NATURAL SCIENCES **Biotechnology** **(required language level B2)** **BACHELOR Level**	**Description**	**Lecturer**	**CP / ECTS**	**Term**
LECTURE & LAB: **Bioreaction Technology** Prerequisites: Basic knowledge on process engineering and mathematics	This module provides a comprehensive understanding of bioreaction engineering and the mathematical modeling of microbial processes, covering topics such as mass transfer, mixing times, and kinetic models. Beyond the lecture, the module includes an integrated laboratory component. In these practical units, students apply the theoretical concepts directly to hands-on experiments.	**Mr. De Vries/Mr. Habermann**	**8**	**fall**
LECTURE & PRESENTATION: **Microbial Ecology** Prerequisites: basic knowledge in Microbiology	Microbial reactions in carbon-, nitrogen-, sulfur- and iron- cycles, levels of regulation in procaryotic metabolism (from DNA structure to post-translation regulation), synthropy, competition, cooperation in theory and presentation of latest information from literature by students	**Ms Gallert**	**4**	**fall**
LAB COURSE: **Practical Molecular Biology** Prerequisites: practice in laboratory work, experience in sterile working techniques, theoretical knowledge of molecular biological processes	Performing a restriction assay and a ligation assay, transformation of different bacteria via heat shock and/or electroporation, gel electrophoresis analysis, cloning phage DNA into a bacteria, PCR detection and expression analysis via qPCR	**Ms Reimer**	**6**	**fall**
LECTURE & INTERNSHIP: **Process Modeling** Prerequisites: Basic knowledge on process engineering and mathematics	Students will learn how to setup a process simulator using the Aspen Engineering Suite as an example. They learn to analyze existing technical processes from the perspective of process modeling. Components of a simulation model and functions of a process simulator are discussed. Students will learn how to create a process model and implement it in simulation software. They apply the created model for process analysis. In the practical part, you will carry out the work independently on an example from industry.	**Mr. Steiniegweg**	**5**	**fall**
LECTURE: **Production-based Biotechnology**	The lecture details the operation of large-scale production facilities, covering administration, product changeovers, and Process Analytical Technology (PAT). Furthermore, the module examines modern industry trends, including personalized medicine, additive manufacturing, and the role of artificial intelligence in biotechnological production.	**Mr. De Vries**	**3**	**fall**
LECTURE & INTERNSHIP: **Mixing & Stirring**	Terms and definitions of mixing and stirring technology, consideration of selected mixing and stirring systems with regard to their function and application, operation and mixing tasks, procedure for scaling mixing and stirring devices. Practical experience in sampling, power measurement and scale-up respectively scale-down	**Mr. Habermann**	**5**	**fall**
LECTURE & LAB WORK: **Heat Recovery**	The module Heat Recovery covers the fundamentals of thermodynamics and applies them to describe heat transfer in heat exchangers. This module also covers the technical description and analysis of heat exchangers, which are used to recover thermal energy from a material flow rather than releasing it unused into the environment. In the laboratory, experiments are conducted to determine heat transfer and to analyze heat exchangers (energy and mass balance and efficiency).	**Mr. Illing**	**5**	**fall**

NATURAL SCIENCES (required language level B2) **MASTER LEVEL** Master of Technology of Circular Economy	Description	Lecturer	CP / ECTS	Term
LECTURE: **Recovery of Recyclable Materials**	The students learn about processes for recovering valuable materials from industrial and other material streams as well as the application and optimization of these processes.In the form of a project, the students deepen what they have learned using an example process.	**Mr. Hüppmeier**	**6**	**fall**
LECTURE: **Water Reuse**	Module description will follow soon	**Mr. Illing**	**6**	**fall**
LECTURE: **Soil Remediation**	Students receive information about typical chemical contamination of soil at contaminated sites (e.g. PAHs, heavy metals, mineral oils) and how to remediate these contaminations. Soil samples are taken from former industrial sites, analyzed and evaluated.	**Mr. Walker**	**6**	**fall**
LECTURE: **Energies and Materials in Biotechnology**	This course introduces students to biotechnological processes, with particular emphasis on the use of material and energy sources. While projects are primarily conducted on a theoretical basis, selected laboratory excursions and practical demonstrations involving yeast, bacteria and mammalian cells are integrated to enhance conceptual understanding.	**Mr. de Vries**	**6**	**fall**
LECTURE: **Solid Waste and Recycling**	Module description will follow soon	**Mr. Habermann**	**6**	**spring**
LECTURE + LAB: **Biopolymers**	The module consists of a lecture and a lab course. Students will learn to prepare, process and analyse biopolymers and understand their role in polymer industry.	**Mr. Rüsch gen. Klaas**	**6**	**spring**
LECTURE: Biodegradability and Environmental Impact **Limited number of participants: max. 2 students**	The module consits of a lecture on "Environmental Assessments" (EIA, EA, ESIA) and social & environmental responsibilities and a seminar in which independent topics on "Biodegradability" of various components are developed and presented	**Mrs. Gallert**	**6**	**spring**
LECTURE **Introduction to Circular Economy**	Module description will follow soon	**Mr. Steinigeweg**	**6**	**spring**
PROJECT: **Circular Economy Project**	Students are working in small groups on an interdisciplinary project in the field of Circular Economy Technology.	**all lecturers**	**6**	**spring**