

Name of module:	Biochemical Engineering
Modulenummer:	402
Keywords:	
Target group(s):	4. Semester BTB
ECTS-Credits:	8
Language of instruction:	German / English
owner:	Prof. Dr.-Ing. Richard Biener

Extent of work (hours)

Workload	Contact hours	Self study	Exam preparation
240	120	82	38

Prerequisites:	Module Principles of bioprocess technology		
Total target:	Beside the theoretical fundamentals of biochemical engineering the cultivation of microorganisms in modern bioreactors including sterile technology and control of bioprocesses are trained. Methods for the dynamic simulation of bioprocesses are taught.		
Module content:	<p><u>Lecture:</u></p> <ul style="list-style-type: none"> - mass transfer in bioreactors - stirring and aeration (oxygen transfer) - scale-up and scale-down - sterile technology - cell harvest and disintegration - industrial applications <p><u>Lab:</u></p> <ul style="list-style-type: none"> - model-based analysis and optimization of bioprocesses: <ul style="list-style-type: none"> - estimation of kinetic parameters by nonlinear regression in Excel and Matlab using experimental data - dynamic simulation of batch, fedbatch and chemostat processes in Matlab - simulation and analysis of different growth kinetics - strategies of process optimization - safety issues in biological laboratories - practical training with bioreactors for the cultivation of microorganisms: <ul style="list-style-type: none"> - preparation of growth media (complex and defined media) - sterile technology - cultivation of micro organisms - feeding strategies for fed-batch bioprocesses - measurement of offline und online parameters for the analysis of the cultivation process <ul style="list-style-type: none"> - determination of the specific growth rate and the specific substrate uptake rate and product formation rate - determination of yield coefficients - mass transfer: determination of the $k_L a$-value - control of bioreactors <ul style="list-style-type: none"> - calibration of pH- and pO_2-probes - cell disintegration 		
Reference material:	Horst Chmiel: Bioprozesstechnik, Elsevier David F. Ollis, James E. Bailey: Biochemical Engineering Fundamentals, McGraw-Hill Handouts		
Offered:	x	every semester	
Relevance for other study programs:	BTB		

Submodules and assessment

Type of instruction / form of learning:	lecture with post processing and preparation
Hours per week:	2
Aims, learning outcomes:	understand and apply the principles of the design and control of bioprocesses
Type of assessment:	written exam part 45 min.
Estimated student workload:	60

Type of instruction / form of learning:	laboratory work
Hours per week:	6
Aims, learning outcomes:	ability to apply tools and methods for the simulation of bioprocesses ability to perform cultivation of microorganisms in modern bioreactors
Type of assessment:	written exam part 45 min.; all experiments passed successfully with reports
Estimated student workload:	180