

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

<b>Module – No.</b>	<b>859</b>	<b>Mandatory module</b>	
<b>Module name</b>	<b>Solar Thermal Laboratory</b>		
Module coordinator	Pascal Leibbrandt, M.Eng.		
Title	Solar Thermal Laboratory		
Title of examination	Solar Thermal Laboratory		
Semester	2		
Course type	Tutorial/Laboratory	English	
SWS/ ECTS/ Workload	4 P	5	150
Requirements for attendance	none		

<b>1. Content and objectives</b>			
<b>Content:</b>			
<ol style="list-style-type: none"> <li>1. Solar collectors, components and systems <ul style="list-style-type: none"> <li>• Collector types, characteristics</li> <li>• Collector loop, operating mode</li> <li>• Heat storage, heat exchanger, controls</li> </ul> </li> <li>2. System design, economics <ul style="list-style-type: none"> <li>• System types, characteristics</li> <li>• Solar heat costs, economics</li> </ul> </li> <li>3. Laboratory experiments <ul style="list-style-type: none"> <li>• Pump hydraulics and pressure drop</li> <li>• Collector test (QDT)</li> <li>• Collector front glazing</li> </ul> </li> <li>4. Current research</li> </ol>			
<b>Learning goals:</b>			
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 standardized test methods (test rig design, data acquisition and evaluation) the students are able to test solar collectors and solar loop components in laboratory.			
<b>2. Method(s) of instruction</b>			
The module consists of a lecture with integrated exercises and an active involvement of the students in the laboratory.			
<b>3. Requirements for attendance</b>			
There are no formal requirements for participation. Basics in physics, mathematics and mechanics are recommended. Basic knowledge in renewable energies and heat transfer is useful.			
<b>Literature:</b>			
[1] Duffie; Beckman: Solar Engineering of Thermal Processes. 4th Edition. Wiley & Sons, Hoboken (2013)			
[2] Schabbach; Leibbrandt: Solarthermie – Wie Sonne zu Wärme wird. Springer, Berlin (2017)			
[3] Nellis; Klein: Heat Transfer. 1st Edition. Cambridge University Press, Cambridge (2008)			
[4] Wesselak, Schabbach; Link; Fischer: Regenerative Energietechnik. Springer Vieweg, Berlin (2017)			
<b>4. Usability of this module</b>			
The module is offered as mandatory module in the master study course „Renewable Energy Systems“ (M.Eng.)			
<b>5. Requirements for assessment</b>			
Assessment is performed as written examination (120 minutes).			
<b>6. ECTS credits</b>			
5 ECTS credits			
<b>7. Frequency of offer</b>			
The module is lectured annually in the autumn semester			
<b>8. Work load</b>			
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			

hours). 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.

**9. Duration of module**

The module is lectured in one semester