**pre311 - Renewable Energy Basics**

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<thead>
<tr>
<th>Module label</th>
<th>Renewable Energy Basics</th>
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<tr>
<td>Module code</td>
<td>pre311</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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**Used in course of study**
- Master's Programme European Master in Renewable Energy (EUREC) > Mastermodule

**Module responsibility**
- Carsten Agert
- Joachim Peinke

**Module counseling**
- Tanja Behrendt
- Robin Knecht
- Hans-Gerhard Holtorf
- Jörg Ohland
- Paul Ziethe

**Entry requirements**

**Skills to be acquired in this module**
- After completing the module, the student will
  - have a good understanding of the physical principles of Renewable Energy Technologies
  - be able to apply principal mathematics related with the underlying physical laws and rules to measure and solve problems during their further studies
  - have a good understanding of the fundamentals of electrical circuits and related physical laws
  - have a good understanding of the fundamentals of electrical machines and the interaction of electrical components of the electric grid
  - have a good understanding of the basic concepts of the photovoltaic effect in semi-conductors
  - be familiar with the measurement procedures needed for the winter lab experiments in the subject related modules.
  - be familiar with working and studying in intercultural teams
  - be familiar with the experimental set-ups of the PPRE lab
  - understand to relate physical, engineering, and mathematical laws to models of energy supply technologies
  - be able to establish simple models and measurement strategies to investigate the behaviour of the respective models.
  - be familiar with the principles of scientific working

**Module contents**

**Renewable Energy Basics**
- Thermodynamics
- Hydrodynamics
- Black and Grey Body Radiation
- Property of (humid) air
- Heat Transfer
- Economic Evaluation of Investments

**Winter Introductory Laboratory**
- Simple electrical circuits
- Inner resistance of power sources
- Measurement of time depending signals
- Measurement of temperature and radiation
- Introduction of standard sensors in radiation and temperature measurement
- Introduction of measurement devices: multimeter, oscilloscope, x-t-writer

**Electrical Power Systems**
- Fundamentals in AC/DC
- Fundamentals of magnetic fields
- Transformers
- DC machines
- Asynchronous-machines
- Synchronous machines
- Semi-Conductor Physics
- Definition of semi-conductor
- Crystal Lattice
- Atom models
- Chemical bonding
- Quantum mechanics
- Photoelectric effect
- pn-Junction
- Solar cell

**Reader's advisory**
Oelert, Gerhard, Economic issues of renewable energy systems: a guide to project planning; ISBN, Roßdorf TZ Verlag
Sørensen, Bent, 2003: Renewable energy. Its physics, engineering, use, environmental impacts, economy and planning aspects; 2nd ed., Acad.Press.
Taylor, John Robert, 1997: An introduction to error analysis ; the study of uncertainties in physical measurements; Univ. Science Books; Sausalito, California; 2. ed.
General books on experimental laboratory work and report writing:
Kirkup, Les, 1994: Experimental methods an introduction to the analysis and presentation of data; Brisbane, Wiley.
Kulschewski, Udo, Knecht, Robin and colleagues, update 2013: Reader for the Introductory Lab Course: AC/DC principles, fast signals, power, measurement strategies, sensors in RE and measurement devices

<table>
<thead>
<tr>
<th>Links</th>
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<tbody>
<tr>
<td>Language of instruction</td>
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<td>Duration (semesters)</td>
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<td>Module frequency</td>
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<td>Module capacity</td>
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<td>Lern-/Lehrform / Type of program</td>
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<tr>
<th>Examination</th>
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<tr>
<td>Final exam of module</td>
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<tr>
<td>RE Basics Physics: After end of lectures (end of October)</td>
<td>RE Basics Physics (25%): Oral exercise (1 hour)</td>
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<tr>
<td>Semiconductor Physics: After end of lectures (mid-December)</td>
<td>Semiconductor Physics (25%): Written exam (0.5 hours)</td>
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<tr>
<td>Electrical Power Systems: After end of lectures (mid-January)</td>
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<tr>
<td>Solar Spectrum Lab: During Semester</td>
<td>Solar Spectrum Lab (25%): Written report (10 - 20 pages)</td>
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<td>SWS</td>
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<td>Workload attendance</td>
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