

Master study course Renewable Energy Systems (M. Eng.)

Module – No.	863	Obligatory elective module	
Module name	Fuel cell technologies		
Module coordinator	Prof. Dr.-Ing. Joachim Fischer		
Title	Fuel cell technologies		
Title of examination	Fuel cell technologies		
Semester	1		
Course type	Language	Lecture	English
SWS/ ECTS/ Workload	4 V	5	150
Requirements for attendance	Successfully completed technical study course (e.g. Bachelor of Engineering)		

1. Content and objectives

Objective

The objective of this course is to understand the electrochemical fundamentals of fuel cells and their operation, the differences between cells types and the design of fuel cell systems. Additionally, aspects of manufacturing fuel cells, their application and the economy of fuel cell systems are addressed.

Module contents:

- Introduction to fuel cells, types of fuel cells and historical aspects
- Electrochemistry basics; double layer phenomena, electrochemical equilibrium, reaction kinetics
- Mass transport
- Steady-state behaviour of fuel cells
- Overview of fuel cell systems
- Fuel processing; fuels, handling and production of hydrogen
- Fuel Cell Characterization
- Manufacturing of fuel cells
- Fuel cell systems for combined heat and power generation and transport, application and economical aspects
- Environmental Impact of Fuel Cells

On-line Lecture notes and training material will be available.

Recommended Literature:

Andrew Dicks, David A J Rand: Fuel Cell Systems Explained, Wiley, 2018

Ryan O'Hayre,, Suk-Won Cha , Whitney Colella, Fritz B. Prinz :Fuel Cell Fundamentals Wiley, 2016

Learning goals:

Students have acquired competent knowledge in state of the art fuel cell technologies.

In addition to fundamental knowledge of fuel cell systems, students are familiar with the design of fuel cell systems and their application in combined heat and power generation as well as in transportation, considering technical and economic aspects. Students are enabled to recognize and evaluate the application and limitations of of fuel cell systems compared to conventional technologies and to draw appropriate conclusions.

2. Method(s) of instruction

Lecture

3. Requirements for attendance

No formal requirements. Basic knowledge on thermodynamics, and chemistry is advantageous.

4. Usability of this module

The module is offered as elective course in the master study course „Renewable Energy Systems“ (M.Eng.) as well as elective course in the master course „Energiesysteme“ (M. Eng.).

5. Requirements for assessment

Assessment is performed either as written examination (90 minutes) or oral examination. Students need to pass the module examination, which encompasses all contents of the lecture.

6. ECTS credits

- 5 ECTS credits

7. Frequency of offer

- Annually in the spring semester
8. Work load
150 h of total work load, therefrom - 80 h of presence at lectures - 40 h of self-study - 30 h preparation for examination
9. Duration of module
1 semester