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

<table>
<thead>
<tr>
<th>Module – No.</th>
<th>859</th>
<th>Mandatory module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module name</td>
<td>Solar Thermal Laboratory</td>
<td></td>
</tr>
<tr>
<td>Module coordinator</td>
<td>Pascal Leibbrandt, M.Eng.</td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>Solar Thermal Laboratory</td>
<td></td>
</tr>
<tr>
<td>Title of examination</td>
<td>Solar Thermal Laboratory</td>
<td></td>
</tr>
<tr>
<td>Semester</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Course type</td>
<td>Tutorial/Laboratory</td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>English</td>
<td></td>
</tr>
<tr>
<td>SWS/ ECTS/ Workload</td>
<td>4 P</td>
<td>5</td>
</tr>
<tr>
<td>Requirements for attendance</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

1. Content and objectives

Content:
1. Solar collectors, components and systems
   - Collector types, characteristics
   - Collector loop, operating mode
   - Heat storage, heat exchanger, controls
2. System design, economics
   - System types, characteristics
   - Solar heat costs, economics
3. Laboratory experiments
   - Pump hydraulics and pressure drop
   - Collector test (QDT)
   - Collector front glazing
4. Current research

Learning goals:
The students have knowledge about the various solar thermal collector types, design and function. They can dimension various solar loop types and design them using typical key figures. The economic viability of the investments and the basics of investment calculation is known to the students. By using typical and standardizes test methods (test rig design, data acquisition and evaluation) the students are able to test solar collectors and solar loop components in laboratory.

2. Method(s) of instruction

The module consists of a lecture with integrated exercises and an active involvement of the students in the laboratory.

3. Requirements for attendance

There are no formal requirements for participation. Basics in physics, mathematics and mechanics are recommend-ed. Basic knowledge in renewable energies and heat transfer is useful.

Literature:

4. Usability of this module

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

5. Requirements for assessment

Assessment is performed as written examination (120 minutes).

6. ECTS credits

5 ECTS credits

7. Frequency of offer

The module is lectured annually in the autumn semester

8. Work load

The total workload for this module is 150 hours; this corresponds to 5 ECTS credits. This workload results from the presence at the lectures with an active participation of the students in the laboratory (about 45
As part of the self-study, the lecture material should be reworked (about 55 hours). The preparation and execution of the examination is about 50 hours.

<table>
<thead>
<tr>
<th>9. Duration of module</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The module is lectured in one semester</td>
<td></td>
</tr>
</tbody>
</table>