Wind Energy Systems
Albert-Ludwigs-Universität Freiburg – Summer Semester 2025

Course Information

Lecture: Prof. Dr. Moritz Diehl
Tutor: Rachel Leuthold

1 Course Aim

The aim of this lecture course (6 ECTS) is that students understand the physical principles of wind energy and the technology of modern wind energy systems. It consists of lectures and exercises.

- global wind energy resource
- aerodynamic principles of wind turbines
- design of modern wind turbines
- control of modern wind turbines
- the electrical system of wind turbines
- alternative concepts and airborne wind energy

2 Course Organization

The course is organized as a flipped classroom style course. We will provide recordings of lectures and suggest exercises to be completed, with a five-day block course of task-focused instruction. There will be office hours offered, for questions, discussions, or other help related to the course-work, once with Prof. Dr. Moritz Diehl, and twice with the tutor (Rachel).

The course webpage is `https://www.syscop.de/teaching/ss2025/wind-energy-systems`. For other course-related questions, you are welcome to contact Rachel at `rachel.colette.leuthold@imtek.uni-freiburg.de`.

3 Sessions

This 6 ECTS course will be given as a block course, with **five full days between: 28.7 - 1.8.2025 from 9:00 to 17:00 (mandatory)**, in a lecture hall in downtown Freiburg (HS 1016 (Kollegiengebäude I)), with preparatory meetings beforehand. The lectures on these days are planned to be fast, intense, and interactive!

The schedule of these preparatory meetings is as follows:

April 23	08:30 - 09:55	with Prof. Diehl	Orientation	(optional)
May 7	**08:30 - 09:55**	**with Prof. Diehl**	**Official Kick-Off**	**(mandatory)**
May 21	**08:30 - 09:55**	**with Prof. Diehl**	**Official Follow-Up**	**(mandatory)**
June 4	08:30 - 09:55	with Rachel	Office Hours	(optional)
June 18	08:30 - 09:55	with Rachel	Office Hours	(optional)
July 16	08:30 - 09:55	with Prof. Diehl	Office Hours	(optional)

These preparatory meetings will take place in room SR 00 007 (G.-Köhler-Allee 106).

As included in the above table of preparatory meetings, there will be office hours with Prof. Diehl or the course tutor, where you can ask any questions about the course content. The format is meant to be highly interactive and depends strongly on your participation. We would recommend that while watching the video lectures or reading the course script, you write down any questions that come to your mind!

A **guided visit to the the E-138 turbine** on Holzschlägermatte, Schauinsland, will be offered in the afternoon of 10.7.2025. The guided visit will be in English (either originally or via translation from German), and will be combined with a short hike to and from the turbine, each way between 45-90 minutes. Further details will be posted on the course webpage.

4 Resources

The suggested resources for this course are:

- the lecture recordings,
- the course manuscript,
- the course textbooks (Burton et al.'s *Wind Energy Handbook* and Manwell et al.'s *Wind Energy Explained*).

All of these resources can be accessed through the course webpage at `https://www.syscop.de/teaching/ss2025/wind-energy-systems`.

5 Exercises

This course has two types of exercises.

First, there is a **Mandatory Self-Assessment of Course Pre-Requisites** that focuses on the most important course pre-requisite information in math and physics. This sheet will be given out on Wednesday May 7th, with the submission deadline (in the box outside Prof. Diehl's office, Building 102, Room 00-073) by 10am on Friday May 16th. **To be eligible for the final exam, you must score at least 70% of the total points available in this exercise!** You will receive the graded responses in class on Wednesday May 21st, to help you decide whether to proceed with the block course of 28.7 - 1.8.2025, and what subjects to refresh.

Furthermore, there are additional optional and ungraded exercises, posted on the webpage. **These additional exercises are voluntary** (though, of course, **we strongly recommend solving them**). The solutions to the voluntary exercises are posted on the course webpage, for self-correction. Please note that self-study may be necessary to cover all the material, considering the time limitations imposed by the course's block-structure.

6 Final Evaluation

The entire grade for this course will be determined by the score of the final (written) exam. This final exam will be 'closed-book,' which means that ONLY pens, a calculator, and one A4 page (that is, two sides) of notes can be used. There will be no opportunity to consult computational resources like ChatGPT, Wolfram—Alpha, Python, etc. The questions will be partially multiple-choice and partially short-answer. There will be a date provided to review your scored exam. A practice exam (with solution) is available on the course webpage.

If you decide to follow the course, please make sure you register for both the Wind Energy Systems Exam and the Wind Energy Systems Studienleistung!