UNIVERSITY OF LJUBLJANA
Faculty of Mechanical Engineering

Energy Conversion Systems (6003-M) 5 ECTS

Lecturer: **M. Sekavčnik, M. Mori**

Lectures: 30h | Tutorials: 12h | Labs: 18h | Project: 0h | Lang. :

Objectives

- Use and integration of basic and applied energy knowledge to model energy and mass flows in complex energy systems.
- Implementation of methods for thermodynamic analysis and optimization of thermodynamic cycles to determine irreversibilities within the energy conversion chain.
- Use and development of new knowledge to design appropriate/sustainable technological solutions and concepts for modern power and heat supply.
- Evaluation of broader aspects of energy supply transformation.

Programme

The scope of the course »Energy Conversion Systems« is to provide a broad knowledge in energy supply (electricity and heat) for modern society from a) socio-economic (understanding the big picture) and b) technological (structure of primary energy sources, grid balancing, technologies available) aspects. From the understanding of the big picture of energy supply of society, which has been transformed in the direction of sustainable solutions (RES, circular economy, sectoral coupling, digitalization), individual lectures address relevant topics (theoretical and practical) so that students can critically evaluate various technological solutions in terms of a) environmental indicators, b) energy efficiency and c) basic economic feasibility. In addition to the large-scale discussion, the content covers: theoretical concepts of thermodynamic cycles their thermodynamic optimization and applications, classical thermal power plants (steam, gas, combined, ORC, CHP…), hydroelectric power plants, integration of distributed energy sources (PV- and wind power plants) into the electricity grids, hydrogen technologies, P2X, energy storage concepts, power balancing, smart grids and virtual power plants.

Prerequisites

Meeting the enrolment conditions for the Master's study programme of Mechanical Engineering - Research and Development program.

Learning outcomes

After attending this course, the student will:

- Have thorough theoretical, methodological and analytical knowledge with elements of a research work that form a basis for very demanding professional work
- Master very demanding and complex work processes and methodological tools in specialised professional fields.
- Be able of planning and managing of the working process based on creative solving of problems that are linked to the teaching and training content.
- Be able of unique innovations and critical reflections.

Assessment

- Theoretical contents (lectures) – 50 %
- Coursework – 10 %
- Laboratory exercises – 20 %

Literature

- Strauß K.: Kraftwerkstechnik, zur Nutzung fossiler, nuklearer und regenerativer Energiequellen, Springer, 2009
- Kopanos G.M., Liu P., Georgiadis M.C.: Advances in Energy Systems Engineering, Springer, 2017