DIM-SAP-246 Sustainable Engineering Principles

SEMESTER: Summer

CREDITS: 4.5 ECTS

LANGUAGE: English

DEGREES: SAPIENS program

Course overview

This course is an introduction to the sustainable development applied to environmental technology and renewable energies. It includes an overview of environmental issues such as air pollution, greenhouse gases, carbon footprint and water pollution. We will study water purification (WPP) and the wastewater treatment plants (WWTP). Finally, we will learn the basic principles of renewable energies systems. During the course, tools such as mass and energy balances, life cycle assessment and environmental management systems will be used.

Prerequisites

Having passed a first year of Bachelor degree in Engineering

Course contents

Theory:

1. Introduction and basic concepts. Ecology. Ecotoxicity. Industrial ecology. Definitions of sustainability. The challenges of sustainability. Limits to growth. Overconsumption.
2. Measurement of sustainability. Interpretations of sustainability. Is sustainability possible? Indicators of sustainability. Examples of commonly used indicators. Ecological footprint. Instruments for sustainability. General criteria. Sustainability rules and policies. Corporate sustainability. Evaluation of social capital.
3. Mass and energy balances. Environmental impact assessment /Strategic Environmental Assessment. Life Cycle Analysis. Cost-benefit analysis.
4. Environmental technology. Air: parts of the atmosphere, pollution measure and control, greenhouse gases, carbon footprint, carbon capture and storage. Climate change. Health risks
5. Environmental technology. Water: hydrology and hydrogeology, quality, purification (WPP) and wastewater treatment plants (WWTP).
6. Environmental technology. Soil: Soil features and pollution. Natural resources management. Solid waste management.

7. Renewable energy: Energy resources. Hydraulic. Solar thermal and photovoltaic. Wind. Biomass. Geothermal energy. Energy from municipal solid waste. Biofuels. Other renewable energies. Storage. Energy efficiency.

Laboratory:

There will be four 2-hour sessions in the second lecture week.

P1. Gaussian dispersion of pollutants
P2. Raw Water Analysis.
P3. Waste Water Analysis
P4. Visit to a municipal solid waste treatment plant (plus other field visits)

Textbooks

- Boyle, G. (2012). *Renewable Energy: Power for a Sustainable Future*. 3rd Edition. Oxford University Press.
- Davis, M. L., & Masten, S. J. (2004). *Principles of environmental engineering and science.* McGraw-Hill.
- Henry, J. G., & Heinke, G. W. (1996). *Environmental science and engineering*. 2nd Edition. Prentice Hall.
- Mulder, K. (ed) (2006). *Sustainable development for engineers.* Greenleaf Publishing.
- Rogers, P.P., K.F. Jalal, J.A. Boyd (2007). *Introduction to sustainable development*. Earthscan Publications.
- Wengenmayr, R. & Bührke, T. (Eds.) (2012). *Renewable Energy: Sustainable Energy Concepts for the Energy Change.* 2nd Edition. Wiley.

Grading

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.
- A minimum grade in the final exam of 4 over 10.

The overall grade is obtained as follows:

- Lab work (15%)
- Student's presentations/essay (15%)
- Intermediate exam (20%)
- Final exam (40%)

The extraordinary exam accounts for 80-90% (with 10-20% being the average of continuous evaluation)