

Course guide

320094 - TAS - Environmental Technologies and Sustainability

Last modified: 04/07/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 124 - CUS - UNESCO Sustainability Chair.
713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: ESCALAS CAÑELLAS, ANTONI
VALENTINA BUSCIO OLIVERA

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE25-ESAUD. Ability to create, encode, manage, disseminate, and distribute multimedia content, taking into account criteria of usability and accessibility of audiovisual, broadcasting, and interactive services. (Specific Technology Module: Sound and Image)

Generical:

CG03-ESAUD. Knowledge of basic subjects and technologies, which enables learning of new methods and technologies, as well as providing great versatility to adapt to new situations.

CG04-ESAUD. Ability to solve problems with initiative, decision-making, creativity, and to communicate and transmit knowledge, skills, and abilities, understanding the ethical and professional responsibility of the Technical Telecommunications Engineer's activity.

CG05-ESAUD. Knowledge for the realization of measurements, calculations, valuations, appraisals, expert opinions, studies, reports, task planning, and other similar work in their specific field of telecommunications.

CG07-ESAUD. Ability to analyze and evaluate the social and environmental impact of technical solutions.

Transversal:

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

Basic:

CB3. That students have the ability to gather and interpret relevant data (typically within their field of study) to make judgments that include reflection on socially, scientifically, or ethically relevant issues.

TEACHING METHODOLOGY

- Face-to-face lecture sessions.
- Face-to-face practical work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.

There will be three types of practical work sessions:

- a) Sessions in which the lecturer provides students with guidelines for analysing data and solving problems using techniques, concepts and theoretical results.
- b) Sessions in which students present group work.
- c) Examination sessions

Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set, whether manually or with the help of a computer.

LEARNING OBJECTIVES OF THE SUBJECT

.The subject is divided into two parts: sustainability and environmental technologies. The aim of the first part is to present the basic principles and fundamentals of the sustainable development paradigm, the factors that have led to the unsustainability of today's society, the current state of the world, and development models and policies from a systemic perspective and considering the logic of complexity. They will become familiar with the mechanisms underlying different economic models and the implications for, and influence on, business administration. The aim of the second part, in which students will already be familiar with the principles of sustainability, is to describe the main environmental technologies (water, energy, waste and air pollution management), the environmental management and assessment technologies that can contribute to a sustainable society, and the environmental technology that is best suited to each situation.

STUDY LOAD

Type	Hours	Percentage
Hours large group	15,0	10.00
Hours medium group	30,0	20.00
Self study	105,0	70.00

Total learning time: 150 h

CONTENTS

TOPIC 1: STATE OF THE WORLD

Description:

- 1.1. Carrying capacity.
- 1.2. Population.
- 1.3. Economy, inequalities and social impacts.
- 1.4. Impacts of human activity. Ecological footprint

Specific objectives:

For students to:

- Understand the concept of carrying capacity and its influencing factors, as applied to humankind.
- Understand the evolution of the world's population in terms of volume, and also disaggregated into regions or rural and urban areas. Understand how the demographic transition model enables the data to be interpreted.
- Understand the bases of the economic model of growth and its quantitative evolution. Understand economic and social imbalances on a worldwide scale and analyse their main consequences and causes.
- Understand the basic resources used and the main forms of waste generated by human activity, as well as the resulting environmental impacts. Analyse the relationship between these impacts and the development model. Become familiar with indicators of these impacts, such as the ecological footprint.

Related activities:

P0: Presentation of the activities

P01: CIRCULAR ECONOMY

Related competencies :

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 11h

Theory classes: 2h

Practical classes: 2h

Self study : 7h

TOPIC 2: CAUSES OF UNSUSTAINABILITY

Description:

- 2.1. A problematic model.
- 2.2. The Copernican revolution and mechanism.
- 2.3. Utilitarianism, anthropocentrism and technocracy.
- 2.4. The sacrifice of equity.
- 2.5. The prisoner's dilemma.
- 2.6. The example of Easter Island.

Specific objectives:

- Understand that "reality" is a relative concept that is interpreted and constructed differently in each cultural context.
- Understand the foundations of our worldview, especially the elements that underlie the current unsustainability.

Related activities:

P03: INDIVIDUAL CARBON FOOTPRINT

Related competencies :

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 10h

Theory classes: 1h

Practical classes: 2h

Self study : 7h

TOPIC 3: THE SUSTAINABILITY PARADIGM

Description:

- 3.1. Historical background.
- 3.2. Introduction to the concept of sustainable development. Discussion.
- 3.3. World summits and institutional initiatives.
- 3.4. The equation $I = P \cdot C \cdot T$.
- 3.5. The capital-based approach. Strong and weak sustainability.
- 3.6. The principles of sustainability.

Specific objectives:

For students to:

- Understand the historical background to the concept of sustainable development.
- Become familiar with different perspectives on the concept of sustainable development.

Related activities:

P03: ECOLOGICAL FOOTPRINT COUNTRIES

Related competencies :

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 10h

Theory classes: 1h

Practical classes: 2h

Self study : 7h

TOPIC 4: DEVELOPMENT MODELS

Description:

4.1. The various aspects of development:

4.1.1. The origin of the concept of development.

4.1.2. The various aspects of development.

4.1.3. Development as a complex dynamic phenomenon.

4.2. Human development and well-being:

4.2.1. Oikonomia and chrematistics: the emergence of the modern free-market model.

4.2.2. Fake goods: the crises of modern sustainability.

4.2.3. Needs and development.

4.2.4. Criticism of political ecology: the welcoming society and post-industrial utopias.

4.2.5. Human-scale development.

4.2.6. The capability approach and the UNDP's human development proposal.

4.2.7. Alternative models of human development.

Specific objectives:

For students to:

- Understand development as a multifaceted phenomenon comprising social, cultural, political, economic, institutional, technological, environmental and ecological aspects.
- Understand the interdependence between these dimensions and their conditioning factors.
- Understand the role of technology, engineering and cooperation in global change.
- Understand the concept of human development and well-being.
- Understand the main proposals of human development models: political ecology proposals, the model of human-scale development, and the human development of the UNDP.

Related activities:

P04: DIFFERENT SOCIETY

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 12h

Theory classes: 1h

Practical classes: 2h

Self study : 9h

TOPIC 5: UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

Description:

- 5.1. UN Agenda 2030
- 5.2. Origin of the UN SDGs
- 5.3. How and who agreed to the UN SDGs
- 5.4. What are the SDGs and what do they entail
- 5.5. How to implement the ODS in our reality
- 5.6. Commitments in SDGs in Europe, Spain and Catalonia

Specific objectives:

- Know the spheres and the different objectives
- Know basic questions about each objective: current situation, basic goals, some examples
- How they relate to our social / economic / industrial reality
- Understand historical globalism theory and some of the new global governance proposals that have arisen in this context.

Related activities:

P05: SUSTAINABLE DEVELOPMENT GOALS

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 10h

Theory classes: 1h

Practical classes: 2h

Self study : 7h

TOPIC 6: CLIMATE CHANGE

Description:

- 6.1. Introduction. Climate change science.
- 6.2. Physical effects of climate change
- 6.3. Social impacts of climate change: relationship of impacts with poverty, refugees, gender
- 6.4. Climate change mitigation. UNFCCC, Kyoto, Paris. Energy transition. Future scenarios.
- 6.5. Adaptation to climate change

Specific objectives:

- Understand basically the climate of the Earth and the causes and measure of anthropogenic climate change
- Know the physical changes caused by climate change (warming, extreme weather, melting ice, sea level rise)
- Understand the social impacts, especially in what the unequal impacts in different social centers
- Understand the magnitude of mitigation needs, ongoing international efforts and their strengths and weaknesses

Related activities:

P06. CLIMATE CHANGE

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 10h

Theory classes: 2h

Practical classes: 2h

Self study : 6h

TOPIC 7: ENERGY

Description:

- 7.1. Introduction and basic concepts, primary and final energies, current energy sources
- 7.2. Fossil fuels: types, characteristics, problems
- 7.3. Nuclear energy
- 7.4. Renewable energies
- 7.6. Energy efficiency
- 7.7. Energy future; conventional projections
- 7.8. Energy future: energy transition, scenarios compatible with the Paris Agreement
- 7.9. Conclusions

Specific objectives:

- Ability to identify the problems associated with the current energy model, in relation to emissions, and to the future depletion of fossil reserves.
- Ability to understand the relationship between the current energy model and the environmental problems it generates.
- Understand how climate change mitigation requires an effective energy transition to renewable sources and obstacles
- Know the main obstacles to the energy transition

Related activities:

P07: ENERGY

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 10h

Theory classes: 1h

Practical classes: 2h

Self study : 7h

TOPIC 8: WATER MANAGEMENT

Description:

- 8.1. Water resources.
- 8.2. Uses of water. Sources of pollution.
- 8.3. Sustainability indicators: environmental and socioeconomic.
- 8.4. Overview of the main water-treatment technologies. Water treatment. Water softening. Water purification.
- 8.5. Demand management.

Specific objectives:

For students to:

- Identify and understand the environmental significance of the main indicators of water quality.
- Identify the main treatments applied in order to soften and purify water and make it potable.

Related activities:

P08: LLOBREGAT RIVER

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 11h

Theory classes: 1h

Practical classes: 2h

Self study : 8h

TOPIC : AIR POLLUTION

Description:

- 9.1. Atmosphere.
- 9.2. Main air pollutants and emission sources.
- 9.3. The effects of pollution.
- 9.4. Air-quality indicators (ICQA).
- 9.5. Description of the main elimination-treatment technologies and gaseous pollutants.

Specific objectives:

For students to:

- Identify the main air pollutants and emission sources.
- Determine air-quality indices.
- Describe the main treatment technologies for eliminating particles and gaseous pollutants.

Related activities:

P09: EMISSIONS AND SOURCES OF POLLUTION

P11: DISPERSION OF POLLUTANTS

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 27h

Theory classes: 2h

Practical classes: 4h

Self study : 21h

TOPIC 10: WASTE MANAGEMENT

Description:

- 10.1. Generation of waste (municipal, industrial).
- 10.2. Management and technology for assessing/processing municipal waste.
- 10.3. Management and technology for assessing/processing industrial waste.

Specific objectives:

For students to:

Identify the main management models and technologies for assessing/treating municipal and industrial waste.

Related activities:

P10: WASTE MANAGEMENT

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 9h

Theory classes: 1h

Practical classes: 2h

Self study : 6h

TOPIC 11: ENVIRONMENTAL MANAGEMENT TOOLS

Description:

- 11.1. Environmental impacts of technology, industry, services and infrastructure.
- 11.2. Environmental management:
 - 11.2.1. Environmental audits.
 - 11.2.2. Environmental impact assessments.
 - 11.2.3. Environmental management systems.
 - 11.2.4. Lifecycle analysis.
 - 11.2.5. Eco-design.
 - 11.2.6. Eco-labelling.
 - 11.2.7. Industrial ecology, clean technologies and best available technologies.

Specific objectives:

For students to:

- Identify and understand the environmental impacts of any sort of activity.
- Determine and understand where the various environmental management tools should be applied in order to reduce the impacts of an activity. Understand the advantages of making environmental management an integral part of an activity.
- Understand, identify and assess the application of clean technologies and best available technologies in an activity.

Related activities:

P12: ECODESIGN PROJECT

Related competencies :

CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 30h

Theory classes: 2h

Practical classes: 8h

Self study : 20h

GRADING SYSTEM

Oral or written tests: 60%
- 1st bimester, weight: 30%
- 2nd bimester, weight: 30%
Practical work: 40%

Obligation to carry out the practices

In accordance with section 3.1.3 of the General Academic Regulations, it has been established in this course that completing the practical assignments and submitting the corresponding reports is a necessary condition to pass the course. This condition will apply to students who, without justification at the discretion of the faculty, have not completed at least 75% of the practical assignments, including report submissions.

Redirection of unsatisfactory assessment results:

- A resit examination will be done for the mid-term exam, in application of the ESEIAAT regulations for redirection of unsatisfactory assessments results
- . This resit examination will consist of a "redirection exam" having the same format and the same base of contents as the mid-term exam.
- This "redirection exam" will take place at the same classroom, day and time assigned to the final exam, i.e., the student taking the resit exam will have 3 hours to do the final exam (2n bimester exam) and the "redirection exam".
- Who will have the right to take the "redirection exam"? For the course groups mentioned above, the students that, having a mark less than 5.0 in the mid-term exam, place a request for the "redirection exam". This request will be placed to the professor responsible for his or her course group, under the terms and deadline set by the professor.
- The mark of the "redirection exam" will replace the mark of the mid-term exam as far as the mark of the "redirection exam" is greater than the mark of the mid-term exam.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

BIBLIOGRAPHY

Basic:

- Novo, María. El desarrollo sostenible: su dimensión ambiental y educativa. Madrid: Pearson Educación, 2006. ISBN 9788483223550.
- Orozco, Carmen. Contaminación ambiental: una visión desde la química. Madrid: International Thomson, 2003. ISBN 8497321782.
- Sawyer, Clair N. Química para ingeniería ambiental. 4a ed. Bogotá: McGraw-Hill, 2001. ISBN 9584101641.
- Tchobanoglous, George. Gestión integral de residuos sólidos. Madrid: McGraw-Hill, 1994. ISBN 8448118308.
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- García Rodríguez, A. La contaminación acústica: fuentes, evaluación, efectos y control. Madrid: Sociedad Española de Acústica, 2006. ISBN 8487985106.
- Max-Neef, Manfred A. Desarrollo a escala humana: conceptos, aplicaciones y algunas reflexiones. Montevideo: Nordan Comunidad, 1993. ISBN 9974420059.
- Morin, Edgar. "Complejidad restringida, complejidad general". Sostenible? [on line]. Núm. 9 (2007), p. 23-49 [Consultation: 14/05/2020]. Available on: <http://hdl.handle.net/2099/3883>.
- Masters, Gilbert M. Introducción a la ingeniería medioambiental [on line]. 3a ed. Madrid: Prentice-Hall, 2008 [Consultation: 20/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=3884. ISBN 9788483224441.
- Wark, Kenneth. Contaminación del aire: origen y control. México: Limusa, 1990. ISBN 9681819543.
- Masoliver, Dolors. Guía práctica para la implantación de un sistema de gestión ambiental. Barcelona: Departament de Medi Ambient, 2000. ISBN 8439353057.

Complementary:

- Campos electromagnéticos, salud pública y laboral: ponencias y materiales de las Jornadas sobre Contaminación Electromagnética y Salud Pública celebradas los 10 y 11 de diciembre de 2002 en Madrid. Madrid: Unión Sindical de Madrid Región, 2003. ISBN 8497210786.

- Fullana i Palmer, P. Anàlisi del ciclo de vida. Barcelona: Rubes, 1997. ISBN 8449700701.
- Rieradevall, Joan. Ecodisseny i ecoproductes. Barcelona: Departament de Medi Ambient, 1999. ISBN 8439349920.
- Stahel, Andri. "Las necesidades humanas y la (re)producción de la pobreza por el desarrollo económico moderno". Ecología política: cuadernos de debate internacional. Núm. 23, p. 141-151.
- Stahel, A.; Cano, M.; Cendra, J. "Oikonomía vs. crematística: base de las contradicciones del desarrollo moderno". Sostenible? [on line]. Núm. 7 (2005), p. 47-71 [Consultation: 14/05/2020]. Available on: <http://hdl.handle.net/2099/1805>.
- Stahel, A.; Cano, M.; Cendra, J. "Desarrollos sostenibles". Sostenible? [on line]. Núm. 7 (2005), p. 73-91 [Consultation: 14/05/2020]. Available on: <http://hdl.handle.net/2099/1806>.
- Fullana i Palmer, P. Anàlisi del ciclo de vida. Barcelona: Rubes, 1997. ISBN 8449700701.
- Programa de las Naciones Unidas para el Desarrollo. Informe sobre desarrollo humano 2006: más allá de la escasez: poder, pobreza y la crisis mundial del agua [on line]. Madrid: CIDEAL, 2006 [Consultation: 08/03/2023]. Available on: <https://hdr.undp.org/system/files/documents/hdr2006escompletopdf.pdf>.
- Water in a changing world. Paris: UNESCO, 2009. ISBN 9789231040955.

RESOURCES

Other resources:

Tecnologia i Sostenibilitat. <https://tecnologiaisostenibilitat.cus.upc.edu>