Biotechnological installations	
Code	(not yet made available)
Credits (as per ECTS)	10
Attendance time	9 SWS
Course language	English
Duration	1 semester
Rota	annually
Module coordinator	Prof. Dr. Frühwirth
Assistant professor(s)	Prof. Dr. Frühwirth, Dipl. Ing. Grubmüller
Incorporation in the degree programs	Industrial biotechnology BSc, mandatory module, 4th Semester
Required knowledge	• Content: Recommendation: Process engineering, technical microbiology, mathematics and statistics, process engineering practical course, technical microbiology practical course
Learning outcomes	Students that have successfully completed this module, • can design devices under observation of the AD 2000 calculation directives • master the technical and organisational basics of plant construction • can sensibly make use of experimental analyses and incorporate the results into a plant design • understand the electrotechnical basics such as voltage and current or building elements such as resistors, capacitors and inductances • can calculate simple circuits with resistors • have basic knowledge of measurement techniques for various mechanical variables • master the basics of control technology • can apply the theoretically acquired knowledge for selected basic operations • are capable of applying acquired measurement data from the laboratory for mathematical description of the processed basic operations • have the ability to experimentally examine complex biotechnological problems in small project-oriented groups and to implement the obtained knowledge in an installation scale up
Content	The following technical contents are taught in this module: Lecture + Exercise "Equipment and plant construction" • Contractual aspects of plant construction • Project documentation • Commissioning plants • Fundamentals of equipment design: Machine elements, materials resistance, manufacturing technology • Materials in installation construction: Classification, properties, mechanical and thermal behaviour of materials • Strength of materials: The term "stress", structural elements under tensile load

	• Dimensioning of pressurised containers with inner and outer positive pressure • Dimensioning of container closures - convex floors under inner positive pressure • Creation of simple installation schematics of container closures and flanges • Armatures, safety installations in equipment • Seals Lecture + Exercise "Electrical, measurement, control and regulation technology" • Electro-technical basics: Ohm's law, mesh rule, node rule, calculation of potential dividers and simple ohmic circuits, electro-technical components such as resistors, capacitors, inductances, diodes, transistors, operational amplifiers and filters • Digital technology: Difference between analogue and digital signal, logic function, data interpretation, binary calculation, sampling theorem, AD/DA converter. • Measurement technology: Basic terminology, measurement of electrical variables such as current, voltage, power, frequency and resistance. Measurement of non-electrical variables such as temperature, pressure, viscosity, flow rate, density, concentrations, oxygen measurement, measurement errors and error calculation • Control and regulation technology: Control loop, controller types, controller design, stability of a controller, behaviour of the controlled system and basics of controllers Practical course "Process development/scale up" • Autonomous pursuit of an assignment from the definition of the subject up to the calculation of an industrial installation • Experimental development of biotechnological processes: Project plan, laboratory protocol, results • Creation of project documentation block flowchart, materials flow table • Technology attribution • Perspectives for industrial implementation
Literature	Lecture + Exercise "Equipment and plant construction" • AD 2000 Regelwerk TÜV Lecture + Exercise "Electrical, measurement, control and regulation technology" • Taschenbuch der Messtechnik Hoffmann Carl Hanser Verlag, 2007 Practical course "Process development/scale up" • Erikson, Johansson, Design of Experiments, Umetrics 2008, Schwister, Lewen, Verfahrenstechnik für Ingenieure, Hanser, 2012

Forms of teaching and learning	• Equipment and plant construction (lecture + exercise), 3 SWS, 3 LP • Electrical, measurement, control and regulation technology (lecture + exercise), 2 SWS, 2 LP • Process development/Scale up (P), 4 SWS, 5 LP
Workload	**Lecture + Exercise "Equipment and plant construction"** Attendance time: 45 h Individual study: 45 h **Lecture + Exercise "Electrical, measurement, control and regulation technology"** Attendance time: 30 h Individual study: 30 h **Practical course "Process development/scale up"** Attendance time: 60 h Individual study: 90 h **Total** Attendance time: 135 h Individual study: 165 h Total: 300 h
Evaluation method	The examination is a written exam (90 minutes) covering the entire module. Participation in this written examination requires students to have successfully completed the prerequisite practical course "Process development/Scale up" (written composition, presentation).
Grading	The module grade corresponds to the result of the examination.