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

Module – Number		864		Compulsory
Name of Module		**Bioengineering**		
Person Responsible		Prof. Dr. Uta Breuer		
Title of the Course		Biological Engineering		
Trial Identification		Biological Engineering		
Semester		1		
Form of Course	Language	Lecture		English
SWS/ ECTS/ Workload		4 V	5	150
Formal Conditions		for graduates holding a Bachelor of Engineering degree		

1. Contents and Qualification Objectives

I **Microbiology and Physiology of Microorganisms**: cell biology, biochemical basic processes in the microbial metabolism, enzyme kinetics, microbial growth (kinetic and process management)

II **Bioprocess Engineering**: bioreactors, sterilization and sterile technology, measurement and regulation technology at bioreactors, upstream and downstream processing

III **Biotechnological Syntheses**:

biomass (feed and food, agriculture, pharmacy),

low-molecular products (methane, alcohols, organic acids, amino acids, lipids and fatty derivatives, nucleotides und coenzymes, vitamins, sweeteners)

macromolecules (microbial enzymes, Insulin, recombinant drugs, products of secondary metabolism)

IV **Biotechnological Remediation Procedures**: aerobic and anaerobic degradation, composting and special systems, anaerobic processes and process variants, liquid and gaseous emissions as well as treatments of wastes, bioremediation of pollutants in soil and ground water, bioleaching, phytoremediation

V **Biodegradables Materials**: biologically degradable materials, renewable biomass, PHA – PHB

VI **Environmental Microbiology**: C-, S-, N-, Fe-cycles, biosensors

Learning goals:
Students acquire in-depth knowledge in bioengineering with a microbial and biochemical-biotechnological focus. In addition to scientific and engineering knowledge, which reflects the link between microbial performance and technical implementation, historical and up-to-date engineering processes especially considering the economic and ecological feasibility are familiar to the students. Thus students are enabled to recognize and evaluate application possibilities and limitations of bioengineering as well as to make comparisons with conventional technologies and to draw appropriate conclusions.

2. Forms of Teaching

Lecture

3. Prerequisites for Participating

Theoretical and practical knowledge acquired in lectures on bioenergy, biogas and bioengineering. These prerequisites can also be acquired through individual studies of appropriate textbooks.

Bibliographical References: For preparation and follow-up the following text books are recommended:

- Colin Ed. Ratledge and Björn Kristiansen, Basic Biotechnology, Cambridge University, 3rd ed. 2006, ISBN13: 9780521549585
- Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, David A. Stahl: Brock Biology of Microorganisms, Pearson Education, 15th ed. 2017, ISBN 978-0134261928
- D.L. Nelson, M.M. Cox: Lehninger Principles of Biochemistry: International Edition, WH Freeman, 7th ed. 2017, ISBN 978-1319108243
- J.L. Slonczewski, J.W. Foster: Microbiology: An Evolving Science, WW Norton & Co Inc., 2013, ISBN 978-0393123678

A literature list for further reading will be handed out in the lecture.

4. Usability of the Module

This module is a compulsory module in the Master Program Renewable Energy Systems (M. Eng.).

5. Requirements for the Award of Credits

Students need to pass the module examination, which encompasses all contents of the lecture.
Type of examination: written examination with a duration of 90 min. Alternative types of examination are possible.

6. Credits and Grades

Modules are assessed by a module examination, which is credited by 5 credit points according to the ECTS (European Credit Transfer and Accumulation System).
7. Frequency of the Module
The module is offered annually in the autumn semester.
8. Workload
Participation in the course = 50 h Preparation and follow-up (of the lecture) = 55 h Preparation for examination = 45 h The entire workload encompasses 150 hours, which equals 5 ECTS credit points.
9. Duration of Module
The module is performed within one semester.