Course Syllabus

International Study Program 2025:
Sustainability and Innovation in Engineering and Environmental Planning

Course 1: Special Topics in Engineering and Environmental Planning

Program description

The intensive, interdisciplinary International Study Program explores the topic of “Sustainability and Innovation in Engineering and Environmental Planning”. The program consists of three parts. Course 1 surveys recent technological developments in four smaller units dedicated to different research areas: Energy, E-Mobility, Agriculture and Materials. In Course 2, students complete a hands-on workshop on methods of innovation. The accompanying cultural module “Living Society” contextualizes the innovation trends explored in Courses 1 and 2 in terms of German culture and history.

Through lab and project work, theoretical input, discussion and company visits, students gain a comprehensive view of innovation processes which transcend disciplinary borders and deepen their understanding of the role and scope of their own discipline therein. The program is designed for students from various engineering and planning fields. In this international program, visiting and local students participate together, enabling intercultural exchange and offering an unforgettable experience abroad.

Course content

- Unit 1: Energy
  The course provides a detailed insight into Germany’s “Energiewende,” both on a global and on a regional scale. The unit gives an overview of basic theory and the potential of key renewable energy technologies. The specific focus is on the region Osnabrück-Steinfurt, which aims to fulfill very ambitious environmental goals. Based on the City of Osnabrück and two neighboring rural regions, political framework, change management, and technology mix are discussed, including a site visit to the bioenergy park in Saerbeck.

- Unit 2: E-Mobility
  The course provides insight into new concepts in electric vehicle design, regenerative energy for e-mobility, traffic management, autonomous driving and the change of mobility concepts. Special focus is put on electric car concepts, battery design, charging technologies, regenerative energy for e-mobility / local smart grids as well as sensor technologies, car-to-car and car-to-infrastructure communication and data analysis and computer vison with regard to autonomous driving.

- Unit 3: Technological Innovations in Agriculture
  The course focuses on digital technologies in agriculture as the most dominant state-of-the-art innovations. The supporting tools open sustainable process options, combining economical, ecological and social aspects in order to solve present and future, global and local challenges. Participants will learn about innovative agricultural technologies in a digital transformation, exploring their strengths and opportunities, as well as weaknesses and threats.

- Unit 4: Materials
  The course provides an introduction to innovation and sustainability aspects in materials engineering. Special focus is placed on (i) iron and steel production in Germany (in particular, the Osnabrück and the Ruhr area), (ii) life cycle analysis of engineering alloys, (iii) polymer materials including biopolymers and (iv) aspects of recycling. Two field trips (steel plant and recycling plant) as well as practical lab work (polymer processing and analytics) are further important components of the unit.

Competence goals

Students, who have successfully completed the course, have a basic understanding of renewable energy technologies, iron and steel production, postindustrial site development, e-mobility, autonomous driving, innovative agricultural technologies in a digital transformation process and polymer technology. Furthermore, they are able to discuss current research and developments with regard to innovation and sustainability within these fields in oral and written form.

Methods

Lectures, Lab work, Plant tours, Field trips

Prerequisites

Basic understanding of materials science and engineering, energy technologies and electrical engineering

Lecturers

Unit 1: Eck, Kuhnke
Unit 2: Tönjes, Pfisterer
Unit 3: Tba
Unit 4: Mola

Literature for Further Reading

- W.D. Callister Jr.: Materials Science and Engineering – An Introduction, Wiley 2002
- Ehrenstein, Polymeric Materials, Hanser-Verlag
- Further literature will be provided during the units.

Exam and grading

The basis for grading is as follows:

- Digital Study Journal (80 %)
- Additional interdisciplinary assessed assignment in the course of the program (20%)

Prerequisite for grading is an individual active participation and engagement with course content.

Duration

6 weeks (May-June)

Frequency

Yearly

Course Language

English