

Syllabus: “Renewable Energy Resources”

International School, Winter Semester 2022/23

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(a) Inhalt und Ansatz | Content and Approach

- The course is intended for students of the faculty of electrical engineering and exchange students of all faculties, as an introduction to renewable energy sources.
- Teaching methods are oriented towards student-centred learning and include activities such as lectures, group work, peer review, and consultations with the instructor.
- The course will be offered as an in-person session.
- Students are required to at least have an advanced level of English to follow the lessons.
- Completion of assignments and regular attendance (at least 80% of all sessions) is required for exam admission.
 - The completion of assignments (homework) counts as 50% of the final mark for the course.
- For full credit, students must turn in homework by the day that they are due (i.e., by 11:59 pm Local Time). Late work is allowed, but with a penalty of 20% per day, it is late. Work submitted by a student as makeup work for an excused absence is not considered late work and it is exempted from this late work policy.
- For the successful completion of the course, the student will be awarded 5 ECTS. Therefore, students should be prepared to spend a considerable time working with the study content.
- Participants are required to register for the course via Stud.IP, where all teaching resources will be made available.

(b) Qualifikationsziele | Learning Objectives

- This course is aimed at introducing students to renewable energy sources.
- The course lays a special focus on the use of photovoltaic and wind energy systems.
- In the lesson plan below, the exact topics are named.

(c) Kursstruktur | Course Structure

- The class will be held every week (till the end of December), in the following schedule:
 - Monday: 12:30pm to 2pm, in room H0112
 - Tuesday: 8am to 9:30am, in room H0113 and 4pm to 5:30pm in room H0112
 - Wednesday: 10am to 11:30am, in room H011
- The course topics/schedule is as follows:
 - Introduction to Class. (1hr.)
 - Definition of Energy, History of Energy, and Energy Consumption. (3hrs.)
 - Atmosphere, Energy Balance, Solar Energy, Air Mass Ratio, and Solar Position. (3hrs)

- Clear Sky Radiation, Radiation at Collector Surface, Incidence Angle, Monthly Clear Sky Insolation, and Solar Radiation Measurement. (3hrs)
- Photovoltaic History, Solar Cell, Photons, Silicon, Energy-Band Diagrams, P-N Junctions, Equivalent Circuits, Fill Factor, and Efficiency. (5hrs)
- Cell Materials, Panel and Strings, Standard Test Conditions, Effects of Temperature and Irradiance, Impact of Shading, and Bypass Diodes. (4hrs)
- Bypass and Blocking Diodes, Effect of Dust, Maximum Power Point Tracking, DC-DC Convertors, Grid-Connected Systems, Inverters, Stand Alone Systems, and Modeling the Impact of Shading in Simulink. (4hrs)
- The History of Wind Energy, Wind Energy in Turkey and the World, Types of Wind Turbines, Power in Wind, Impact of Altitude and Temperature, and Effect of Tower Height. (4hrs)
- Maximum Rotor Efficiency, Tip-Speed Ratio, Electrical Machines, Synchronous Machines, Asynchronous Machines, and Slip Machines.
- Induction Machines Equivalent Circuit, Active and Reactive Power of Induction Machines, Types of Wind Turbines, Average Speed in Wind, Weibull and Rayleigh p.d.f., and Importance of Actual Data. (5hrs)
- Wind Farms and Energy Estimates, Variation of Wind in Time, Ideal Power Curve, Economics of Wind Power Systems, and Wind Power Simulation in Simulink. (4hrs)
- Solar Thermal Power Systems. (4hrs)

(d) Studien- und Prüfungsleistungen | Course Assessment

- **The exam was already written in December 2022! The exam can't be taken again in February 2023! Only students who already had taken the exam in December will be able to gain a grade and the ECTS points for the course!**
- The final exam is a in person, closed-book, closed-notes written exam. You may bring one note sheet (both sides of A4-sized paper)
- The written exam will be held on 21.12.2022. The room will be announced over Stud.IP.
 - The registered date for the exam is 03.02.2023. Which is not the date the exam will be written, but the date the student will have to register to get a mark on their transcript.
- For the successful completion of the course, the students will be awarded 5 ECTS.
 - The final grade will be based on 50% final exam and 50% homework.