

Environmental and Recycling Technology (M. Eng.), Renewable Energy Systems (M. Eng.)

Module – Number	864	Obligatory in specialization Environmental Technology (ET) Compulsory in the specialization RT (recycling technology) within ERT as well as in the master program Renewable Energy Systems (RES)		
Module name	Bioengineering			
Module coordinator	Prof. Dr. Uta Breuer			
Title	Biological Engineering			
Title of examination	Biological Engineering			
Semester	2 nd			
Course type	Language	Lecture	English	
Credit hours/ ECTS/ Workload	4	5	150	
Formal Conditions	Bachelor of Engineering or Bachelor of Science degree			

1. Content and objectives

Content:

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 objectives:

Students acquire in-depth knowledge in bioengineering with microbial and biochemical-biotechnological focus. In addition to scientific and engineering knowledges which reflect the link between microbial performance and technical implementation, historical and up-to-date engineering processes are shown especially considering the economically and ecologically feasibility. In this way students are enabled, to recognize and evaluate application possibilities and limits of bioengineering as well as to compare with conventional technologies.

Literature: For preparation and following-up the following textbooks are suitable:

1. Colin Ed. Ratledge and Björn Kristiansen, Basic Biotechnology, Cambridge University, 3rd ed. 2006, ISBN13: 9780521549585
2. 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
3. D.L. Nelson, M.M. Cox: Lehninger Principles of Biochemistry: International Edition, WH Freeman, 7th ed. 2017, ISBN 978-1319108243
4. J.L. Slonczewski, J.W. Foster: Microbiology: An Evolving Science, WW Norton & Co Inc., 2013, ISBN 978-0393123678

Further literature will be announced during the lectures.

2. Method(s) of instruction

Lecture

3. Requirements for attendance

Knowledges and abilities which are demonstrated in lectures as bioenergy or biogas (B.Eng. RET) as well as bioengineering (B.Eng. URT). These prior knowledges could also be acquired by individual study or appropriate textbooks.

4. Usability of this module

This module is obligatory in the specialization ET and a compulsory module in the other specialization RT as well as in the Master Program Renewable Energy Systems (RES).

5. Requirements for assessment

Students need to pass a module examination which encompasses all contents of the lecture.
Exam: Written exam with a duration of 90 min. Alternative forms of exam are possible.

6. ECTS Credits

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 offer

The module is offered in the first academic year.

8. Workload

- course participation	= 50 h
- preparing and following-up of the lecture contents	= 55 h
- exam Preparation	= 45 h
Total workload	150 h = 5 ECTS

9. Duration of module

The module is held within one semester.