MBB Nr folgt – Renewable Energy Conversion

1	**Module Number**	**Study Programme**	**Semester**	**Offered in**	**Duration**	**Module Type**	**Workload (h)**	**ECTS Points**
	MBB Nr folgt	MBB/MAP	6	☒WS ☒SS	1 Semester	Comp. elective	150	5

2	**Courses**	**Teaching and Learning Forms**	**Contact Time**		**Self-Study Time**	**Language**
			(SWS)	**(h)**	**(h)**	
	a) Renewable Energy Systems	Lecture	2	30	75	English
	b) Turbo Machines	Lecture	2	30	[bitte nur Summe ein-tragen]	
	c) Renewables Lab	Lab	1	15 [1 SWS = 15h]		

3 **Learning Outcomes and Competences**

Once the module has been successfully completed, the students can...

Knowledge and Understanding

- recognize the significance of renewable energy sources, i. e. solar energy, wind energy, hydro power, geothermal energy, bio-fuels and biomass and carriers.
- recognize the significance of sustainability, energy efficiency and its evaluation.
- understand and explain the technical principles of the usage of renewable energy sources.
- understand the different types of turbo machines.
- understand conservation laws in turbo machines

Use, Application and Generation of Knowledge

Use and Transfer

- apply the laws of thermodynamics and of fluid mechanics to evaluate the usage of renewable energy sources.
- calculate the energy potential for the usage of renewable energy sources.
- calculate energy losses in the framework of energy conversion systems.
- analyze basically the energy efficiency of technical systems.
- take different perspectives and points of view on renewable energy sources and weight them up against each other.
- familiarize themselves with new ideas and topics in the framework of renewable energies based on their acquired knowledge.
- analyze turbomachinery stages.
- calculate indicators and parameters of turbomachinery stages.
- apply dimensionless numbers and laws of similarity to turbo machines.

Scientific Innovation

- optimize the usage of renewable energy sources for electricity generation and for heating.
- independently develop approaches for usage of renewable energy sources and assess their suitability.
- develop concepts for the optimization of electricity generation by renewable energy sources.
- develop concepts for the optimization of turbo machines

Communication und Cooperation

- communicate actively within an organization and obtain information about renewable systems and turbo machines.
- use the acquired knowledge, to evaluate the usage of renewable energy systems and interpret them according to other aspects.
- use the acquired knowledge, to evaluate the usage of turbo machines and interpret them according to other aspects.

Scientific Self-Conception/ Professionalism

- derive recommendations for decisions from a sustainable energy conversion perspective on the basis of the analyses and evaluations made.
- justify solutions with respect to renewable energy systems and turbo machines theoretically and methodically.

4	**Contents** **a) Renewable Energy Systems** Fundamental overview of the description and calculation of renewable energy sources like solar energy, wind energy, hydro power, geothermal energy, bio-fuels and biomass. **b) Turbo Machines** Overview of different turbo machines: axial flow and radial flow, fans, compressors, pumps, gas turbines, steam turbines, water turbines wind energy converters, conservation laws in turbo machines, dimensionless numbers and laws of similarity of turbo machines, analysis of turbomachinery stages, indicators and parameters of turbomachinery stages **c) Renewables Lab** Using and enhancing the knowledge acquired in the lectures by performing experiments in the fields of renewable energy systems and turbo machines.
5	**Participation Requirements** Obligatory: Thermodynamics 1, Base module for specialization Sustainability Recommended: Thermodynamics 2 (in parallel)
6	**Examination Forms and Prerequisites for Awarding ECTS Points** a), b), c) Written examination (120 minutes), graded c) Lab reports, not graded
7	**Further Use of Module** • Bachelor thesis (depending on selection of topic) • RMM 3422 - Energieeffizienz • RMM AW1 - Energiewandlung, -speicherung und -systeme
8	**Module Manager and Full-Time Lecturer** • Prof. Dr.-Ing. Rainer Stauch (Module Manager) • Prof. Dr.-Ing. Sandra Hartl
9	**Literature** • Scripts of lectures (including further references) • M. Kaltschmitt, W. Streicher, A. Wiese. Renewable Energy. Springer, 2007 • D.J.C. MacKay. Sustainable Energy – without the hot air. UIT, 2009 • J.W. Tester, E.M. Drake, M.J. Driscoll, M.W. Golay, W.A. Peters. Sustainable Energy – Choosing Among Options. MIT Press, Cambridge, 2005 • V. Wesselak, T. Schabbach, T. Link, J. Fischer. Handbuch Regenerative Energietechnik. 3rd edition, Springer, 2017 • S.L. Dixon. Fluid Mechanics, Thermodynamics of Turbomachinery. 4th edition, Butterworth-Heinemann, 1998 • K. Menny. Strömungsmaschinen. 5th edition, Teubner, 2006 • W. Bohl, W. Elmendorf. Strömungsmaschinen 1. 11. Auflage, Vogel Buchverlag, 2013
10	**Last Updated** 13.11.2023