Intelligence. A Guide for Thinking Humans*. ISBN 9780241404836 (Digital)
- Stuart Russell and Peter Norvig. *Artificial Intelligence. A Modern Approach*. ISBN

9781292401133 (Digital)

- Mark Coeckelbergh. *AI Ethics*. ISBN 9780262538190 (Digital)

- Stuart Russell. *Human Compatible. AI and the Problem of Control*. ISBN 9780241335246 (Digital)

BEHAVIOR RULES

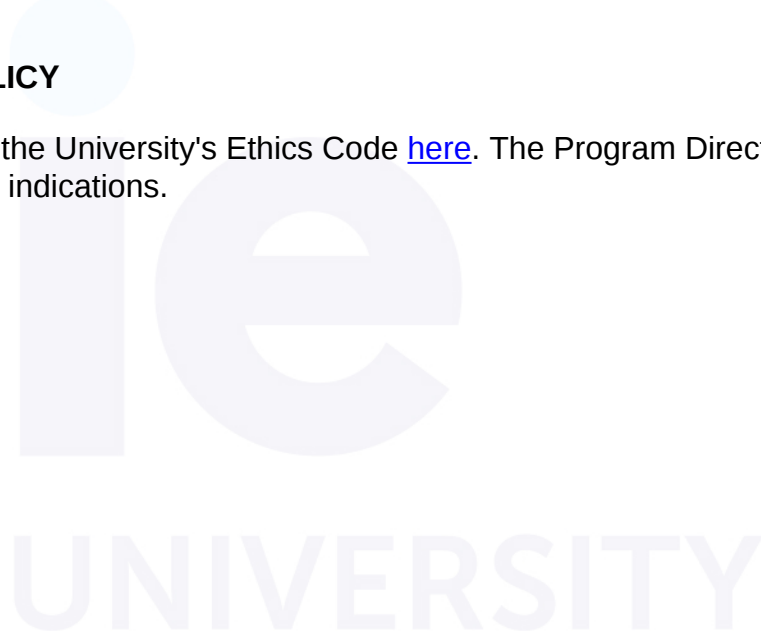
Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.



TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.J.WastRes

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **IRENE SÁNCHEZ ANDREA**

E-mail: isancheza@faculty.ie.edu

An enthusiast of resource recovery

Dr. Sanchez-Andrea holds a PhD in Microbiology from the Autonomous University of Madrid (Spain), defended with honours (cum laude and awarded with the Extraordinary Doctorate Prize of the Faculty of Sciences) in 2012. After working in Spain, Germany, and USA, she became tenured professor in Wageningen University in 2017 and moved to Ie university in 2023. Her research focuses on the discovery of novel microorganisms, pathways and applications for resource recovery and biomolecules production reducing the anthropogenic impact on ecosystems.

Office Hours

Office hours will be on request. Please contact at:

irene.sanchez@ie.edu from 9:30 to 2.

SUBJECT DESCRIPTION

Step into the world of sustainable innovation with the IE Impact Technology course - Waste to Resources. You will experience a hands-on course which will take you beyond the basics of circular economy. Whether you are a techie or not, this course is intended for anyone eager to learn, innovate, and make a difference. Discover the pivotal shift from a 'take-make-dispose' model to a regenerative circular system, where nothing is wasted and everything is valued.

You'll deepen into the core of sustainability, exploring how sectors like food, agriculture, fashion, plastics energy or e-waste are reinventing themselves. Through case studies, you'll see how circular economy can succeed (and fail). Finally, you will dive into a project which will challenge your knowledge, not only from the technical point of view but from a holistic one, from ideation to implementation.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals. At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following.

This course consists of 15 sessions divided in three components: lectures (9 sessions), a challenge to be solved (2 sessions) and game simulations (2 sessions) plus 1 session for evaluation. All sessions for this course will be live-in sessions. The 10 sessions of theory will be complemented with a game simulation to understand waste management in the context of space trash, together with global governance, and political decisions.

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours

Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Critical GenAI use is encouraged

In this course, the use of generative artificial intelligence (GenAI) is encouraged, with the goal of developing an informed critical perspective on potential uses and generated outputs.

However, be aware of the limits of GenAI in its current state of development:

- If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get good outcomes. This will take work.
- Don't take ChatGPT's or any GenAI's output at face value. Assume it is wrong unless you either know the answer or can cross-check it with another source. You are responsible for any errors or omissions. You will be able to validate the outputs of GenAI for topics you understand.
- AI is a tool, but one that you need to acknowledge using. Failure to do so is in violation of academic honesty policies. Acknowledging the use of AI will not impact your grade.

Suggested format to acknowledge the use of generative AI tools: I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work].

If you have chosen not to include any AI generated content in your assignment, the following disclosure is recommended: No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE's core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

- humanistic approaches to interpersonal relations, decision-making, and critical thinking;
- familiarity with the technologies that are applied to solve some of the world's greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the **IE Challenge** where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Introduction to the course and to circular economy

- Ice breaker
- Overview of linear vs. circular economy
- Importance of transitioning to a circular model/introduction to circular principles

Lecture: Introduction to the course

- Environmental, social, and economic impacts of the linear model
- Overview of linear vs. circular economy
- Importance of transitioning to a circular model/introduction to circular principles
- The new vision of waste in the circular economy

Explanation of Reflection 1

SESSION 2 (LIVE IN-PERSON)

Lecture: Waste Characterization and Assessment.

- Types and composition of different waste streams and consequent environmental impacts.
- Life cycle analysis (LCA) of waste products
- Assessing environmental impact and resource potential

Deadline of Reflection 1

Explanation of assignment 1

SESSION 3 (LIVE IN-PERSON)

Lecture: R strategies I

- Consumption and Waste in today's World.
- R strategies in circular economy.
- Manufacturing Process Map
- Postconsumption Map.

SESSION 4 (LIVE IN-PERSON)

Lecture: R strategies II

- Principles of recycling
- Materials for recycling
- Overview of recycling processes (mechanical, chemical, biological)
- Challenges and innovations in recycling technologies
- Explanation of peer-feedback to assignment 1 through FeedbackFruits or similar software (a session-time deadline)

Deadline Assignment 1

Explanation of the peer feedback to Assignment 1

SESSION 5 (LIVE IN-PERSON)

Lecture: Food and agricultural Waste

- Introduction of the platform for sharing the common feedback.
- Food and agricultural waste management.
- Resource Recovery and Recycling.
- Innovations and future trends

Deadline Feedback Assignment 1

Explanation of Reflection 2

SESSION 6 (LIVE IN-PERSON)

Lecture: Fashion and Plastic Waste

- Fashion waste. Typology and processes overview.
- Plastic waste. Typology and processes overview.
- Circularity Trends in Fashion and Plastic Sectors.

Deadline Reflection 2

SESSION 7 (LIVE IN-PERSON)

Lecture: Waste-to-Energy Technologies

- Waste materials and products.
- Waste-to-Energy processes overview. Impact measurement. Circular credits and carbon footprint.
- The role of R&D in Energy sector decarbonization.

Questions for assignment 2 on the challenge

SESSION 8 (LIVE IN-PERSON)

Lecture: e-Waste Management

- Challenges of electronic waste
- Recycling and resource recovery from electronic devices
- Responsible disposal of e-waste

SESSION 9 (LIVE IN-PERSON)

Lecture: Circular Economy Business Models

- Transitioning from linear to circular business models
- Economic benefits of circular economy practices
- Case studies on companies successfully implementing circular principles.
- Challenges: regional and national policy and regulations, circular Supply Chain Management, geopolitics.

Deadline Assignment 2

Explanation peer-review of Assignment 2

SESSION 10 (ASYNCHRONOUS)

Lecture: Governance (I)

- Preparatio for the SpaceGov activity

Games & Simulations: Facing New Challenges in Space & Cyber Affairs: SpaceGov (IRE090056-U-ENG-HTM)

SESSION 11 (LIVE IN-PERSON)

Lecture: Governance (II)

Global Governance and International Relations through SpaceGov

- Management of waste as a collective problem
- Importance of Technology for societies
- Cooperative/competitive nature of complex social processes

Deadline Feedback of Assignment 2

Games & Simulations: Facing New Challenges in Space & Cyber Affairs: SpaceGov (IRE090056-U-ENG-HTM)

SESSION 12 (LIVE IN-PERSON)

Lecture: Final Project Workshop and Feedback Poster Visualization.

- Poster Visualization.
- Presentation workshop.
- Q&A.

SESSION 13 (LIVE IN-PERSON)

Exam

In paper, MCQ and 1 to develop

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final Presentations

- Group presentations of refined circular business proposals
- Q&A session with panel of experts and peers
- Evaluation and feedback on presentations

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		10% reflections + 20% assignments
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or “re-sit”) in June/July.

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- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

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BIBLIOGRAPHY

Recommended

- Edited by Terry Tudor, Cleber JC. Dutra. *The Routledge Handbook of Waste Resources and the Circular Economy*. Routledge International Handbooks. ISBN 9780367637590 (Printed)
- Siming You. *Waste-to-Resource System Design for Low-Carbon Circular*

Economy. Elsevier. ISBN 9780128226 (Digital)

BEHAVIOR RULES

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ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.K.ClimTec

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **MARIA DEL CARME HUGUET MICHEO**

E-mail: mhuguet@faculty.ie.edu

Carme Huguet is a seasoned researcher with over two decades of experience across six countries. Her work focuses on addressing globally significant issues through scientific research, with a particular emphasis on understanding the impacts of climate change and other human activities on life on Earth. She employs a multidisciplinary approach and specializes in the development and application of organic geochemical tools to study past and present terrestrial and marine processes. A recognized leader in biogeochemistry, she serves on the board of the Geochemical Society. Huguet is also passionate about teaching and has founded a research group dedicated to active STEM learning, developing innovative materials and activities. She is actively involved in the scientific community, participating in outreach activities, organizing workshops, and serving as a session chair among other roles.

More details:

- <https://www.ie.edu/university/about/faculty/carme-huguet/#:~:text=Carme%20Huguet%20is%20a%20well,can%20be%20addressed%20through%20science.>
- <https://scholar.google.com.co/citations?user=Fd4oT24AAAAJ&hl=en>

Office Hours

Office hours will be on request. Please contact at:

mhuguet@faculty.ie.edu

SUBJECT DESCRIPTION

Embark on a transformative journey with our Climate Technology course, designed to empower you with a deep understanding of climate change and its profound impact on our daily lives. This course is not just about learning; it's about becoming a part of the solution.

Our holistic, transdisciplinary, and integrative approach will guide you through the complexities of global change. We believe that to tackle such a multifaceted issue, an interdisciplinary perspective is essential. Our first step is to comprehend the climate system itself, to grasp the changes it's undergoing, and to understand the far-reaching consequences at all levels.

We will then move into mitigation and adaptation strategies and technological solutions. It's in our hands to act within our areas of expertise to build the solutions of the future. Through adaptation and mitigation actions, we can build a more resilient society. Join us and be a part of this crucial journey towards a sustainable future.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
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Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Restricted use of GenAI

In today's world, generative artificial intelligence (GenAI) is changing how we work, study and, in general, how we get things done. However, in the context of this course, the use of GenAI is not permitted, unless it is otherwise stated by the instructor. The use of GenAI tools would jeopardize the students' ability to acquire fundamental knowledge or skills of this course.

If a student is found to have used AI-generated content for any form of assessment, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

IE IMPACT OVERVIEW

E IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with "pillar courses" in three of IE's core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop:

humanistic approaches to interpersonal relations, decision-making, and critical thinking;

familiarity with the technologies that are applied to solve some of the world's greatest challenges; and

entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU's core values of sustainability and diversity.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals. 3- Avoid using the word "challenge" in session #1 4- Re-sit / retake policy: copy and paste from syllabus template.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Technology course – Climate Solutions

- o Explain course dynamics.
- o Start of the course challenge, group configuration and countries
- o What do you know: exploratory quiz.

SESSION 2 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to the Climate system and its dynamics

- o Know the components of the climatic system: spheres, sinks, flows.
- o Learn how the climate system works: heat budget and flow, atmospheric circulation, ocean circulation, feedback.
- o Biogeochemical Cycles-link carbon and water cycle.

Supporting material:

Book Chapters: The Climate System: an Overview (IPCC)

SESSION 3 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Introduction to Climate Change

- o Understanding the basics of climate change
- o The science behind global warming and greenhouse gases

Supporting material:

Article: What Is Climate Change? (UN)

Article: What Is Climate Change? (NASA)

SESSION 4 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Impact of Climate Change

- o Discussing the environmental, economic, and social impacts of climate change
- o Case studies on the effects of climate change, primary and secondary, students will research and present.

Supporting material:

Article: Consequences of climate change (European Commission)

Article: The Basics of Climate Change (The Royal Society)

SESSION 5 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Climate Change Mitigation and adaptation

- o Understanding the concept of climate change mitigation and adaptation, resistance, and resilience.
- o Exploring various strategies for reducing greenhouse gas emissions.
- o What are we adapting to?

Supporting materials:

Article: Responding to Climate Change (NASA)

Book Chapters: Inter-relationships between adaptation and mitigation (IPCC)

SESSION 6 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Industrial)

- o Understanding the technology behind carbon capture and storage: Where and how.
- o Geoengineering
- o Discussing the potential and limitations of this technology-approach.

Supporting materials: articles will be provided.

Article: Negative emissions technologies and practices: the way forward (European Commission)

SESSION 7 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Negative emission technologies (Nature Based)

- o Exploration of various nature-based NETs such as afforestation, reforestation, blue carbon (carbon captured by oceans and coastal ecosystems), and soil carbon sequestration.
- o Examination of real-world applications and case studies of nature-based NETs.

Supporting materials: articles will be provided.

Article: Could negative emissions actually help curb climate change? (European Commission)

SESSION 8 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Regenerative agroecology and land management, going beyond sustainable agriculture.

- Exploring the connection between agriculture, farming, and climate change
- Techniques for promoting real sustainable food production systems agriculture.

Supporting materials:

Other / Complementary Documentation: Movie: Ganado o Desierto

Other / Complementary Documentation: Movie: Kiss the Ground (Netflix)

SESSION 9 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Green Cities

- Understanding the concept of green cities
- Role of green cities in reducing greenhouse gas emissions and improving water use.
- Madrid Deep Demonstration project, EIT Climate KIC
- Towns in Transition

Supporting materials:

Other / Complementary Documentation: Towns in Transition (transitionnetwork.org)

Article: Supporting municipalities to develop collaboration capability to facilitate urban transitions and

sustainability: Role of transition intermediaries in Madrid (Journal of Cleaner Production Journal of Cleaner Production 426:138964, 2023) (ResearchGate)

SESSION 10 (ASYNCHRONOUS)

Sustainability Topics:

- Environment
- Governance

Climate Change Policy

- o Discussing the role of policy in climate change mitigation and adaptation
- o Review of international climate agreements and policies

Supporting materials: COP meetings

Other / Complementary Documentation: COP meetings (UN)

SESSION 11 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Social Challenge

Climate Change and Society

- o Understanding the social dimensions of climate change
- o Role of individual and collective action in climate change mitigation

Supporting materials: articles will be provided, other sources:

- <https://www.worldbank.org/en/topic/social-dimensions-of-climate-change#1>
- <https://www.ipcc.ch/report/ar6/wg2/>

SESSION 12 (LIVE IN-PERSON)

Sustainability Topics:

- Environment

Climate Change Communication

- o Importance of effective communication in climate change mitigation
- o Techniques for communicating about climate change to diverse audiences.
- o Discussing the role of innovation in climate change mitigation

Supporting materials: articles, booklets will be provided. Additional:
<https://www.un.org/en/climatechange/communicating-climate-change>

SESSION 13 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Final EXAM

SESSIONS 14 - 15 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge

Climate Change Innovation

Students present their work.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		Class participation should be active, engaged and always respectful with the professor and fellow students.

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year).
- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade

components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.

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After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Puay Yok Tan (Editor), Chi Yung Jim (Editor). *Greening Cities: Forms and Functions (Advances in 21st Century Human Settlements)*. ISBN 9811350515 (Digital)

- Jose Carlos Magalhaes Pires (Redactor), Ana Luisa da Cunha Goncalves (Redactor). *Bioenergy with Carbon Capture and Storage: Using Natural Resources for Sustainable Development*. Academic press. ISBN 0128162295 (Digital)

BEHAVIOR RULES

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ATTENDANCE POLICY

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ETHICAL POLICY

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE- IMPACT.2.S.L.Leisure

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **MARIANO ALVAREZ DIENTE**

E-mail: mad2@faculty.ie.edu

Mariano Álvarez has extensive professional experience as a professor at IE University and IE Business School and has been a regular instructor at IBM for more than 20 years.

He complements his teaching activity at IE University with responsibilities in telecommunications projects for the public and private sectors and has lectured for institutions such as the CNP (National Police Corps) and the University of Valladolid.

His current focus is on initiatives in the areas of digital transformation, Internet of Things, Big Data and advanced analytics and AI. This allows him to acquire, also from a practical approach, the depth and breadth of knowledge necessary to be permanently updated in the complex IT world.

In addition to his education as a telecommunications engineer, he also has an education in Humanities (holds a bachelor's degree in literary theory and comparative literature and a master's degree in applied philological studies.) and often, in his lectures, stresses how important it is to put the focus on technology as an enabler of human evolution. In his opinion, technology is only useful if the human species can thrive through it.

Professor Alvarez always encourages students to explore the uses of technology in the development and expansion of niche markets for entrepreneurship; while upholding the welfare of our modern society and the right to our individual freedom.

Office Hours

Office hours will be on request. Please contact at:

Contact details: e-mail: mad2@faculty.ie.edu

Office hours: Live tutorials available by previous appointment.

SUBJECT DESCRIPTION

The present course addresses the evolving landscape of leisure and entertainment in the context of modern, fast-paced lifestyles and technological advancements. It explores how these changes meet the growing demand for new leisure experiences, influenced by demographic shifts and changing societal preferences. The course delves into the significant impact of technology on making leisure and entertainment experiences more accessible, thereby enhancing mental, emotional, and physical health. It also considers the role of technology-driven leisure in promoting work-life balance, environmental sustainability, social equity, and cultural preservation.

Students will examine how these experiences not only provide personal enjoyment and relaxation but also serve broader societal and global objectives, such as fostering social interaction, breaking down cultural barriers, and promoting economic diversification. The curriculum is designed to provide a comprehensive understanding of the interplay between technology, leisure, and social change, encouraging students to critically analyze and creatively engage with the future of leisure and entertainment. Through this course, participants will gain insights into how technology can transform leisure experiences into opportunities for personal growth, social impact, sustainable economic development, job creation and global connectivity.

In addition, students will also have the opportunity to potentially contribute to society by thinking critically about solutions or projects in this sector that, who knows, may become a reality.

LEARNING OBJECTIVES

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way companies are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, companies and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future projects, business initiatives and even in identifying or generating new business model opportunities to solve the problems faced by our society, companies, and individuals.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in

Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Nowadays, the great development of Generative Artificial Intelligence (GenAI) is rapidly changing the way we work, study and, in general, the way we do things.

However, for the context of this course, we believe that an improper use of AI tools would mean reducing the learning possibilities of the interesting contents covered. Therefore, it will be up to the instructor to indicate when the use of AI tools is appropriate and it will be considered academic misconduct to use them without the instructor's supervision. Such misconduct will result in the failure of the corresponding assignment and even the entire course.

PROGRAM

IE IMPACT OVERVIEW

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT learning journey begins with “pillar courses” in three of IE’s core values: the Humanities, Technology, and Entrepreneurship to help IEU students develop: humanistic approaches to interpersonal relations, decision-making, and critical thinking; familiarity with the technologies that are applied to solve some of the world’s greatest challenges; and entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

It culminates with the IE Challenge where students apply the skills, mindsets, and knowledge acquired in the three pillar courses to address problems framed within IEU’s core values of sustainability and diversity.

SESSION 1 (LIVE IN-PERSON)

Introduction to Technology and Leisure. Digital Transformation in Travel and other leisure experiences

- Introduction to the course objectives and structure (Assignments, exams, presentations, evaluation).
- Overview of key concepts, including leisure technology, digital transformation, and experiential design.
- Historical evolution and current trends in technology adoption in leisure sectors

Concepts covered: leisure technology, digital transformation, experiential design

Supporting materials: slides and additional materials provided by the professor

SESSION 2 (LIVE IN-PERSON)

Social Media, Online Communities and identities in Leisure. E-commerce and the Future of Leisure Retail

- The role of social media, online communities in shaping contemporary leisure experiences and building online communities.
- User-generated content, influencer marketing, and community-driven leisure activities
- Successful social media campaigns in promoting leisure experiences and destinations
- Privacy, authenticity, and digital well-being.
- Exploration of social media strategies for leisure brands and organizations, including content creation, influencer marketing, and community engagement.
- The intersection of e-commerce and leisure retail, exploring how online shopping platforms and digital marketplaces are reshaping the way consumers access and engage with leisure products and services.
- Streaming platforms and their impact on entertainment consumption
- Trends in original content production and distribution
- Cultural implications of binge-watching and on-demand viewing habits

Assignments/activities: Students will examine how platforms like Facebook, Instagram, TikTok and others have transformed the way individuals socialize, consume media, and participate in leisure activities. Other cases studies and further discussion.

Concepts covered: Social Media, E-commerce, Digital Platforms and Retail industry in Leisure sector.

Supporting materials: slides and additional materials provided by the professor

SESSION 3 (LIVE IN-PERSON)

Data Analytics for Leisure Decision-Making and personalization. Use of Blockchain in leisure industries

- The role of data analytics in informing decision-making and optimizing leisure experiences.
- Overview of data analytics techniques for analyzing user behavior and preferences in leisure technology.
- Understanding recommendation algorithms and their influence on leisure choices
- Exploring issues of algorithmic bias and diversity in content recommendation
- Introduction to blockchain technology and its applications in leisure
- Potential for blockchain to revolutionize leisure industries
- Personalized Recommendations and Curation

Assignments/activities: Analysis of real-world datasets related to leisure consumption patterns. Statistical analyses to identify trends and correlations, and creating data visualizations to communicate insights effectively. Use cases of blockchain in ticketing, authentication, and digital rights management

Concepts covered: Data analytics, bias, diversity, Blockchain, Curation

Supporting materials: slides and additional materials provided by the professor

SESSION 4 (LIVE IN-PERSON)

Virtual Reality and Immersive Technologies, immersive Experiences in Entertainment. Artificial Intelligence in personalization

- The transformative potential of virtual reality (VR) and other immersive technologies in redefining leisure experiences. How technology such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) is revolutionizing storytelling, gaming, and live events
- Applications of AR and VR technologies in transforming leisure experiences: virtual travel, immersive cultural experiences, and interactive entertainment
- Designing AR/VR experiences for personalized leisure activities
- AI-driven personalization strategies for tailoring leisure experiences based on user preferences and behavior
- AI-powered virtual assistants, chatbots, and recommendation systems

Assignments/activities: Analysis of VR demos, interactive experiences, and discussions of real-world applications of VR in leisure domains such as gaming, entertainment, tourism.

Case studies: immersive museum exhibits, virtual destination tours, online games...

Case studies: AI-driven personalization in travel, cultural exploration, and entertainment

Concepts covered: AR, VR, MR, AI-powered solutions.

Supporting materials: slides and additional materials provided by the professor

SESSION 5 (LIVE IN-PERSON)

Digital Health and Wellness Technologies. Personalized Well-being

- The intersection of technology and wellness, focusing on the role of digital health technologies in promoting physical and mental well-being: telehealth services.
- Exploration of emerging technologies for well-being, including wearable devices and biofeedback systems.
- Fitness Trackers & Wearables: smartwatches and health apps for monitoring activity and well-being.
- Mental Health Apps: Exploring guided meditations, mindfulness apps, and mental health resources available through technology.

Assignments/activities: Discussion in small groups and conclusions sharing

Concepts covered: Wellnes, Digital health, mental well-being, apps, wearable devices

Supporting materials: slides and additional materials provided by the professor

SESSION 6 (LIVE IN-PERSON)

Smart Cities and Urban Leisure Experiences, Sustainable Tourism and Hospitality. Ecotourism Practices.

- This session will explore the concept of smart cities and their potential to enhance leisure experiences in urban environments.
- Focus on sustainable tourism and ecotourism practices, exploring how technology can be used to minimize environmental impact and promote responsible travel behavior.
- Case studies on eco-friendly leisure technologies and sustainable tourism initiatives. Virtual Tourism and Immersive Experiences. Smart Hotel Technologies: IoT and Automation.
- AI in Travel Planning and Customer Service. Sustainable Destination Management. Case studies: eco-friendly travel apps, carbon offset initiatives

Assignments/activities: Analysis of case studies of sustainable tourism initiatives around the world, exploring tools and technologies for monitoring and mitigating environmental impact, and discussing strategies for engaging travelers in sustainability efforts.

Concepts covered: Sustainable tourism and hospitality, Ecotourism, eco-friendly leisure.

Supporting materials: slides and additional materials provided by the professor

SESSION 7 (LIVE IN-PERSON)

Digital Arts and Creative Expression, cultural exploration, cultural Heritage Preservation and digital archives.

- This session will explore the intersection of technology and creativity, focusing on the ways in which digital tools and platforms are democratizing artistic expression and transforming the creative process. Creative coding and interactive media,
- Students will also explore the intersection of technology and cultural heritage preservation, focusing on the role of digital archives, virtual reality, and augmented reality in safeguarding and promoting cultural heritage assets.
- Examination of digital tools for cultural exploration, including virtual museum tours, language learning apps, and online cultural exchanges.
- Leveraging location-based technologies for personalized cultural exploration and heritage preservation
- Digital mapping, geo-tagging, and interactive guides for cultural sites and landmarks
- Language Learning Apps: Examining language learning apps and online resources for enhanced cultural immersion.
- Technology in the film sector

Assignments/activities: Analysis of how technology is transforming museums, historical sites, and cultural experiences

Concepts covered: Heritage, museums, creativity, cultural exploration, location-based technologies

Supporting materials: slides and additional materials provided by the professor

SESSION 8 (LIVE IN-PERSON)

Gaming Culture and esports. Streaming platforms

- Gaming has evolved into a mainstream form of entertainment, with millions of players worldwide participating in online multiplayer games, Esports competitions, and virtual reality experiences. Gaming communities provide social interaction and opportunities for collaboration and competition.
- Gaming Culture and Esports Phenomenon. Evolution of gaming as a leisure activity. Rise of esports and competitive gaming
- Social and cultural aspects of gaming communities
- Augmented Reality (AR) and Virtual Reality (VR) Experiences in Esports and Gaming Platforms.
- Social Media Marketing and Fan Engagement. Data Analytics and Personalization. Interactive Stadium Experiences. Broadcasting and Content Distribution. Immersive Fan Experiences. Sponsorship Activation and Brand Integration.
- Streaming Services and On-Demand Entertainment. Streaming platforms continue to dominate

the entertainment landscape, offering a vast library of movies, TV shows, documentaries, and live events. Subscription-based models provide users with on-demand access to a wide range of content anytime, anywhere.

Assignments/activities: Analysis of how technology is transforming the gaming industry. Case studies based on new platforms, the rise of Esports

Concepts covered: Gaming, Esports, digital platforms,

Supporting materials: slides and additional materials provided by the professor

SESSION 9 (LIVE IN-PERSON)

Travel technology. Digital Transformation in Travel

- Smart Travel Assistants and AI-powered travel assistants help travelers plan and organize their trips more efficiently. These assistants use machine learning algorithms to suggest personalized travel itineraries, recommend activities based on preferences, and provide real-time travel updates and assistance.
- Virtual Reality (VR) Travel: VR technology enables users to virtually explore destinations from the comfort of their homes. Companies are offering immersive travel experiences, allowing users to "visit" destinations, landmarks, and cultural sites around the world without physically traveling.
- Personalized Travel and Leisure Planning. AI-driven travel planning tools and personalized itinerary recommendations
- Planning & Booking, Immersive Experiences and Travel Safety & Security
- Mobile apps for travel planning, navigation, and booking

Assignments/activities: Exploration of digital innovations in the travel industry, such as online booking platforms, virtual reality tours, and smart destination management systems.

Examples of successful implementations of digital technologies in travel experiences

Concepts covered: Travel, VR and AI in the travel industry, personalization, immersive experiences

Supporting materials: slides and additional materials provided by the professor

SESSION 10 (LIVE IN-PERSON)

Design Thinking for Leisure Innovation. Digital Storytelling and Immersive Narratives. Entrepreneurship in Leisure Technology

- Principles and methodologies of design thinking, with a focus on applying design thinking to leisure innovation.
- The art of digital storytelling and its role in creating immersive leisure experiences.
- Prototyping immersive leisure and tourism experiences. Students will learn about the process of launching and scaling a leisure technology startup, from ideation and validation to product development and market entry.
- The role of immersive media technologies (360-degree video, spatial audio) in storytelling and cultural exploration
- Immersive museum experiences, virtual heritage tours, and interactive storytelling platforms
- User experience (UX) design principles for leisure attractions and tourism destinations
- Introduction to user experience (UX) design principles and methodologies, including user research, prototyping, and usability testing.

Assignments/activities: Analysis of examples of digital storytelling across different media formats, such as video games, virtual reality experiences, and interactive websites, and experimenting with storytelling techniques and tools.

Concepts covered: Design thinking, narratives and storytelling, entrepreneurship

Supporting materials: slides and additional materials provided by the professor

SESSION 11 (LIVE IN-PERSON)

Gamification and Experiential Design, Interactive Experiences in Leisure.

- Gamification and experiential design as strategies for enhancing leisure experiences through technology. Application in leisure contexts to enhance engagement and motivation.

Gamification techniques for engaging leisure activities

- Interactive media installations in theme parks and entertainment venues
- Designing interactive leisure experiences: escape rooms, AR scavenger hunts.

Assignments/activities: Analysis of examples of digital storytelling across different media formats, such as video games, virtual reality experiences, and interactive websites, and experimenting with storytelling techniques and tools.

Concepts covered: Gamification, motivation, interactive media.

Supporting materials: slides and additional materials provided by the professor

SESSION 12 (ASYNCHRONOUS)

Ethical and Privacy Considerations in Leisure Technology

- This session will delve into the ethical implications of technology use in leisure contexts, with a focus on data privacy, surveillance, digital addiction, and algorithmic bias.
- Ethical considerations in content creation and distribution
- Addressing issues of digital piracy, copyright infringement, and content moderation
- Role of media literacy in promoting responsible consumption of digital entertainment

Understanding Leisure Behavior in the Digital Age

- The dynamics of leisure behavior in the digital age. Exploring how technology has transformed the ways in which individuals engage in leisure activities.
- Examples including the rise of digital media consumption, online gaming, and social networking.
- Accessibility and Inclusive Design in Leisure Technology

Assignments/activities:

Exploration of the concept of "technological leisure" and its implications for individual well-being, social relationships, and community participation

Students will explore the ethical dimensions of technology-enabled leisure experiences, considering questions of consent, equity, and cultural representation.

Concepts covered: Data Privacy and protection, surveillance, digital addiction, algorithmic bias, ethics, user behavior in Digital Leisure

Supporting materials: slides and additional materials provided by the professor

SESSION 13 (LIVE IN-PERSON)

The Future of Leisure Technology

- Students will explore emerging trends and predictions in leisure technology, considering how advances in fields such as artificial intelligence, virtual reality, immersive storytelling, wearable technology, and the Internet of Things are shaping the future of leisure experiences.
- The impact of robotics and automation on leisure experiences, from theme parks and attractions to hospitality and service industries.
- Exploring the metaverse: virtual worlds, digital twins
- Challenges and Opportunities in the future of technology applied to the leisure industry

Assignments/activities: Students will try to envision what the future of the entertainment industry will look like.

Concepts covered: The metaverse, IoT, future AI, new narratives

In this session the Final exam will take place

Supporting materials: slides and additional materials provided by the professor

SESSIONS 14 - 15 (LIVE IN-PERSON)

Final presentation and reflection

- In this session, students will have the opportunity to showcase their learning and knowledge of the course by presenting the teamwork they have developed throughout the course.
- Students will also have the opportunity to receive feedback from peers and instructors, fostering a culture of constructive criticism and continuous improvement

Supporting materials: slides and additional materials provided by the professor

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

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- It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., “notable” in the extraordinary call.
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Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

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TECHNOLOGY

IE-IMPACT IE-IMPACT SEP-2024 TCH3OB-IE-IMPACT.2.S.M.Securit

Area Computer Science and AI

Number of sessions: 15

Academic year: 24-25

Degree course: SECOND

Number of credits: 3.0

Semester: 1º

Category: COMPULSORY

Language: English

Professor: **JUAN GRAU GÓMEZ**

E-mail: jgraug@faculty.ie.edu

Juan Grau is an IT consultant and educator with broad experience working with customers across western Europe. Understanding their needs and positioning the best solutions for their companies to succeed. He works with customers to improve their security posture and their business applications performance. He currently teaches Cloud Computing, Cybersecurity, Artificial Intelligence, ICT Governance, Computing Structures and Microsoft Azure as an adjunct professor at IE University and others international universities.

Holding a Master in Electronics and Telecom Engineer BS from UPM (Universidad Politécnica de Madrid) and Master Business Program from IESE Business School (Spain). Juan has been holding positions as Southern Europe Director or Country Manager in several Systems, Networks, Telecom and CyberSecurity companies as Aerohive, BlueCoat, Bitdefender, Brocade, CA, Cabletron Systems, CrossBeam, Enterasys, Huawei, Radware, Riverstone Networks, Ruckus Networks, Zerofox. He has 30 years of experience in Sales and Business Development introducing last innovation technics into the market. He holds several certifications in Microsoft and Azure, Google and Tech Selling Programs

More details about his profile can be found at <https://es.linkedin.com/jgrau>

Office Hours

Office hours will be on request. Please contact at:

jgraug@faculty.ie.edu

SUBJECT DESCRIPTION

Insights into Modern Intelligence: Exploring Technology's Role in National Security

Join us for an illuminating journey into the world of modern intelligence operations and the pivotal role technology plays in safeguarding national security. In "Insights into Modern Intelligence," we delve into the fascinating realm of espionage, surveillance, and intelligence gathering, offering a comprehensive overview accessible to all audiences.

Through engaging discussions and captivating case studies, we explore how governments leverage technology to enhance their intelligence capabilities, ensuring the safety and security of their citizens in an ever-evolving geopolitical landscape. From traditional methods of information gathering to cutting-edge cyber tactics, we unravel the intricacies of intelligence operations and shed light on the ethical considerations and societal implications of these practices.

By participating in this course, students will gain a deeper understanding of:

1. The evolution of intelligence gathering techniques and the role of technology in shaping modern geopolitics.
2. The utilization of advanced surveillance systems, data analytics, and artificial intelligence in intelligence operations.
3. The ethical dilemmas and legal frameworks surrounding intelligence gathering and surveillance practices.
4. The impact of cyber threats and digital vulnerabilities on national security and the strategies employed to mitigate these risks.
5. The importance of interdisciplinary collaboration and information sharing in fostering effective intelligence operations.
6. The emerging field of cyber intelligence and its significance in addressing contemporary security challenges.
7. The principles of resilience and adaptive governance in building resilient cities and communities in the face of threats and disruptions.

By mastering these concepts and acquiring hands-on experience with cutting-edge technologies, students will develop invaluable skills in critical thinking, problem-solving, data analysis, and strategic decision-making. Join us in unraveling the complexities of modern intelligence and shaping the future of national security.

LEARNING OBJECTIVES

At the end of this course, students will be able to:

- Demonstrate familiarity with the fundamentals of the disruptive technologies discussed in the course.
- Demonstrate knowledge of key technological trends in society, framing the technologies addressed in your course topic – and their latest developments – within them.
- Reflect on how the use of the technologies discussed in the course affects and influences lifestyles, behaviors, and views among different groups of people (i.e. generational differences or other differences in profiles or archetypes of people).
- Present and discuss a use case of how a technology discussed in the course has been or could be applied to solve a specific problem or challenge facing society and apply critical thinking to identify the potential implications of its applications.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	13.3 %	10.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	13.3 %	10.0 hours
Group work	20.0 %	15.0 hours
Individual studying	40.0 %	30.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course for research, ideation, generating an outline, proofreading, grammar check, coding, image generation with appropriate acknowledgement. GenAI may not be used for exams. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course.

If you are in doubt as to whether you are using GenAI tools appropriately in this course, I encourage you to discuss your situation with me.

Below, a suggested format to acknowledge the use of generative AI tools. Please note that acknowledging AI will not impact your grade.

I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]

If AI was permitted to use in your assignment, but you have chosen not to include any AI generated content, the following disclosure is recommended:

No content generated by AI technologies has been used in this assignment.

PROGRAM

IE IMPACT is a multi-bachelor, multi-school mandatory academic program for all IEU students whose mission is to foster the skillsets, mindsets, and toolsets we at IE University believe students need to develop into innovative problem-solvers who will lead positive change.

IE IMPACT begins with "pillar courses" in three of IE's core values: the Humanities, Technology and Entrepreneurship. The IE Impact learning journey aims to help IEU students to develop:

- humanistic approaches to interpersonal relations, decision-making and critical thinking;
- familiarity with the technologies that are applied to solve some of the world's greatest challenges; and
- entrepreneurial mindsets, know-how, and skills to identify and solve problems worth solving, and to create validated business models that enable solutions to be enduring and scalable to achieve a greater positive impact.

The IE Challenge is the culmination of the IE Impact learning journey, and its fourth and final course. Students in the IE Challenge will apply the skills, mindsets, and knowledge they began to develop during the three pillar courses, and through their hands-on work they will deepen their learning development and skills related to IE's core value of Diversity. In the IE Challenge, IEU students will choose which challenge or sector they want to focus on and then they will be placed into teams. Some challenges are framed within a client-model in which the teams work as Innovation Consultants, while other challenges are supported by industry leaders who serve as mentors and industry experts and teams work as Innovators and/or Entrepreneurs. All challenges are aimed at students deepening their knowledge of problems related to the sustainability of People, Planet and Prosperity as per the Sustainable Development Goals and the UN's 2030 Agenda.

This course aims to educate students on the disruptive technologies that are making an impact on solving some of the world's most pressing social challenges and that are reshaping the way organizations are designed, managed, and executed. The subject covers the latest technological trends and delves deep into the well-rounded analysis of technology, how it is implemented and how it is understood in different generations and cultures. It will focus specifically on how society, organizations and people apply technology. A practical, human-centered approach will be employed, which will help students frame, develop, and discover how technology will help them with their future aspirations and to solve the problems faced by society, organizations, and individuals.

Students will have the opportunity to select their course topic amongst a variety of major subject areas, such as Environmental Sciences; Financial Systems; Health & Technology; Innovation Engineering (Low-Code, No-Code tools); Robotics and Industrial Automation; Sustainable Cities; Technology & Ethics; Technology and Sustainable Development Goals (SDGs); Web, AI & Meta-Intelligence, etc.

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IE IMPACT OVERVIEW

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SESSION 1 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Social Challenge

Description (Theory): Introduction to the course

Learning Objectives: Familiarising with subject matter, Clear understanding of course requirements.

Concepts to be covered in Course: Biological/Cultural Anthropology

Introduction to Modern Intelligence and National Security

Course overview and discussion of basic intelligence and national security concepts. We will see the different sessions, objectives and expected work to be done along the sessions.

Intro to the Course

Course summary: contents description.

IE and Students expectations.

Assignments and Grading.

SESSION 2 (LIVE IN-PERSON)

Sustainability Topics:

- Social Challenge
- Economic Development

Description (Theory): Human behaviour evolved as an adaptation to the physical and social environment of the archaic past. Since the technical environment is changing too fast for human adaption, traits that were once features are now bugs.

Learning Objectives: Understanding of Human Predicament

Concepts to be covered in Course: Evolutionary Psychology, Evolutionary Mismatch, Signaling Theory,

Big Data

Description of the session

In this session, we will explore the world of Big Data, focusing on how it is collected, stored and used in the intelligence domain. We will also examine data regulation, including the laws and regulations governing the collection, storage and use of big data.

Learning objectives for the session

- Understand the fundamental concepts of Big Data and its application in the field of intelligence.
- Become familiar with the methods and technologies used to collect and store large volumes of data.
- Explore the ethical and legal challenges related to the collection and use of Big Data.
- Understand the regulations and standards that affect the management of big data.

List concepts covered in this session

- Definition and characteristics of Big Data.
- Methods of large-scale data collection.
- Applications of Big Data in the field of intelligence and security.
- Ethical and legal aspects of Big Data use.
- Relevant regulations and standards, such as GDPR, CCPA

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: How to find out what Google knows about you and limit the data it collects (CNBC)

Other / Complementary Documentation: The Dangers of Video Surveillance and A.I. (Youtube)

Other / Complementary Documentation: Big Data: A Revolution That Will Transform How We Live, Work, and Think (Youtube)

Assignments: Reading

Reading: The new fable of the bees: multilevel selection, adaptive societies, and the concept of self interest (Evolutionary Psychology and Economic Theory (pp. 201-220). Emerald Group Publishing Limite. 2005.

SESSION 3 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): We are the Symbolic Species. The Power of Stories.

Learning Objectives: Clear understanding of stories and models of Homo Sapiens

Concepts to be covered in Course: Myths, Memes, Symbotypes

IoT and Smart Technologies

Description of the session

In this session we will explore the fascinating world of smart technology and the Internet of Things (IoT), examining how these advances are transforming our daily lives and their relevance to national security.

We will look at how internet-connected smart devices are collecting real-time data, from sensors in smart cities to home devices, and how this information can be used to improve decision-making in intelligence and security operations.

Learning objectives for the session

- Understand what the Internet of Things is and how it works.
- Explore the practical applications of IoT in different sectors, such as health, agriculture, industry, etc.
- Analyse smart technologies, such as sensors, actuators, and control systems, and their role in building smart environments.
- Discuss the security and privacy challenges associated with the mass deployment of IoT devices.
- Consider the opportunities and risks presented by smart cities and the Internet of Things in general.

List concepts covered in this session

- Definition and characteristics of the Internet of Things.
- Typical architecture of an IoT solution.
- IoT applications in different sectors, such as health, agriculture, industry, etc.
- Key technologies used in smart systems, such as sensors, actuators and control systems.
- IoT security and privacy: threats, vulnerabilities and best practices for protection.
- The role of IoT in the development of smart cities and the improvement of urban quality of life.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Security and Privacy Challenges in the Internet of Things (IEEE)

Article: Smart City Architecture and its Applications Based on IoT (Procedia Computer Science Volume 52, 2015, Pages 1089-1094) (Elsevier)

SESSION 4 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): There are many widely known, yet faulty models of the Human Being.

Learning Objectives: Clear understanding of models (Game Theory).

Concepts to be covered in Course: Homo Economicus, Tragedy of the Commons, Prisoners Dilemma, Egoism/ Altruism.

Artificial Intelligence

Description of the session

In this session, we will dive into the exciting field of Artificial Intelligence (AI), exploring how this advanced technology is fundamentally transforming the way intelligence and national security services operate. We will look at how machine learning algorithms and artificial neural networks are being applied in a variety of scenarios, from detecting patterns in large datasets to automating complex intelligence analysis tasks.

Learning objectives for the session

- Understand the basic concepts of Artificial Intelligence and its subfields.
- Explore applications of AI in sectors such as health, education, commerce and industry.
- Discuss the ethical and social implications of AI, including issues such as privacy, algorithmic discrimination and employment automation.

List concepts covered in this session

- Definition and types of Artificial Intelligence.
- Practical applications of AI in everyday life and in various sectors.
- AI algorithms and techniques, such as machine learning, neural networks, etc.
- AI ethics and social considerations. Future challenges and opportunities in the field of AI.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Other / Complementary Documentation: Machine Learning vs Deep Learning (Youtube)

Other / Complementary Documentation: Supervised vs. Unsupervised Learning (Youtube)

Technical note & tutorials: Types of Algorithms (ENT020208-U-ENG-VID)

SESSION 5 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): The Anthropocene and Innovation

Learning Objectives: Clear understanding of what it means to design something.

Concepts to be covered in Course: Artefact, The Built Environment, Design and Design Thinking

Robotics and Aerial Surveillance

Description of the session

In this session, we will delve into the impact of robotics and aerial surveillance on data collection and target surveillance, exploring how these technologies are revolutionising traditional methods of intelligence gathering and providing an unprecedented perspective on homeland security. We will look in detail at how drones and other robotic systems are being used to conduct surveillance, reconnaissance and data collection missions in remote or hard-to-reach environments, as well as in urban and critical areas.

Learning objectives for the session

- Understand the role of robotics and aerial surveillance in data collection and target surveillance.
- Explore the applications of drones and other robotic systems in intelligence and security missions.
- Analyse the challenges and opportunities associated with the use of aerial surveillance technologies.

- Discuss the ethical and legal implications of aerial surveillance in society.

List concepts covered in this session

- Introduction to robotics and aerial surveillance.
- Types of drones and robotic systems used in surveillance.
- Applications of aerial surveillance in civilian and military environments.
- Technical and operational challenges of aerial surveillance.
- Impact of aerial surveillance on privacy and civil rights.
- Strategies to mitigate risks associated with aerial surveillance.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Unmanned Aerial Vehicles for Civil Applications: A Review (MDPI)

Article: Robotic Vision for Human-Robot Interaction and Collaboration: A Survey and Systematic Review (Transactions on Human-Robot Interaction, Vol. 12, No. 1, Article 12, 2023) (ACM)

Article: Societal acceptance of urban drones: A scoping literature review (Technology in Society 75, 2023) (Elsevier)

SESSION 6 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): Design, Animism, Magic, and the Cargo Cults

Learning Objectives: Familiarising with subject matter, Clear understanding of course requirements

Concepts to be covered in Course: Animism, Magical Thinking, Cargo Cults, Fetichism

Generative AI and Content Automation

Description of the session

In this session, we will see what is Generative AI, the main tools, etc We will explore how generative AI is transforming the production of information and content and how can be used in the national intelligence.

Learning objectives for the session

- Understand the basic concepts of Generative Artificial Intelligence (AI) and Content Automation.
- Explore the practical applications of generative AI in the creation of visual, auditory and textual content.
- Analyse examples of the use of generative AI in the national intelligence.
- Discuss the ethical and social implications of content automation and generative AI.

List concepts covered in this session

- Definition and principles of Generative Artificial Intelligence.
- Techniques and algorithms used in content generation by AI, such as GANs, recurrent neural networks, among others.
- Practical applications of generative AI in the creation of audiovisual content, generative text,

etc. and the use by national intelligence.

- Outstanding examples of generative AI projects and applications.
- Discussion of ethical challenges and concerns related to content automation and generative AI.

PRACTICE

Using prompts to get useful insights in national security.

Article: Generative AI: A New Frontier in Artificial Intelligence (Deloitte)

Other / Complementary Documentation: Introduction to Generative AI (Google; Youtube)

Other / Complementary Documentation: Algorithmic Bias and Fairness (Crash Course; Youtube)

SESSION 7 (LIVE IN-PERSON)

Description (Theory): The Grip of Marketing, the “Holy Trinity of Design”

Learning Objectives: Clear understanding of Supply and Demand and how Marketing can skew them

Concepts to be covered in Course: Marketing, Satisfactoriness, Need and Want, Novelty, Beauty, and Convenience

XR. Extended Reality

Description of the session

Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR): Exploring how AR, VR and MR are being used in intelligence and security applications, enabling visualisation of complex data, simulation of security scenarios, training of personnel, remote surveillance and collaboration in virtual environments.

Learning objectives for the session

- Understand the concepts of augmented reality, virtual reality and mixed reality.
- Explore the applications of AR, VR and MR in the field of intelligence and security.
- Become familiar with the technologies and devices used in AR, VR and MR by immersing in this virtual ecosystem.
- Analyse how these technologies can enhance data visualisation and simulation of security scenarios.
- Discuss the challenges and ethical considerations in the use of AR, VR and RM in security applications.

List concepts covered in this session

- Definition and differences between augmented reality, virtual reality and mixed reality.
- Applications of AR, VR and MR in intelligence and security, such as remote surveillance, scenario simulation, personnel training, etc.
- Technologies and devices used in AR, VR and MR, such as virtual reality glasses, augmented reality viewers, etc.
- Examples of XR use cases in security and defence applications.
- Challenges and ethical considerations in the use of these technologies.

PRACTICE

We will use the IE Metaverse platform to take an important decision in our role inside this virtual environment with an immersive experience.

Article: Use of virtual reality simulators for training programs in the areas of security and defense: a systematic review (Multimedia Tools and Applications (2020) 79: 3495–3515) (CED)

Article: No pain, no gain? The effects of adding a pain stimulus in virtual training for police officers

(Taylor&Francis)

SESSION 8 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Theory): Systemic Thinking, The Circular Economy, Applied Ethics

Learning Objectives: Clear understanding of what needs to change in our production and consumption.

Concepts to be covered in Course: Sustainability, The Doughnut Economy, Circular Design

Blockchain

Description of the session

In this session, we will discuss on blockchain technology and its impact on information security, along with cryptocurrencies and their role in financial transactions.

Learning objectives for the session

- Understand the fundamental concepts of blockchain technology and how it works.
- Analyse the impact of blockchain technology on information security and data management.
- Explore the applications of blockchain in different sectors.
- Study the characteristics and operation of cryptocurrencies, such as Bitcoin and Ethereum.
- Assess the risks and challenges associated with the use of cryptocurrencies in financial transactions.

List concepts covered in this session

- Blockchain technology: definition, characteristics and operation.
- Types of blockchains: public, private and consortium.
- Applications of blockchain in information security and data management.
- Cryptocurrencies: characteristics, operation and types.
- Blockchain use cases in different industries.
- Security and privacy in financial transactions with cryptocurrencies.

PRACTICE

In this session, we will create our own crypto wallet to understand better how a Blockchain is.

Technical note & tutorials: Moving Forward: The Blockchain Opportunity (IST020192-U-ENG-VID)

Technical note & tutorials: Cryptocurrencies and Bitcoin (IST020387-U-ENG-VID)

SESSION 9 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Research): Quantitative and Qualitative User Research, Secondary Literature

Learning Objectives: Clear understanding of how to collect data

Concepts to be covered in Course: Desktop Research, Ethnography

Cybersecurity

Description of the session

In the session dedicated to Cyber Security, we will delve into the analysis of the growing cyber threats facing governments and organisations today, from ransomware and phishing attacks to sophisticated intrusions backed by state actors and hacker groups. We will explore in detail the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and information systems, as well as the motivations behind these attacks, ranging from data theft and extortion to sabotage and interference in government operations.

Learning objectives for the session

- Understand the current cyber threats facing governments and organisations.
- Become familiar with the different forms of cyber attacks, such as ransomware, phishing and intrusions.
- Understand the tactics, techniques and procedures used by cybercriminals to compromise the security of networks and systems.
- Analyse the motivations behind cyber attacks and their potential impacts.
- Explore strategies and best practices to mitigate and prevent cyber attacks.

List concepts covered in this session

- Types of cyber threats: ransomware, phishing, state-sponsored intruders, etc.
- Tactics, techniques and procedures (TTPs) used by cybercriminals.
- Motivations behind cyber attacks.
- Impact of cyber attacks on the security and functioning of organisations.
- Strategies for mitigating and preventing cyber attacks.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Technical note & tutorials: Cybersecurity: Protecting your Digital Self (IST020120-U-ENG-VID)

Technical note & tutorials: Cybersecurity: The risk of Data and Algorithms (IST020268-U-ENG-VID)

SESSION 10 (ASYNCHRONOUS)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Research): Deciding on real research matter. Application of different Research methods

Learning Objectives: Clear understanding of the employment of research

Concepts to be covered in Course: Interviews, Focus Groups, Cultural Probes

Biometrics and Facial Recognition

In this session, we will explore biometric techniques and their use in the identification of individuals, with a special focus on facial recognition. Students will learn about the principles behind biometrics, how biometric data is collected and used, and the current and potential uses of facial recognition technology in various fields.

Description of the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

Learning objectives for the session

- Understand the fundamental concepts of biometrics and facial recognition.
- Explore the different methods used in the capture and analysis of biometric data.
- Analyse the benefits and ethical challenges associated with the use of facial recognition technology.
- Examine practical applications of facial recognition in areas such as security, commerce, healthcare, etc.

List concepts covered in this session

- Definition and principles of biometrics.
- Types of biometric features: facial, fingerprint, iris, voice, etc.
- Processes for capturing and analysing biometric data.
- Algorithms and techniques used in facial recognition.
- Current and potential uses of facial recognition in society.
- Ethical and privacy considerations in the use of biometric technology.

PRACTICE

Analysis of the accuracy of face recognition using an online tool.

Article: Facial Recognition Technology: A Survey of Policy and Implementation Issues (Center for Catastrophe Preparedness and Response, New York University, 2009) (CED)

Article: The ethical application of biometric facial recognition technology (AI & SOCIETY (2022) 37:167–175) (Springer)

SESSION 11 (LIVE IN-PERSON)

Sustainability Topics:

- Environment
- Governance
- Social Challenge
- Economic Development

Description (Application): Introduction to Design Thinking

Learning Objectives: Clear understanding of “Double Diamond Design Process”

Concepts to be covered in Course: Induction/Deduction/Abduction, Divergence/Convergence

Open Source Intelligence

Description of the session

In this session, we will explore the importance of Open Source Information in Intelligence (OSINT), looking at how it is used in intelligence and security information gathering. We will delve into the key concepts of OSINT and examine how it can be effectively applied in the collection, analysis and use of information to support intelligence and security operations.

Learning objectives for the session

- Understand the concept of Open Source Information in Intelligence (OSINT) and its importance in intelligence gathering.
- Become familiar with the different types of open sources available and how to access them.
- Explore the techniques and tools used in OSINT collection.
- Analyse OSINT use cases in intelligence and security operations.

List concepts covered in this session

- Definition and scope of Open Source Information in Intelligence (OSINT).
- Types of open sources, including social media, public databases, government websites, etc.
- OSINT search and collection techniques, such as advanced search engine searching, web scraping, social network analysis, etc.
- Common tools used in OSINT collection and analysis.
- OSINT use cases in intelligence and security, including threat detection, risk assessment, incident investigation, etc.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Open source intelligence (crowdstrike.com)

Article: A quantitative study of the law enforcement in using open source intelligence techniques through undergraduate practical training (Forensic Science International: Digital Investigation 47 (2023) (CED)

SESSION 12 (LIVE IN-PERSON)

Description (Application): Consulting with Students on their projects

Learning Objectives: Clear understanding of empathetic research

Concepts to be covered in Course: Empathy, Closed/Open Questions, Empathy Maps, Content Analysis

Emerging Technologies and National Security

Description of the session

In this session, we will explore emerging technologies and their impact on national security. We will discuss future trends in technology and how they may affect a country's security. We will analyse how innovations in areas such as artificial intelligence, quantum computing, biotechnology, cybersecurity and robotics can transform national security and geopolitical landscapes.

Learning objectives for the session

- Identify the most relevant emerging technologies and their potential impact on national security.
- Understand how technological trends can influence national security policy-making.
- Analyse the challenges and opportunities posed by new technologies for national security.
- Explore case studies and concrete examples that illustrate the use of emerging technologies in the field of homeland security.

List concepts covered in this session

- Future trends in technology and their relevance to national security.
- Potential of quantum computing for cryptography and cyber security.
- Biotechnology applications in defence and health security.
- Ethical and legal challenges associated with the use of emerging technologies in national security.

- Mitigation and response strategies to address emerging threats.

IN-CLASS QUIZ

In the last 5 minutes of the class, we will run a quiz related to the concepts explained during the session.

Article: Quantum technologies in defence & security (NATO)

SESSION 13 (LIVE IN-PERSON)

Description (Final Exam): 19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

Resilience and Adaptive Governance

Description of the session

In this session, we will explore the principles of resilience and adaptive governance in homeland security. We will look at how organisations and governments can develop resilient capacities to cope with and recover from crises and threats in the national security domain. We will also examine adaptive governance approaches, which involve the ability to adapt and respond effectively to complex and changing environments.

Learning objectives for the session

- Understand the concept of resilience in the context of national security.
- Explore the key principles and components of organisational and governmental resilience.
- Analyse case studies and examples of crises and threats in homeland security and how they were addressed through resilient approaches.
- Become familiar with the principles of adaptive governance and their application in homeland security environments.
- Reflect on the importance of collaboration and coordination between different actors in building resilience and adaptive governance.

List concepts covered in this session

- Definition of resilience and its components.
- Examples of crises and threats in national security.
- Principles of organisational and governmental resilience.
- Adaptive governance approaches and their application in homeland security. Importance of collaboration and coordination in building resilience.

FINAL EXAM (25%)

19 question-multiple choice + 1 open, critical-thinking/analytical question with max 400 word response.

Article: Governance for Resilience: How Can States Prepare for the Next Crisis? (Carnegie)

SESSIONS 14 - 15 (LIVE IN-PERSON)

Description: Presentation of Project

Learning Objectives: Clear explanation and presentation of projects

Group Work Presentation

Simulation of a national security scenario in which students take on specific roles, such as intelligence analysts, cyber security officers, political leaders, etc. We will use the Space and Cyber Affairs Game (SpaceGov). During the game, students will face collective action problems related to two very important challenges: space governance and cyber warfare.

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Individual work	55 %		2 reflections (10%), individual assignments (20%), final exam (25%)
Group Work	30 %		Intermediate deliverables and Final Presentation (20%) + Self and Peer Review (10%)
Class Participation	15 %		10% 5 graded pre-class work reading or video preparation. 5% Overall in-class participation (does not include attendance).

RE-SIT / RE-TAKE POLICY

BIBLIOGRAPHY

Recommended

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- Donald A Norman. (2007). *Emotional design : why we love (or hate) everyday things*. Basic Books. ISBN 9781280598562 (Digital)
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- Michael Leube. (2024). *The Future Designer. Anthropology meets Innovation in Search of Sustainable Design*. Routledge. ISBN 9781003464 (Digital)
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BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may

provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

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